FOOD & PROSPERITY

Balancing Technology and Community in Agriculture

THE ROCKEFELLER FOUNDATION
CENTENNIAL SERIES

Rockefeller Foundation

Innovation for the Next 100 Years

FOOD & PROSPERITY

BALANCING TECHNOLOGY AND COMMUNITY IN AGRICULTURE

By Amanda Carroll Waterhouse

Innovation for the Next 100 Years
Rockefeller Foundation Centennial Series

Cover: Top: Transplanting rice at the International Rice Research Institute (Rockefeller Archive Center.) Bottom: Photo by Kathrin Ziegler. Getty Images.

Book design by Pentagram.

Food & Prosperity:
Balancing Technology and Community in Agriculture

Printed in Canada.

Published by
The Rockefeller Foundation
New York
United States of America

In association with Vantage Point
Historical Services, Inc.
South Dakota
United States of America

ISBN-13: 978-0-9796389-4-7
ISBN-10: 0-9796389-4-1

Rockefeller Foundation Centennial Series
Books published in the Rockefeller Foundation Centennial Series provide case studies for people around the world who are working "to promote the well-being of humankind." Three books highlight lessons learned in the fields of agriculture, health, and philanthropy. Three others explore the Foundation's work in Africa, Thailand, and the United States. For more information about the Rockefeller Foundation Centennial initiatives, visit http://www.centennial.rockefellerfoundation.org.

Notes & Permissions
The Foundation has taken all reasonable steps to ensure the accuracy of the information provided in the book; any errors or omissions are inadvertent. This book is published without footnotes or endnotes. A manuscript version with citations and references for all sources used is available at www.centennial.rockefellerfoundation.org.

Captions in this book provide information on the creator and the repository from which the images in this book were obtained. The Foundation has made its best efforts to determine the creator and copyright holder of all images used in this publication. Images held by the Rockefeller Archive Center have been deemed to be owned by the Rockefeller Foundation unless we were able to determine otherwise. Specific permission has been granted by the copyright holder to use the following works:

Jonas Bendiksen: 4-5, 8-9, 17, 57, 74-75, 95, 96-97, 123, 170-171, 203, 204-205, 212, 218, 221, 222-223.
Ken Spain: 89
Mississippi Department of Education: 92
Ted Spiegel: 167
Antony Njuguna: 169
Thomas L. Williams: 180
Marion Kaplan: 182-183
Ashwin Gatha: 189
Wendy Stone: 198-199

By Dr. Judith Rodin
President, The Rockefeller Foundation

John D. Rockefeller Sr. and his advisors saw agricultural production as critical to prosperity. At the beginning of the twentieth century, they embarked on an unprecedented effort to help poor farmers in the southern United States increase agricultural productivity. This effort profoundly influenced innovation in the agricultural sector in the United States and, later, in countries around the globe.

Today, food and prosperity are still intrinsically linked. Farm production provides the life-sustaining calories and nutrients that allow poor communities and, indeed, all people to sustain healthy, secure livelihoods. With increased agricultural yields, crop sales generate cash to allow families, communities, and nations to invest in infrastructure, education, and vital services.

In the early twentieth century, the leaders of the Rockefeller Foundation were remarkably prescient in their understanding of the systemic relationship between seeds planted in the field and the aspirations of poor residents of the rural American South, and later of Latin America and Asia. Today, the Rockefeller Foundation continues this focus on the need to transform human systems to create food security in the hopes of nourishing the human potential in the world's most challenging regions, especially sub-Saharan Africa.

In the drought-prone northern region of Tigray in Ethiopia, for example, we have worked with partners to help improve the livelihoods of poor farmers by introducing crop insurance, microcredit, and improved resource management strategies to strengthen food and income security. These initiatives build resilience in communities that face climate, political, and economic challenges that are often beyond their control and result from forces global in nature. They also encourage farmers and pastoralists to make the marginal investments necessary to increase land and labor productivity.

As a founder of the Alliance for a Green Revolution in Africa, we are investing in science and technology that will allow governments to prepare for the effects of climate change and enable farmers to raise improved varieties of maize, cassava, and other food crops. We are also supporting the development

of programs and institutions that will make the agricultural sector more resilient, including telephone helplines for farmers who have questions about everything from plant disease to transport and markets. At the same time, through our impact investing initiative and our philanthropic partnerships, we are working to bring new financial capital to farmers and communities eager to invest in their future.

With Africa's growing population, it is critical that small subsistence farmers have the means to make the transition to commercial production, both to shore up their own livelihoods and to help ensure a food supply that meets the needs of the continent's growing urban population. As cities expand around the world, this need to increase agricultural productivity through plant-breeding programs, education, and resource management grows as well. We also need to unlock the range of human potential in these communities, and this means ensuring that women are able to both fully contribute to and benefit from the development, management, and marketing of agricultural products.

All of these initiatives encompass a systemic view of the relationship between food security, resilience, and development. Though the science and technology we use today represents the aggregation of generations of innovations in the laboratory, the field, and the marketplace, we understand, as our forbearers did, that community is at the heart of social change.

In his brief autobiography, published in 1913, John D. Rockefeller Sr. suggested that the best philanthropy "that does the most good and the least harm, that nourishes civilization at its very root…is not what is usually called charity." Instead, the greatest good comes when innovators take risks and carry "doubtful enterprises" through to success. This entrepreneurial spirit has infused the efforts of the Rockefeller Foundation—from the fields of Alabama to the Green Revolutions in Latin America, Asia, and Africa—for the last century, as we have worked to bring food to the tables and prosperity to the homes and communities of poor and marginalized families worldwide.

By Kofi Annan
Former Secretary General of the United Nations
Chairman of the Alliance for a Green Revolution in Africa

When the Rockefeller Foundation helped launch the Alliance for a Green Revolution in Africa (AGRA) in 2006, it brought more to the Alliance than simply money and know-how. It also provided the wisdom that came from a century of working to conquer hunger and promote prosperity through increasing agricultural production around the world.

Much has changed over the last century. Colonial empires have crumbled. New nations have asserted themselves on the global stage. The world's population has grown tremendously, and for many in the developed world, affluence has never been greater. But many of humanity's afflictions persist, including war, disease and, most pervasive of all, hunger and malnutrition. These problems are especially apparent in Africa, where nearly 350 million people go hungry every day.

The global community must find the will and resources to feed those who are starving now. As I have said on many occasions, the world needs better coordination of emergency food and nutrition programs. We need improved early warning systems that will alert us to potential food shortages. We also need to be able to respond to these crises more quickly by moving food reserves and cash to the countries and communities where they are needed. Above all, however, we must follow the advice of John D. Rockefeller and commit ourselves to addressing the root causes of hunger and malnutrition.

More than a hundred years ago, Rockefeller financed and founded the General Education Board (GEB), a precursor to the Rockefeller Foundation. The GEB began working with small-holder farmers in some of the poorest counties in the Southern United States in the hope that increasing agricultural production would increase food security and raise incomes in these communities. With increased prosperity, these communities would invest in the education of their children, thus ensuring greater opportunities for future generations.

The GEB paved the way for the Rockefeller Foundation's international agricultural efforts in Europe and Asia in the years prior to World War II. Then, in the middle of the war, the Foundation launched a remarkable initiative in Mexico to increase food production substantially through the development and introduction of more productive and resilient varieties of wheat, corn, beans, and other staple crops. The increases in agricultural yields were spectacular. Over the next several decades the Rockefeller Foundation sought to introduce high-yield seeds and new cultivation strategies in other developing nations. These efforts became known as the Green Revolution and are credited with saving more than a billion lives.

Certainly, the Foundation and the world learned lessons along the path of the Green Revolution. In some regions, greater agricultural productivity heightened inequality and intensified the marginalization of the poor and vulnerable in society. In other places, intensive use of petrochemical fertilizers and irrigation led to environmental problems and even the increase of human parasites like schistosomiasis. These consequences prompted serious reflection and great debate both within and outside the Foundation.

As *Food & Prosperity* points out, the Rockefeller Foundation learned from success and disappointment. Deepening its commitment to fighting hunger and malnutrition after the 1970s, it continued to invest in both science and human capacity. A second phase of the Green Revolution focused on continued increases in agricultural yields, while striving to protect the environment and strengthen communities along the way.

Without a doubt, the first green revolution provided the launch pad for Asia's astonishing progress over the last generation, but it did not touch Africa in the ways that some had hoped for. In recent decades, however, Africa has become a primary focus for the Rockefeller Foundation's agricultural work, and drawing on the lessons learned from Asia, they have embarked with

us on a uniquely African Green Revolution. I hope and believe that AGRA will provide a similar impetus to the future of our continent while ensuring economic, social, and environmental sustainability.

Today, as we work with our partners at the Rockefeller Foundation, I have every reason to be optimistic. Since launching AGRA, we have introduced over 400 new crop varieties developed with the help of local farmers. We have helped to train and fund 14,000 agro-dealers who are providing these new varieties and fertilizers to small farmers across the continent. With our partners, we have worked to regenerate 380,000 hectares of depleted soils in Sahelian countries through the precise application of small doses of fertilizer. Meanwhile, we have focused on training individuals involved in agricultural and food production and distribution processes, supporting more than 450 graduate students to take MSc and Ph.D. degrees in plant breeding and soil science at African universities.

These efforts to strengthen agriculture in Africa are painted against a background of other factors that strengthen my hope and resolve. Economic growth across the continent is strong. Foreign investment and private sector funders are increasingly seeing opportunities in Africa. Governance in many countries has improved, and education and health are more accessible, especially to women and girls. Meanwhile, the institutions that comprise our civil society are growing and becoming more active.

The Rockefeller Foundation has played no small part in these changes. As readers of *Food & Prosperity* will discover, the Foundation's commitment to improving the well-being of humanity is deeply rooted. Agriculture has been an important part of the Foundation's program for decades, and the lessons learned from its experience should inspire and humble those of us who strive today to conquer hunger and promote prosperity in our own era.

To understand the state of Mexican agriculture, the Survey Commission drove nearly 5,000 miles in their green "carryall" station wagon: (from l to r) Elvin Charles Stakman (Univ. Minnesota), Paul Mangelsdorf (Harvard), Richard Bradfield (Cornell), Richard Schultes (Harvard). (Rockefeller Archive Center.)

Fire-engine red. Professor Richard Bradfield, a soil agronomist at Cornell University's renowned college of agriculture, was on his way to New York City to pick up the Rockefeller Foundation's new "carryall" station wagon, and its color was not at all appropriate. There was no way such an attention-grabbing vehicle could be discreetly driven over the back roads of rural Mexico without becoming a spectacle. Bradfield and his fellow scientists, members of the Foundation's Agricultural Survey Commission to Mexico, had a mission: observe, draw conclusions, and report back to the Rockefeller Foundation. Though they would never be invisible, they should be discreet—quiet, discerning, and, above all, scientific in their appraisal. This meant limiting the effect their presence had on that which they observed. A bright red station wagon just wouldn't do. Foundation officials had the vehicle repainted a "pleasing green," and sent Bradfield on his way. It was the summer of 1941.

Green. It fit the tone of Bradfield's pursuit, but he had no way of knowing that he was a forward scout of what would become the Green Revolution, one of the most influential accomplishments of the Rockefeller Foundation in the 20th century. Bradfield and his three colleagues were simply a scientific survey team with a mandate from the Foundation to explore ways to help Mexico solve its pressing agricultural crisis. Truth be told, they were not exactly sure what could be done. There was no precedent, no template for what they were about to do. They intended to drive into Mexico and take it one mile at a time.

In Syracuse, Bradfield picked up Paul Mangelsdorf, a botanist from Harvard University who was one of the world's leading authorities on corn. Mangelsdorf brought with him a young Harvard graduate student, Richard Schultes, who was an adventurous scientist—part botanist and part anthropologist, with fieldwork research experience. Schultes had just returned from a trip to the Amazon Basin in search of wild, disease-resistant rubber plants that could be used in the war effort. In 20 years he would be widely acknowledged as the father of modern ethnobotany—the study of how humans have used, managed, and perceived plants. But in the summer of 1941, as the team approached the Mexican border, his greatest contribution was his ability to speak Spanish.

Dr. Elvin Charles Stakman, a plant pathologist from the University of Minnesota, completed the team. Stakman was the most prestigious scientist on the trip: older, and first among equals. (Among his graduate students at Minnesota was a young plant pathologist by the name of Norman Borlaug, whose interest in wheat stem rust would later make him a hero of the Green Revolution.) On the Mexico trip, Stakman's colleagues gave him the nickname *"jefe,"* only partly in jest. Stakman was absorbed in work at the University of Minnesota, and could not take time for the tedious drive to the border. Let the younger scientists break in the station wagon. He would meet the team in Mexico City.

These were not junior researchers. They were the foremost scientists in their fields. It was testament to the authority of the Rockefeller Foundation that when President Raymond Fosdick asked who might serve on a commission to study how the

Foundation could help Mexico, three of the most prestigious agricultural scientists in the nation answered the call and gave up their summers to chase the opportunity.

Heading south toward the Laredo border crossing, the station wagon rumbled through cotton farms in east Texas where the General Education Board (GEB), another Rockefeller philanthropy, had first experimented with agriculture programs 30 years earlier. The GEB had been a primary sponsor of the farm demonstration movement that agricultural scientist Seaman Knapp led at the turn of the century. Knapp had taken a holistic approach to agriculture, combining science with popular, demonstration-based education for farmers. His work had long since been popularized and taken over by extension programs at the U.S. Department of Agriculture (USDA) and the nation's land-grant colleges. It was just the way the Foundation liked to work. Invest early in an innovative idea, bring a program to maturity, and then pass it to government or other entities for permanent support.

Knapp had worked among farmers close to home, but working in a foreign country, where language and culture and traditions were bound to get in the way, promised to be exponentially more difficult. At the border, Dr. George Payne, a Rockefeller Foundation medical officer, met the team. Agriculture work in foreign countries might be newer and less tested, but the medical division of the Foundation, especially hookworm, yellow fever, and malaria specialists, had worked in Mexico and around the world for decades. Payne would escort the team to Mexico City to help them get started.

Stakman had also worked in Mexico. As early as 1917 he had been part of a USDA research team studying stem rust in wheat. He spoke Spanish and knew his way around the Mexican agricultural landscape. Once, during the 1917 trip, he had absentmindedly walked into a wheat field unannounced, only to be confronted by a farmer demanding to know what he was doing. "Is this your wheat field?" Stakman had called out. "What in the hell are you doing in it?" came the answer. Responding that he was a plant pathologist from the United States would hardly satisfy any farmer. As the Commission learned, most agricultural scientists worked in laboratories and behind desks, and rarely met with farmers or ventured out onto farms.

History may record that Stakman, Bradfield, Mangelsdorf, and Schultes were groundbreaking pioneers, but as they drove through Mexico, they traveled in the footsteps of others. For almost a decade prior to their trip, Dr. John Ferrell, associate director of the International Health Division of the Foundation, and Josephus Daniels, U.S. Ambassador to Mexico, had tried to convince the Rockefeller Foundation to pursue agriculture work in Mexico. They saw it as an opportunity to work on a pilot project to determine if elevating the farm economy could improve nutrition for the rural poor. Their early attempts to convince the Foundation failed. It would take a shift in the Mexican political landscape, the spread of war, and the addition of U.S. government voices to the chorus of advocates for Mexican agriculture work to convince the Foundation to explore it as a possibility. With all of these elements aligned, in early 1941, Foundation President Raymond Fosdick agreed to convene a

study commission to collect data. What was the situation in Mexico? How could the Rockefeller Foundation help? A few months later, Bradfield and his colleagues crossed the border in their green carry-all station wagon.

Overview

For a century, the agricultural work of the Rockefeller Foundation has been shaped by the delicate negotiations and personal relationships that arise out of first encounters between strangers. In each place the Foundation worked, whether in the United States or abroad, its activities have been characterized by a creative tension between science and technology on one hand and local knowledge, culture, and politics on the other. At times, the push and pull in this encounter has yielded innovative breakthroughs, while at other times the clash has produced effects that fall far short of the Foundation's intentions.

Mexico became a pivot point in the history of the Foundation's work on agriculture. It was large-scale and global in its ambition. Mexico became a laboratory in which the Foundation asked fundamental questions about the nature of agricultural development. Could the Foundation contribute to lifting farmers out of poverty into a nascent middle class? Would the Mexico program discover new technological innovations that might improve productivity and feed

a creative tension between science and technology on one hand and local knowledge, culture, and politics on the other.

the world? Could scientists unlock the nutritional secrets of ancient food crops and make them more nutritious? After Mexico, agriculture moved to the center of the Foundation's theory of global development and helped reshape the world.

This book traces the century-long process of scientific discovery and technological application that the Rockefeller Foundation implemented in different farmlands and cultures around the world. This is also the story of evolving definitions of agricultural prosperity. At times the Foundation focused its efforts on strategies to increase the wealth of farmers. At other times the Foundation focused on research that would improve the nutritional content of food. During the Green Revolution, when the world's population was increasing exponentially, scientists went into the fields and focused their creative talents on increasing the yields of staple food crops. The Foundation's changing notions of agricultural prosperity informed its aims and methods as it negotiated the tension between technology and culture.

The first important agriculture work funded by Rockefeller philanthropy was in the Southern United States. Chapter One explores the work of the General Education Board (GEB), an early subsidiary philanthropy created by John D. Rockefeller Sr., as it aimed to improve farm practices in order to lift poor American farmers out of poverty. In the decade leading up to the Rockefeller Foundation's official establishment in 1913, the GEB funded popular education programs for farmers. On experimental farms, GEB agriculturalists proved the value of new methods. The GEB also created clubs for farm children to demonstrate new production techniques to their skeptical

parents. Later, the GEB extended its work from the American South to the rural Northeast.

After the United States Congress shifted full support for this work to the government, another subsidiary Rockefeller philanthropy, the International Education Board (IEB), pursued similar educational programs abroad in the years after World War I. Chapter Two describes how the IEB funded farm demonstration projects and agriculture clubs in Northern and Eastern Europe. Like their counterparts at the GEB in the American South, officers of the IEB reasoned that farmers with more income would be more likely to support education. In Europe, the IEB encountered the same differences in social class and rural culture that the GEB had in the United States, with the added struggle of working through foreign languages and cultures on the geographic margins of Europe.

In China, as described in Chapter Three, the Foundation built on the relationship between agriculture and prosperity. It supported a new, more integrated program for rural reconstruction and development. The China work became entangled in political tensions that the Foundation struggled to understand, but it learned valuable lessons along the way.

During the Great Depression, as detailed in Chapter Four, the Foundation turned back to the United States in an effort to help address rural poverty and urban food shortages. As in China, the need to raise the quality of life in rural America encouraged the philanthropists to develop a strategy that combined improvements in the food supply with increased wealth for farmers. For the first time in its history of agriculture programming, the Foundation focused its funding across various

disciplines, including health. It supported social science research in an attempt to understand the underlying social forces at work in agriculture, and to chart a course forward. It also recognized nutrition studies as an important and emerging borderland between agriculture and public health. The insights it gained into the science of nutrition and yield, agricultural policy, and the forces of the market in these years would inform its work for decades.

As the U.S. economy recovered and the United States mobilized for World War II, the Foundation turned its attention to Mexico. Chapter Five chronicles the encounter between Rockefeller Foundation scientists, including the members of the Survey Commission in 1941, and their partners in Mexico. This experience transformed the way that Foundation officers worked internationally. Up to the 1940s, the agents of cultural exchange, those who actively implemented technology in local contexts, were outside advisors to the Foundation—people like Booker T. Washington in the American rural South or Jimmy Yen in the Chinese countryside. They acted as a bridge between strangers, between the philanthropists and scientists of the Foundation and the people whose lives they sought to improve. It was in Mexico that Foundation officers aimed to bridge the cultural gap themselves, by working and living full time in remote Mexican villages. They sought to transform food production there by building an operational infrastructure that promoted scientific techniques and technology to produce high-yielding food crops.

In the 1950s, as developed in Chapter Six, the Foundation geographically expanded the new model for agriculture work

it had created in Mexico. It opened regional research, training, and extension institutions, first in Colombia and Chile, and then in India. Like the Mexico program, these pioneering initiatives focused on scientific agricultural techniques and technology as the path to prosperity.

In the 1960s, the Rockefeller Foundation further expanded its approach by supporting a network of international agricultural research institutes that transcended national governments and regional agricultural concerns. Chapter Seven explores the development of these global institutes, which were funded in collaboration with other philanthropic institutions and concentrated their work on unlocking the secrets of individual staple crops. Key centers included the International Rice Research Institute (IRRI) in the Philippines, the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, and the International Center for Tropical Agriculture (CIAT) in Colombia. Over time the institutes would develop international staffs and serve international educational needs, but in the beginning they were similar to the in-country Rockefeller programs, complete with Rockefeller Foundation officers living and conducting their research in foreign countries where they were forced to engage both scientific and cultural challenges.

It was in this period that a U.S. government official coined the now-famous term “Green Revolution” to describe the proliferation of agricultural science and technology that had raised agricultural productivity so quickly across the world. While the Green Revolution is credited with saving more than a billion lives from famine, by the 1970s the Green Revolution

became the focus of widespread criticism. As Chapter Eight details, the Foundation reoriented its agriculture programs to respond to these concerns. Out of this review grew a new operating structure and set of goals. The Foundation focused on addressing "second-generation" problems of the Green Revolution, which centered more on social and environmental issues and less on high crop yield. The Foundation also reduced the role of its own staff in the field and began to rely on a growing cadre of local experts to introduce new technologies.

This new sensitivity to culture and local control continued to define Foundation work for decades. Chapter Nine describes how the Foundation streamlined funding in the 1980s to target neglected regions of the world as well as areas with the greatest scientific promise. This translated to a new focus on sub-Saharan Africa and on the emerging science of biotechnology. The latter has redefined the scope and content of agricultural technology, allowing farmers to combine higher yields with farm sustainability and higher nutritional quality. The Foundation chose local actors to implement these new technological advances.

In the 1990s and beyond, the Foundation has continued to prioritize sub-Saharan Africa and biotechnology in its agriculture programs. Chapter Ten looks at how the Rockefeller Foundation partnered with the Bill and Melinda Gates Foundation in 2006 to launch the Alliance for a Green Revolution in Africa (AGRA), which remains a central focus of the Foundation's agricultural programming today.

A Bigger Job

When members of the Foundation's Agricultural Survey Commission returned to the United States from Mexico in August 1941, they were inspired by what they had seen. The report they produced deeply impressed Foundation leaders. Even U.S. Vice President Henry Wallace, who had played a part in encouraging the Foundation to pursue its Mexican agriculture work, exclaimed upon reading it, "Perfectly swell!"

As Elvin Stakman later reported, the scientists knew that their job was not just surveying the landscape, but rather studying it with an eye toward the future, toward the policies that would change it. "When you undertake, not only to make discoveries, but also to determine their potential values, and then to capitalize on those values, it's a bigger job than merely making the discoveries," he said many years later. The agricultural scientists took on this bigger job with gusto, knitting together their knowledge of science with a vision of progress and the greater good that would inform the Foundation's role and identity for generations to come.

Unlike Stakman, earlier Rockefeller philanthropists had no idea how important and far-reaching their agriculture work would become. Yet they started out in much the same way. Just as Richard Bradfield drove his green station wagon south toward the unknown, Wallace Buttrick, another agent of Rockefeller philanthropy, boarded a train in 1905 and headed for a field-based fact-finding mission in the heart of the American West.

The General Education Board, a precursor to the Rockefeller Foundation, included many of John D. Rockefeller Sr.'s most trusted philanthropic advisors (l to r, from bottom row): Edwin Alderman, Frederick Gates, Charles Eliot, Harry Pratt Judson, Wallace Buttrick, Wickliffe Rose, Hollis Frissell, John D. Rockefeller Jr., E.C. Sage, Albert Shaw, Abraham Flexner, George Vincent, Anson Phelps Stokes, Starr Murphy, Jerome Greene. (Rockefeller Archive Center.)

CULTIVATING THE VINEYARD

Dr. Wallace Buttrick's train trip to the western United States in 1905 was not the first journey he made in the service of the General Education Board (GEB). He was, in fact, a key figure in the Board's creation and in the development of its approach to problem solving, including its use of field surveys to assess local conditions and needs. Survey commissions were the eyes on the ground and acted as advisors on policy.

The GEB had opened its doors in 1902, a full decade before the Rockefeller Foundation received its charter. It took on the task of promoting education in the Southern United States "without distinction of sex, race, or creed." It provided support for public schools and worked to promote public health. Its aim of using education as a means and an end in itself motivated the GEB to become involved in agricultural work in the Southern United States.

Buttrick's survey trips inspired him to advocate for this new arena of GEB work. His extensive travels through the South in the first decade of the century convinced him that the "main obstacle to progress was not apathy or provincialism but poverty." In rural communities, low agricultural productivity kept incomes low, and poor communities were unable to support public education.

Other Rockefeller advisors agreed that in order for their school programs to succeed, they needed a new educational program that would teach farmers in the field and increase productivity and crop yield. Frederick T. Gates, Rockefeller's key philanthropic advisor, called for a "practical way" to spread the "facts and art of agriculture to farmers." He suggested that there should "be no limit to the value of the crops they might raise." Yet what would this program look like? What would be its lessons and teaching technique?

Buttrick, then Secretary of the GEB, spent the better part of 1905 trying to answer this question. Before heading to Texas, he had traveled extensively in North America, researching agricultural education. However, he was unsatisfied with what he found. No successful model existed to teach the principles of scientific agriculture techniques to farmers. It was not until he visited the Agricultural and Mechanical College of Texas that he found both the zeal and technical ability that he sought. David Houston, the president of the college (who would later become U.S. Secretary of Agriculture), quipped during a meeting, "Buttrick, you came at the right time. We have two universities in Texas. One is at Austin and the other is Dr. Seaman Knapp. He is here now."

Buttrick agreed to meet with Knapp. He soon realized that Knapp's farm demonstration concept, which was already gaining attention in Texas, was just what he was looking for. Knapp's approach offered an efficient way to increase productivity through the eradication of simple problems, which, in the case of agriculture, meant crop blights and poor soil. Farm demonstrations could disseminate simple and effective lessons for blight prevention and soil fertilization, and became a model for Rockefeller's famed hookworm eradication program in the same region.

Farm Demonstration & the USDA

Though Seaman Knapp was not on the GEB radar before 1905, he had already enjoyed a long and honored career in popular agricultural education. Born in 1833 in upstate New York, he was schooled and married in the Northeast, working as a teacher until he moved his family to Iowa in 1863. He spent 20 years there, alternately working as a farmer, preacher, and educator. In the late 1870s, he became a professor of agriculture at Iowa Agricultural College. He edited the *Western Stock Journal and Farmer*, participated in the Iowa Improved Stock Breeders' Association, and suggested that Congress should establish a system of agricultural experiment stations—which finally happened in 1887.

In 1885, Knapp moved his family to Louisiana to work on the North American Land and Timber Company development project. Though business-oriented, this work gave the former university professor and farmer the opportunity to combine his scientific and experiential knowledge with

Seaman Asahel Knapp pioneered a farm demonstration method to disseminate agricultural science to farmers all over the United States, earning the support of the USDA and the General Education Board. (Rockefeller Archive Center.)

practical farming. The work inspired him to create a model for popular agricultural education based on demonstration. Knapp's work began with figuring out what crops could grow on land that had previously been considered unfit for agriculture in the area around Lake Charles, Louisiana. He chose rice, and attracted farmers by the trainload. The major challenge became convincing the newcomers, who were unimpressed with the soil, to grow crops both of the variety and in the method that Knapp advocated. He persuaded some to relocate to "strategic tracts," where he demonstrated cutting-edge rice growing and harvesting techniques. This tactic was an immediate and clear success. The farmers stayed, and their neighbors emulated their growing techniques. Within half a decade, farmers grew rice in this manner all over the Gulf Coast, and Louisiana became a major rice producer. Knapp saw the act of teaching-by-doing as absolutely key to his success. He later said of this work, which he performed from 1885 to 1903, that "we then learned the philosophy and the power of demonstration."

The Louisiana work also led to Knapp's official collaboration with the United States Department of Agriculture. He had a previous relationship with James Wilson, who became Secretary of Agriculture in 1897. Both had been professors at Iowa Agricultural College, and when Wilson served in the U.S. Congress, Knapp sent him and others draft legislation designed to obtain more federal funding for agricultural experiment stations, thus contributing to passage of the Hatch Act of 1887. In 1898, Knapp was appointed a USDA special advisor for the South and given the title "Agricultural Explorer." As part of his rice research, he traveled to rice-growing regions of Southeast Asia and the Caribbean in search of improved rice varieties, returning with strains of rice that enhanced America's rice production. The USDA also recruited Knapp to help fight the boll weevils that plagued Southern agriculture. Boll weevils, insects that attack cotton, had spread from Mexico to Texas in 1892. From Texas, they were moving northward and eastward, blighting cotton crops.

Knapp started his campaign against boll weevils in Terrell, Texas, in 1903. Using the same teaching-by-emulation technique that he developed for rice farmers in Louisiana, he preached better practices and diversified farming. He also coached farmers to harvest cotton before boll weevil larvae hatched and to burn cotton stalks in autumn to deprive the boll weevil of a breeding environment.

Knapp's first demonstration in Texas took place on Walter C. Porter's land. Farmers from the surrounding area were invited to observe. The U.S. Congress later deemed the demonstration such a success that it approved $40,000 in funding for Knapp to expand the program to other counties. By 1905, the so-called "Farmers' Cooperative Demonstration Work" had expanded throughout Texas, Louisiana, Arkansas, Oklahoma, and Mississippi. Knapp's methods greatly reduced the spread of the boll weevil and diminished the damage it caused to cotton crops in the Southern United States. Success on this scale fit the GEB's vision for agriculture work perfectly.

The GEB Extends Farm Demonstration

Wallace Buttrick's first meeting with Seaman Knapp turned into a two-day conference. They discussed the aims and methods of the farm demonstration model as well as the limitations imposed by the existing scope of the USDA program. Knapp argued that if his demonstration model "paid" in dealing with pest-ridden farms, there was "every reason to suppose that it would pay still more handsomely where no handicap at all existed." In other words, even farmers who were not suffering from boll weevils would benefit from learning the techniques of scientific agriculture, and the result would be an overall increase in agricultural productivity. Knapp was frustrated that federal policymakers had only been focused on interstate problems like the boll weevil. He wanted them to authorize a general farm demonstration program that could be expanded to all states in the American South.

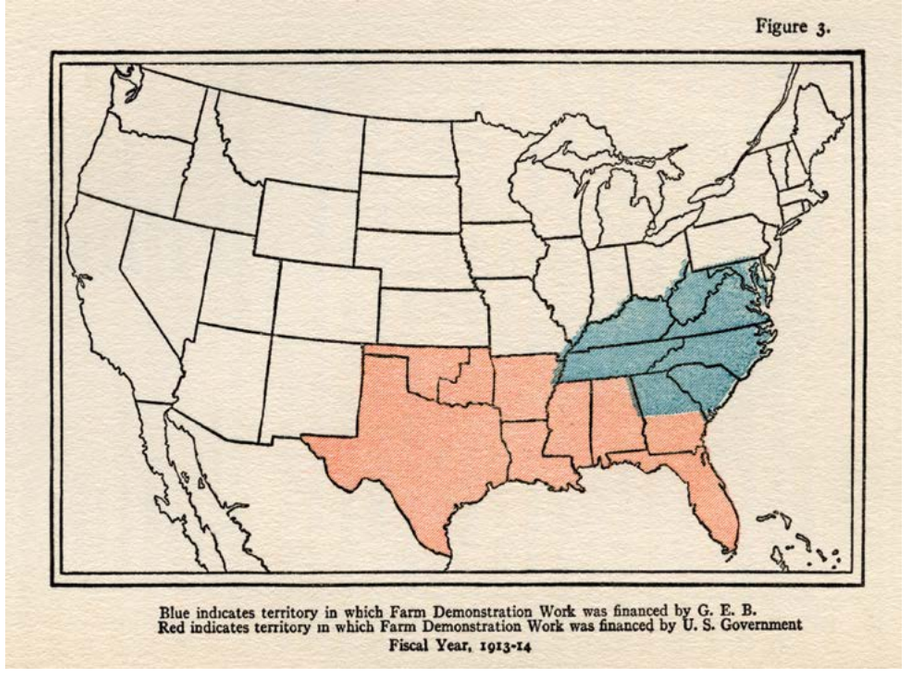
These talks with Knapp gave Buttrick a compelling model for popular farm education. He also realized that the GEB could support education for farmers in states unaffected by the boll weevil, where the USDA was doing little to increase agricultural productivity. In January 1906, Buttrick asked Frederick T. Gates—John D. Rockefeller's primary philanthropic advisor—to travel to Washington, D.C., to meet with Knapp. Gates, like Buttrick, was excited by the concept. At a later meeting with U.S. Secretary of Agriculture James Wilson, Buttrick proposed that the GEB help expand the farm demonstration program to states unaffected by the boll weevil. Under the terms of a formal agreement signed in April 1906, they agreed that federal funds would go to infested states, and GEB funds to non-infested ones. The agreement stipulated, however, that the USDA would supervise the work

and appoint local extension agents to work with farmers, while the GEB would simply pay salaries and costs in the areas it funded.

Though this arrangement limited GEB control, it did not restrict its level of commitment. The GEB quickly expanded its efforts from Mississippi to other states, such as Alabama. After 1909, it contributed over $100,000 every year, reaching nearly $200,000 for 1913. These increases partly reflected the success of the program as a whole. Meanwhile, USDA funding expanded as the boll weevil spread to new areas. By 1913, the government's support reached $300,000 a year. Though the GEB originally targeted southern states in the U.S., it also took on work in New Hampshire and Maine. In all, the GEB invested $925,750 in farm demonstration work in the Southern United States between the spring of 1906 and the summer of 1914 (equivalent to about $22 million in 2012 dollars), as well as $50,876.45 in the northern states.

Unfortunately, as the farm demonstration movement was expanding, its champion, Seaman Knapp, died in 1911. Farm agents carried his legacy forward. As part of their training, they read Knapp's *Ten Commandments of Agriculture*, which included lessons in plowing,

By 1913-14, the boll weevil had spread through the southernmost United States, from Texas to Florida. The division of funding between the GEB and USDA shifted as the boll weevil spread, with the GEB working only in areas where the pest had not invaded. (General Education Board, The General Education Board 1902-1914. Rockefeller Archive Center.)



planting, cultivating, harvesting, rotating crops, and fertilizing, as well as the use of waste products, machinery, and account books. In lectures and in writing, Knapp had emphasized the scientific and business aspects of agriculture. He told audiences that "agriculture may be divided into eight parts: one-eighth is science; three-eighths is art; four-eighths is business management." He had gained access to rural communities by convincing the best farmer to grow a test plot using his methods. This plot served as a demonstration field for other farmers.

Knapp's agents also started agricultural clubs to reach more members of rural communities. The clubs cultivated a culture of scientific agriculture. Agents used boys and girls clubs to educate children in good farming practice. Through the children, agents reached the parents, who often imitated the children's practice out of praise for—or embarrassment over—their greater success. Boys clubs focused on actual crop growing. Boys asked their fathers for a small plot of land to tend cotton or corn using Knapp's method. Girls clubs encouraged vegetable gardening, home economics, and household management practices tailored to the rural lifestyle. Knapp also created clubs for women, to teach them how to grow and can vegetables for future use.

By 1912, Knapp's approach was widespread and successful. That year, over 100,000 farmers volunteered to participate in demonstrations performed by nearly 1,000 agents and special appointees on 663 demonstration farms, as well as through new boys and girls clubs. Farm productivity increased. Corn yields on demonstration farms in Virginia averaged 41 bushels an acre, compared to 23 bushels on other farms. Seed cotton on demonstration farms in Georgia averaged 1,303 pounds per acre, compared to 732 pounds on nearby farms that relied on old methods. During this period, when corn and cotton prices remained fairly stable, the increased yields created additional revenue for farmers who employed farm demonstration methods. This work infused American farming with a culture of agricultural science and even changed the very appearance of the landscape as people followed Knapp's "gospel of clean farming."

"Alabama Must Feed Herself"

The transformation of agriculture inspired by Knapp involved many people. Agents walked into the fields to encounter farmers and teach them where they lived, town by town, county by county. But there was a difference between teacher and pupil, played out across the divide of agricultural science. Farm demonstration agents came from the world of agricultural colleges and extension services. They believed that their

Seaman Knapp encouraged the creation of boys and girls clubs, hoping that parents would adopt the agricultural techniques their children learned. (Rockefeller Archive Center.)

professional education could be translated into popular understanding and extended to new territory. Farmers understood their craft in terms of local knowledge, defined success by what had produced the best yields in the past, and replicated those techniques. Knapp knew that there was no culture of science among these farmers, and so kept communication simple, remarking, rather shrewdly, that the "average man, like the crow, cannot count more than three." Yet he also believed in the capabilities of these farmers once they received the lessons of agricultural science filtered down through farm demonstrations. "More could be gained through intelligence," he concluded, "than was lost through the weevil."

Knapp's farm demonstration model appealed to the USDA and the GEB not just because it disseminated information, but also because it did so with multiple mechanisms to overcome farmer skepticism. Farm agents commanded attention with their own strangeness, using it to demonstrate new techniques and display clearly superior results. This worked across an agricultural-science divide that was often compounded by differences of

class and race. Agents and farmers negotiated an understanding across this divide. The GEB characterized farm demonstration as "essentially a cooperative undertaking, the financial contributors, the agent, the farmer, the community, all participating." Because Knapp's work straddled two funding sources, the GEB also had to negotiate what role it could play monetarily.

GEB funding of farm work at the Tuskegee Institute showed these negotiations in action. The Board's funding changed substantially from 1906 to 1914 as its role in Alabama, and among southern schools for blacks, evolved. Booker T. Washington had been hired to run the Institute after it was established in 1881. Its aims and methods had much to do with his personal and educational upbringing. Born into slavery on a Virginia plantation in 1856, Washington moved to West Virginia to work after emancipation. He attended the Hampton Normal and Agricultural Institute in Virginia and Wayland Seminary in Washington, D.C., before returning to Hampton to teach. The "Hampton model" was based on an industrial education philosophy of manual labor, normal school and trade training, economic development, and self-help for its black students. Washington brought much of this philosophy to Tuskegee, including an emphasis on agriculture. He appointed George Washington Carver—who by 1896 had a master's degree in agricultural science from Iowa Agricultural College—to a post at Tuskegee. Carver became known for his practical approach, including advocating diversification of the southern agricultural economy through crop rotation and creating hundreds of products from simple plants such as peanuts and sweet potatoes.

Tuskegee gained support on the national stage as Booker T. Washington appealed to different groups. He worked to convince white elites in the South that blacks would be better workers if educated; northern donors that they would gain a Protestant work ethic; and southern blacks themselves that education offered a way to self-employment and landownership. Implementing this educational model made Washington an African-American leader for conciliatory racial politics. In 1895 he delivered a speech, the "Atlanta Compromise Address," in which he suggested that African Americans would acquiesce in disfranchisement and social segregation if American whites would encourage black progress in economic and educational opportunity. For northern philanthropic institutions, Washington became a chief exemplar of and spokesman for industrial education. By 1900 Tuskegee was the best-supported center for African-American education in the country.

Seaman Knapp included African-American farmers and tenants in his educational scheme from the beginning. After all, they produced the "bulk of the cotton crop." In some states, white agents worked with black farmers; in

others, the USDA appointed black agents, whose numbers increased as the program expanded. Schools like Tuskegee and Hampton played a key role in this system. Their training produced black teachers and agents, and they furnished facilities and tools for focusing on black farmers. After visiting Tuskegee in 1906, Knapp wrote a letter to Wallace Buttrick, suggesting that black schools offered a promising vehicle to reach black farmers and tenants, who would benefit from a program that combined agricultural science and "good practical knowledge" related to farming. "Now in building up the country," he wrote, "let us go ahead, and build systematically and upon a true foundation of success in agriculture, proper instructions in farm management."

In 1906, the USDA appointed Thomas Monroe Campbell as the first Negro farm demonstration agent and assigned him to Macon County, Alabama, where the Tuskegee Institute was located. Campbell had attended Tuskegee. Promoted to state agent in Alabama, and then later to field agent for seven southern states, including Texas and Oklahoma, Campbell advocated for an extension building on the Tuskegee campus, which became headquarters for black farm extension work in Alabama. He was a key figure in transmitting the lessons of farm demonstration to African-American farmers all over the South. The GEB complemented Campbell's work by funding auxiliary actors and programs for agricultural improvement in Alabama, including "state supervisors of Negro rural schools," who were white. In addition to these measures that indirectly affected Tuskegee, the GEB also funded the Institute directly. By 1915 the Board's contributions totaled $135,483.48 (over $3 million in 2012 dollars).

Prizes offered to Boys Corn Club members encouraged them to use Knapp's high-yield methods on their demonstration plots. (Rockefeller Archive Center.)

Canning was taught through women's clubs as a way to preserve the harvest. These women proudly displayed their work during an exhibit in Macon County, Alabama, in 1915. (Rockefeller Archive Center.)

The GEB never intended its funding to be permanent. John D. Rockefeller and his advisors believed that philanthropy should help move individuals and communities along the path to self-sufficiency and self-determination. They embraced the idea, reflected in a report from an Alabama State Agent for Negro Schools, for example, that "Alabama Must Feed Herself." In the minds of men like Buttrick and Frederick Gates, the farm demonstration program was a clear success; it was time for others to formalize a more permanent institutional structure to carry the work forward.

"A Higher Mission"

The U.S. Congress designed the Smith-Lever Act, which it passed in 1914, to create a permanent institutional framework for farm demonstration, building on a long tradition of federal government support for agricultural development. The U.S. Department of Agriculture had been established in 1862. Passage of the Morrill Act that same year created land-grant colleges and gave states public land to support higher education. The Hatch Act of 1887 extended this federal support for agriculture by funding experiment stations established in connection with the land-grant institutions. Later legislation increased funding and expanded the scope of

federal support for agricultural research. But as Congressman Asbury F. Lever, a Democrat from South Carolina, asserted in 1914, the knowledge generated by all of this research had been "accumulating for more than half a century and reservoiring in our colleges and other institutions" without reaching the people it was designed to help—farmers in the field.

Sponsors of the Smith-Lever Act believed farm demonstration and agricultural extension would "naturally and logically [complete] the chain of agencies fostered by the Federal Government for the betterment of agriculture." Senator Hoke Smith, a Democrat from Georgia, saw it as a way to bring results from the laboratories and field experiments to the local farm communities, to "carry the school to the farmer and make his own fields a laboratory in which we can demonstrate the value of science when applied to agriculture."

As the bill came before the U.S. Congress, however, two events fueled public antipathy for the Rockefellers and galvanized support for the measure. The first stemmed from a conflict in the spring of 1914 between armed coal miners and the Colorado National Guard in Ludlow, Colorado. Thousands of miners had been striking for months, protesting the Rockefeller-owned Colorado Fuel and Iron Company's refusal to negotiate with the United Mine Workers labor union. On April 20, violence erupted. The company's guards sprayed the striking miners' tent colony with rifle shots and machine gun fire, and then ignited a fire that spread through the camp. Between 19 and 25 people died, including 13 women and children who suffocated in a dirt bunker underneath one of the tents. The "Ludlow Massacre" received much attention in the media, serving as a symbol to many of industrial ruthlessness and immorality. John D. Rockefeller Jr., who would come to play a leading role in his father's philanthropy, sat on the Colorado Fuel and Iron board of directors. He was blamed for the tragedy, and some members of Congress hesitated to support a program associated with the Rockefeller name.

Booker T. Washington was an advocate of black advancement through education. Appointed head of the Tuskegee Normal and Industrial Institute in 1881, he promoted agricultural science. (Library of Congress.)

Public criticism of the Rockefellers was compounded later in 1914 when U.S. Senator William Kenyon of Iowa learned of the original 1906 memorandum between James Wilson (of the USDA) and Wallace Buttrick (of the GEB), delineating funding roles for the farm demonstration program. Though this agreement was not secret, its contents had not been common knowledge; only a few top officials at either organization knew what

District Demonstration Agent T.M. Campbell used the Jesup wagon to carry agricultural tools, stock, and poultry from community to community as he taught African-American farmers in Alabama how to increase their agricultural yields. (Rockefeller Archive Center.)

it said. Kenyon, who served on the Senate Agriculture Committee, publicly condemned the agreement because it allowed the GEB to pay hundreds of government salaries (those of demonstration agents, whose payment the USDA issued). According to Kenyon, the agreement made the Rockefellers sponsors of a "silent empire." He feared they were attempting to establish an "invisible government" through these gifts.

These two scandals prompted "extraordinarily hostile outbursts" in Congress. New Jersey Senator James E. Martine proclaimed, "I hope the United States may be spared from living on the contribution of a Rockefeller or a Carnegie. It would be equivalent to a family living on the wages of sin." Thomas Gore of Oklahoma declared that any money coming from the Rockefellers was "red with human blood and dripping with human tears." He advocated a "divorcement of the Government from the General Education Board."

The Rockefellers had their supporters. Congressman William West of Georgia (where farm demonstration had already taken place) argued that

government could condemn business practices while still allowing philanthropy to benefit the American people. "I am not defending these rich men," West said during a debate. "Their great donations to these objects may appear to many, and they appear to me, as a philanthropic paradox; but they give it, and why not receive it for these objects?" Hoke Smith, sponsor of the bill and also of Georgia, declared that the "fund as heretofore contributed has done a great service," and that "I am not moved to appropriate the money from the National Treasury by any adverse feeling toward the past use of this fund."

"We begin with the increase of the crop because that is the basis for all possible future prosperity." *Seaman Knapp*

Ironically, Congressional hostility towards the Rockefellers in 1914 served the long-term strategic goals of Rockefeller philanthropy. The farm demonstration program had been an outstanding success. The GEB hoped the federal government would adopt the program. Congressmen incensed at the idea that the salaries of some federal employees had been paid by Rockefeller philanthropy voted to appropriate funds to ensure the farm demonstration program's future independence—exactly the outcome the GEB wanted in the first place. Notably, congressmen on both sides of this debate argued that the federal government could afford to pay for this program, and so should take on the responsibility. The House approved the bill on April 27, 1914, and the Senate passed it on May 2, after which President Woodrow Wilson signed it into law.

The GEB officially terminated its agreement with the USDA in 1914 and returned to more direct work with educational institutions in the Southern United States. It funded groups that still affected farming life, such as rural youth clubs and rural public schools, as well as vocational agriculture in community programs, agricultural high schools, and state agricultural colleges. Though congressional condemnation had damaged the GEB's reputation, as well as its working relationship with the federal government, passage of Smith-Lever represented an enormous success for the GEB's agriculture program.

In addition to results it achieved during its period of involvement with the USDA from 1906 to 1914, the GEB's larger educational aims continued to benefit from agricultural improvement even after its role ended. Federal funding meant that farmers gained more access to the lessons that agricultural science had to offer them. In turn, increased crop yields made higher socioeconomic levels more attainable.

To Seaman Knapp, agricultural productivity had been a means to an end. "There is a higher mission," he stated in 1910. "We begin with the increase of the crop because that is the basis for all possible future prosperity. The farmer must be made independent." Frederick Gates, John D. Rockefeller's advisor and confidante, took it one step further. With more farm income, he argued, farmers in the Southern United States would increasingly support schools. Greater educational attainment would promote even greater prosperity.

Unlike later agriculture work, in which productivity and food security would be central, the earliest Rockefeller agricultural philanthropy was intimately bound up with educational aims. These early Rockefeller officers were more interested in planting the figurative germ of education than any actual seed. Indeed, Raymond Fosdick, who would become the Rockefeller Foundation's president, later characterized GEB efforts as "[cultivating] the vineyard of American education."

Though this early work in agriculture was different from later efforts in many ways, it was also influential. The GEB planted seeds because it saw them as necessary to its aim of doing the same for ideas. In the process, it solidified a set of techniques to approach problems of farming on a large scale. The cultivation of new scientific farming principles and their promulgation through farm demonstration programs in cooperation with government extension agents proved a powerful formula. The process of figuring out this new model yielded institutional memory within Rockefeller philanthropies for negotiating working projects in the field as well as partnerships with government agencies. It also set the standard for defining the success of agricultural policy as continuation by an outside agency—in this case its institutionalization in the United States through the passage of federal law.

Just as Wallace Buttrick had sought and found in Seaman Knapp a bridge between his world and that of the farmer that fulfilled his deepest charitable educational ambitions, Rockefeller philanthropists of the International Education Board (IEB) would travel to Europe in the 1920s on much the same quest. They ventured forth by boat, across that wide ocean, already armed with the farm demonstration model as they pushed agriculture into the new frontier of international work.

In 1908, by following Seaman Knapp's advice, farmer Daw Jacks grew an abundance of cotton, sweet potatoes, and corn on his demonstration plot near Marianna, Arkansas, even though the land had been cultivated for 75 years (Rockefeller Archive Center.)

GERMINAL IDEAS

Soren Sorensen was impressed. The Danish Agricultural Attaché to Washington stood in a cotton field, surveying the landscape. Changes wrought by the GEB's agricultural demonstration program in the American South had given him big ideas about what could be done at home in Denmark. Inspired, he had approached the GEB in the 1920s to see if they would help.

John D. Rockefeller Jr. wanted to work with Sorenson, but the GEB's charter, enacted by Congress, limited the institution's activities to the United States. Junior, as he was known, talked to Wickliffe Rose, the head of the GEB, as well as other advisors. Together they created the International Education Board (IEB) in January 1923 for the "promotion and advancement of education throughout the world." (Six years later, as part of a major reorganization of the Rockefeller philanthropies, the Rockefeller Foundation would absorb most of the programs of the IEB.)

Although the IEB extended the mission of the GEB into the international arena and there was a close relationship between the two boards in purpose and personnel, the IEB was also a product of the havoc of World War I. Wickliffe Rose was pivotal in its establishment, serving as director of the new entity while continuing to head the GEB. He felt compelled by the "disillusion of the world tragedy of 1914-1918" and the "desperate need" it disclosed to find "some ingredient which would heal the dissension of nations." Rose concluded that "knowledge is that ingredient, or at least it is an essential item in the prescription."

Both entities sought to improve education, but the GEB worked in the U.S. with the ultimate goal of correcting social inequalities while the IEB aimed to prevent future conflict between nations. To achieve this goal, the IEB focused on correcting the "impoverishment of educational and other intellectual resources" caused by World War I, especially in the arenas of natural science, the humanities, and agriculture.

Given the GEB's success with farm demonstration programs, agriculture offered a promising starting point for the IEB's work in Europe. Soren Sorenson's request for help had opened lines of communication, and the philanthropists at the IEB liked the context it offered. Denmark was predominantly agricultural, farming techniques could be improved, and the country could also serve as a center of operations in Europe.

In 1923, the Board sent Frants P. Lund to Denmark as an advisor. Lund, like Seaman Knapp before him, offered a bridge across the divide between agricultural science and culture. He had been born and educated in Denmark, but had lived and worked in the United States for a considerable time. He had been a farm demonstration agent for the USDA, running an important section of girls club work. This experience helped him learn how to teach agricultural science to farm families. In Denmark, on Lund's advice, the IEB set up a wide range of projects, including farm and home economics clubs, gardening classes, and home instruction.

The success of the project in Denmark led to requests from other countries. Within a year, Sweden sought IEB aid for farm demonstration work, as did Finland the following year. In total, the IEB contributed about $295,500 to education in these three Scandinavian countries (nearly $4 million today). Popular support preceded this work, and contributions from national governments usually followed. Further requests and contributions in Northern Europe made it easy for the IEB to spread its farm demonstration work. The model also fit, because Northern Europe in the 1920s, like the American South, was both rural and marginal to the regional centers of urban commerce and culture.

As in the American South, farm demonstration agents in Europe sought to teach agricultural science to farmers across a divide that was geographical as well as intellectual and cultural. Farmers were skeptical of the demonstrators' techniques. The advisors understood that skepticism and built on it. Lund created a sort of traveling show, modeled on the Tuskegee Jesup wagon, an agricultural school on wheels designed by Booker T. Washington and George Washington Carver, to promote science in rural areas. Lund used educational films to showcase his favorite farm demonstration program: boys and girls clubs. Recognizing that USDA films

An embroidered flour sack was given to the Rockefeller Foundation to commemorate its Belgian war relief efforts in 1919. The Foundation not only sent food ships to Belgium but also supported food aid in Poland, Serbia, Montenegro, and Albania. These efforts did not provide long-term food security, however. After World War I, Rockefeller philanthropists focused instead on humanity's problems by addressing the root causes in agriculture and other arenas. (Rockefeller Archive Center.)

were "not at all adequate" in the Danish context, he secured IEB funds in 1923 to commission several films, to be made in rural New York State.

Showing movies and developing curriculum that communicated across cultural differences wasn't easy, as Lund's telegrams to the IEB reveal. On one occasion, Lund struggled with how to incorporate a home economics demonstration into an American-made film because the "pimientos" he hoped to use were not a familiar food item in Scandinavia. Another home economics program had to be rejected because dress forms were "not ordinarily [a] girls project." Lund also had to struggle with technical issues. A film he received in 1925 was damaged in transit due to poor packing. Fortunately, Lund was able to repair the movie and show it. But while an urban audience in Copenhagen was "very much interested in seeing it," an epidemic of foot and mouth disease among local cattle prevented farmers in some rural communities from leaving their animals to watch a movie. As all of these incidents reveal, the IEB's agent in Scandinavia had to adjust his strategies to respond to local social and cultural circumstances; new technologies likewise often posed challenges as the IEB sought to transfer ideas and information about scientific agriculture.

The IEB pursued very limited popular education outside of the farm demonstration model. The Board gave about $18,000 over a five-year period to the Hungarian Village Association, which taught traditional village crafts and supported village educational and community centers. In Norway, the IEB gave $8,452 to an institute in Oslo to instruct farmers in agricultural subjects such as soil cultivation, forest management, and livestock production. In these countries, IEB work went beyond the tactics of farm demonstration and clubs that it had inherited from the GEB, expanding the range of subjects it could teach-by-doing in order to promote a broader concept of rural community development.

From Popular to Professional Agricultural Education

The professional arm of IEB agriculture education also began with a trip abroad. This time it was American officers who would seek out established European institutions to serve as their cultural bridge to the foreign student. In 1924, following what was becoming a central feature of Rockefeller philanthropy, Albert R. Mann from Cornell University and

Claude B. Hutchison from the University of California embarked on a trip to survey European agricultural universities. They intended to gather data on the state of research and teaching in agricultural science to form a plan for strategic giving in this arena and to build the network of contacts that would prove critical to the program's success.

Mann and Hutchison had previously worked together at Cornell. An "alert, competent, and gracious American" with a "conservative attitude and sound judgment," Mann was described as a "godsend" to agricultural officers and educators handicapped by postwar impoverishment. The IEB had appointed him director of its professional educational efforts in July 1924, but he could only stay away from his college duties for a period of two years. Hutchison, a "tall, solidly-built man," who "spoke easily" and with "self-assurance," was appointed to assist and then succeed Mann as director. He would provide the continuity of vision and management to strengthen the scientific basis for agriculture abroad. Mann left his imprint by leading the Board's efforts in this arena first. After Mann's departure from Europe in 1926, Hutchison would become the "lone wolf."

The two scientists traveled extensively to complete their survey work. They visited every country in Western Europe, including the British Isles. They traveled through much of Northern Europe and met officials in many Baltic and Eastern European states. They went as far south as Greece. In each country, they surveyed "every educational and research institution dealing with agriculture, veterinary medicine and forestry." The data they collected and the contacts they made shaped the IEB's professional agricultural education program, which would support both people and institutions over a wide geographical range.

Basing their decisions on the information gathered by Mann and Hutchison, the IEB's Board established a fellowship and traveling professorship program. Fellowships targeted younger workers who showed promise in a range of agricultural sciences, including plant physiology, plant pathology, soil chemistry, soil bacteriology, cytology, mycology, genetics, and entomology. The Board provided grants to 223 fellows to travel to 31 other countries to work with experts in their field. The IEB also awarded traveling professorships on a more limited basis to scientists who had already established themselves in their field. Twenty-six senior professors traveled abroad to teach and advise on research at foreign institutions, six of whom also acted in an advisory capacity for the IEB, reporting on scholars and universities they encountered.

The IEB focused on developing human capital in the field of agricultural science through these two streamlined programs. It also sought to stimulate

the flow of ideas and knowledge within the field. During his visit to Austria, Hutchison had remarked that it seemed like researchers "needed about ten tons of coal more than anything else." Yet what they bemoaned was the lack of scientific journals. The American scientists heard similar stories all over Europe after the war, but especially in Central Europe, where professors felt they were isolated from the rest of the scientific world. In response, the IEB provided $50,000 to agricultural institutions in Poland, Hungary, Austria, and Bulgaria for periodicals and laboratory equipment. These grants helped stimulate the exchange of ideas and information within the field. The IEB also explored more fundamental innovative efforts to transform the knowledge system within which agricultural development took place.

Two girls, Tuovi and Salme Halkilahti, inspect their crops in Finland in 1927. Girls clubs in Northern Europe taught vegetable gardening and canning. (Rockefeller Archive Center.)

In Rome, the International Institute of Agriculture had embarked on an ambitious effort to centralize the collection of agricultural information. When Wickliffe Rose, the president of the IEB, visited this institute during a tour of Europe in the early 1920s, he was impressed. The IEB later granted almost $80,000 to the Institute for its agricultural census project and library reorganization. (The IEB also located its European headquarters in the Institute for the first year of its work, before moving to Paris in 1925.) The census, published in 1932, provided a uniform survey of 62 nations throughout the world producing crops and livestock. It represented a significant milestone in the generation of reliable, thorough, and timely statistical information for the international agricultural scientific community. The United Nations Food and Agriculture Organization (FAO) continues this work today.

IEB efforts to strengthen the exchange of information about agricultural science played a particularly important part in countries that were less industrialized. In Bulgaria, for example, three-fourths of the population was estimated to be agricultural. The country's ability to pay World War I reparations depended upon its selling wheat and tobacco abroad. Impoverished by the war, the government could not provide

Swedish boys club agents inspect a club member's plot in 1930. Following the farm demonstration model, boys clubs in Northern Europe focused on growing crops in demonstration plots with guidance and instruction from demonstration agents. (Rockefeller Archive Center.)

adequate support to the University of Sofia College of Agriculture. In 1925, the University applied to the IEB for a grant to help construct a new building for agricultural research and instruction. Claude Hutchison had visited the institution during the survey trip and understood the need. With his encouragement, the IEB appropriated $115,000 in 1926 to enable the University of Sofia to proceed. The grant was so important to the government that it stopped construction on every other major building in the country until it completed the agriculture building. The new facility contributed to a remarkable turnaround in agriculture in Bulgaria. By 1939, historian George Gray states, Bulgaria was "without question, the most competent and active outpost of scientific agriculture in the Balkan states." In that same year, the University of Sofia awarded Hutchison an honorary doctorate.

The IEB gave its largest grant, $2,859,788 (roughly $40 million in 2013 dollars), to Cambridge University to create a full agricultural program integrated with other scientific disciplines. "The total spread over into agriculture on the one hand, and into the basic physical sciences, on the other," Hutchison explained. Nearly $2 million of the grant helped pay for construction and equipping of laboratories for agriculture, botany, physiology, and zoology, while over $900,000 went toward a new Cambridge University Library. Upon the inauguration of this new building, one university leader said that Rockefeller funding "opened up vistas and new lines of advance in fields which are no longer cultivated by one branch of science alone, but are common ground where biologists, physicists, and chemists co-operate with a single purpose." In short, Rockefeller philanthropy played a key role in promoting a more interdisciplinary approach to agricultural science in the United Kingdom.

A Limited Perspective

The International Education Board's work in both popular and professional agricultural education in the 1920s sought to develop human capital and institutions. Like the GEB before it, the IEB sponsored demonstration programs that popularized scientific ideas. From the boys and girls clubs of Denmark to the Cambridge Library, from Hungarian village craft to soil bacteriology fellowships, agents of the IEB promoted science as a way to enhance agricultural productivity and improve rural life. Along the way, the Board struggled to communicate these ideas in ways that would engage farm families.

At the same time, the IEB focused on the creation of scientific knowledge. Grants for surveys, libraries, lab equipment, fellows, and experiment stations constituted a multifaceted, concerted effort to enhance the infrastructure for research and strengthen the networks for sharing new discoveries. Much of this work followed the pattern laid down by Wickliffe Rose, who believed in planting "germinal ideas." As described by Hutchison, Rose tended to "find some professor, let's say, working on something new, and he would like to make that man a grant, to give him more assistance, or to help him buy some new equipment, or to strengthen his library facilities, or do something to help him develop that idea in science with the hope that it would thrive and grow."

The International Education Board funded the Hungarian Village Association as a way to expand European rural education beyond farm demonstrations and agricultural clubs. The association taught women village crafts. (Rockefeller Archive Center.)

Albert R. Mann graduated from Cornell University in 1904, and was dean of the New York State College of Agriculture from 1917 to 1931. He took a leave from 1924 to 1926 to direct the beginning of the International Education Board's agricultural science and education efforts in Europe. Officers and educators there called him a "godsend." (Kaiden—Keystone. Rockefeller Archive Center.)

Despite all of these efforts, the IEB's work in agriculture remained marginal to the larger program of the Rockefeller Foundation in the 1920s. Most of the resources of the Foundation and its sister philanthropies were devoted to medicine, public health, and basic scientific research. In 1928, it seemed briefly that the Foundation would place a greater emphasis on agriculture. After a fundamental reorganization of various Rockefeller philanthropies, however, the IEB was eliminated as a separate entity, and its earlier efforts were absorbed into new programmatic divisions of the Rockefeller Foundation. Under a new guiding principle, "the advancement of knowledge," a program area in the natural sciences was devoted to agriculture and forestry. But the Foundation did not appoint an officer to lead this effort. Instead, in 1930, as the worldwide Great Depression took hold, it officially described the program as "suspended." Convinced that the development of agriculture had become a priority for governments, Rockefeller Foundation leaders felt that they could exert greater leverage in other disciplines and arenas.

In part, the decision to give a low priority to agriculture reflected a traditional perspective on its role in community and economic development. Within this perspective, food production aimed first to sustain the local population and second to serve as a source of cash to grow the local economy. As a result, the founders of the GEB had seen agriculture as a means to an end, a way to increase prosperity in order to support the larger goal of increasing educational attainment. It would take a later generation of leaders, informed by the development of nutrition science, to appreciate the systemic relationship between food, health, and prosperity. But in the 1930s the Foundation launched an innovative experiment in China that would help guide this later generation.

Targeting Youth for Agricultural Development

As the GEB learned in supporting the farm demonstration model, programs aimed at young people influence parents and build a basis for future support. Targeting youth has been an important part of the Rockefeller Foundation's agriculture work in sub-Saharan Africa in recent years.

In Abuja, Ajima Farms and General Enterprises Nigeria Limited received $100,000 to develop a youth agricultural entrepreneurship training center. In Kenya, the Foundation has funded a pilot project to develop a business model to expand youth participation in agricultural systems, giving $175,000 to Farm Concern International in Nairobi between 2010 and 2013. This project aims to address youth unemployment and increase agricultural productivity in Kenya.

Radio has proved a useful tool for reaching youth in sub-Saharan Africa. With support from the Rockefeller Foundation, Farm Radio International began broadcasting "FarmQuest," a program that encourages youth in Mali and other African countries to view farming as a rewarding profession. A similar grant to Agriculture Climate Change Education Community Programmes in Nairobi helped launch a participatory radio show to encourage youth to enter farming in Kikuyu-speaking districts of Kenya.

These efforts recognize that youth interest and financial realities are closely intertwined. They stimulate youth involvement in the farming sector in ways that will lead to real positive economic impact.

The International Education Board funded plant physiological research in Europe, including work by the Laboratory for Plant Pathological Research at Holland Agricultural University in Wageningen, Holland. (Rockefeller Archive Center.)

RURAL RECONSTRUCTION

James "Jimmy" Yen (Yan Yangchu) was the kind of man that American philanthropists in the 1920s could believe in. John D. Rockefeller Jr. was so taken with the young social reformer that he invited Yen and his family to spend a week at the Rockefeller's summer home in Maine in 1928. Along with many American leaders in the 1920s, Rockefeller hoped that Yen would be able to lead a movement that would transform rural life in China.

Like Seaman Knapp or Frants Lund before him, Jimmy Yen offered a cultural bridge between the Foundation and the nation it was trying to help. Born in the hinterland of China in 1893, in the same year as Mao Zedong and during the waning years of the Manchu Dynasty, Yen learned the classics in a traditional Chinese school in Szechuan Province. He moved on to a western education in missionary schools. Barred from attending Hong Kong University because he was not a British subject, he traveled to the United States for college. He graduated from Yale in 1918 and earned a Master's degree in History and Politics from Princeton University in 1920.

During World War I, Yen volunteered with the YMCA as a literacy instructor for thousands of Chinese laborers who had been brought to France to work behind the Allied lines. In this position he developed a method for improving literacy by teaching a thousand commonly used Chinese characters. The experience in popular education gave him great respect for China's illiterate peasants and taught him the "ignorance not of the coolies but of the intellectuals like myself."

After working to promote Chinese literacy for years, Dr. James "Jimmy" Yen (Yan Yangchu) (front center) sought new ways to fit his teaching into an integrated program for rural development. The Mass Education Movement he founded in 1923 included instruction in agriculture as well as in reading and writing. Other MEM officials included Dr. Chen Zhiqian (Health Division, rear center) and Dr. Qu Shiying (Education Division, front right). (Selskar Gunn. Rockefeller Archive Center.)

After Yen returned to China, he collaborated with the YMCA on a national literacy program based on his simple curriculum. Successful in his efforts to expand literacy in rural China, Yen discovered, like GEB reformers in the rural American South, that education alone could not transform a community without a corresponding change in economic circumstances. As one man remarked: "Mr. Yen, I thank you for bringing this literacy school to our village, but my stomach is still just as empty as my illiterate neighbor's."

This critique went to the heart of the challenge facing Yen and others working to shape China's future in the 1920s. With the end of imperial rule, various factions were struggling to hold political power—feudal landlords, liberal democrats, and emerging communists. Meanwhile, American leaders, including John D. Rockefeller Jr., believed a singular moment had come to modernize China and, in the process, build a close relationship between China and the United States. All of these actors seemed to recognize that the key to the future was in developing rural life and agriculture in China.

No outside organization or foreign government would invest more in China during what some historians call the "Republican era" than the Rockefeller Foundation and subsidiary Rockefeller philanthropies. Working with Jimmy Yen and other Chinese partners, the Foundation would pioneer new approaches to public health and agriculture that proved to be enormously influential in the field of development. Against the backdrop of civil and global war in the 1930s and 1940s, these successes were sometimes hard to recognize, but their legacies have become increasingly apparent to those who work in community health and agriculture today.

Rockefeller Philanthropy in China in the 1920s

The special relationship between the Rockefeller family and China began with Standard Oil. As historian Mary Brown Bullock points out, John D. Rockefeller sold kerosene to China for the first time in 1863, the same year he made his first contribution to Baptist missions in the Middle Kingdom. By the 1880s, as Standard Oil grew to become the largest petroleum refiner in the world, China had become an important market. Rockefeller's philanthropy likewise expanded in this era, including his support for the work of American Baptist missions and the YMCA.

John D. Rockefeller Jr. deepened the family's interest in China. With Frederick Gates, he helped persuade his father to fund several surveys of conditions in China prior to the creation of the Rockefeller Foundation. Soon after the Foundation was founded in 1913, the work of the China survey committees led to the creation of the Peking Union Medical College (PUMC) under the management of the China Medical Board (CMB). For years, the CMB operated as a branch of the Rockefeller Foundation. In 1928 it would become an independent institution with its own endowment, but during its early years it remained closely tied to the Rockefeller Foundation. The Rockefellers and the Rockefeller Foundation invested tens of millions of dollars in the PUMC in an effort to promote western medical science.

With the PUMC the Rockefeller Foundation hoped to create an elite institution with high standards that would become a benchmark for China's further development in medicine. But Rockefeller philanthropic initiatives in China did not stop with medical education. In the 1920s the Foundation worked to promote higher education in other arenas as well—including the social sciences and agriculture.

In particular, the International Education Board funded a major initiative at the University of Nanking, which American missionaries had established in 1888. This private university offered a bridge between American institutions and Chinese government and culture. In the early 1920s John H. Reisner, dean of the College of Agriculture and Forestry at the University of Nanking, visited his alma mater, Cornell University in Ithaca, New York. An agriculturalist and missionary, Reisner had been on the faculty at the University of Nanking since 1914. At Cornell, he described Nanking's need for strains of crop plants improved by American scientists, and appealed for help. Cornell agreed to provide support on a shared basis with the IEB.

Under this arrangement, professors from the Department of Plant Breeding at Cornell traveled to China to teach and supervise research on a rotating basis. The IEB paid a portion of their salaries while they were in China, and the University of Nanking paid their travel expenses and managed the finances of their plant breeding work. These efforts helped establish a department of plant breeding at the University of Nanking, which remained under the supervision of resident directors from Cornell for the duration of the program, from 1924 to 1931.

Though IEB funding was modest, it formed part of a concerted effort that laid the groundwork for future agricultural science in China as well as Rockefeller Foundation work in agriculture. Influenced and guided by these visiting professors, the University of Nanking started a plant breeding station at the Tai Ping Men Farm. Researchers experimented with crops such as corn, rice, barley, cotton, soy, and wheat. According to the IEB, by 1931 "some 30,000 articles had been published in 350 Chinese journals." The IEB and the Rockefeller Foundation also helped promote the creation of other cooperative research stations modeled after Tai Ping Men. By 1931, eleven such stations had been established in the region. These facilities provided a venue for the professional education of younger Chinese agriculturalists. Meanwhile, the China Medical Board contributed $25,000 toward the completion of a new science building to house the College of Agriculture and

John D. Rockefeller Sr. (left) and his son John D. Rockefeller Jr. funded large-scale philanthropic efforts in China, including Jimmy Yen's work toward integrated rural development. (Rockefeller Archive Center.)

The China Medical Board funded the completion of a new building for the College of Agriculture at Nanking University in 1924. (Rockefeller Archive Center.)

the Department of Biology. This left the original building, which at one time had housed all scientific disciplines, for the exclusive use of the physics and chemistry departments. Though Nanking did not perform any kind of demonstrations for farmers at this time, a more widespread program would develop in the 1930s that would depend on these early pioneering efforts, growing out of the conversation between John D. Rockefeller Jr. and Jimmy Yen.

The Mass Education Movement

Aiming to expand the impact of his rural literacy program and to do more to promote rural development in China, Jimmy Yen had founded the National Association of Mass Education Movements (MEM) in 1923. This initiative gradually expanded its work from basic literacy into scientific agriculture, cooperative marketing, public health, and local government instruction, as part of an integrated program of rural social uplift.

Yen's approach to agricultural development included many of the strategies and values of the GEB and IEB, but they were also unique to the Chinese situation. Like the Rockefeller organizations, Yen believed that science could be used to improve rural agrarian life. Unlike the GEB and the IEB, however, he did not rely exclusively on farm demonstration programs.

Instead, he believed that agricultural education could work in tandem with other popular efforts and take a more holistic approach to rural prosperity.

Yen's work was particularly attractive to John D. Rockefeller Jr. The two men had met through YMCA contacts in the United States. During the 1920s, Junior had spearheaded an effort among different philanthropies to fund "new directions in social work, foreign missions, and historic preservation" in China. He pledged $400,000 of his personal money to the YMCA, to be matched by other donors. The funds went partially to a model village initiative to improve working and living conditions in a suburb of Shanghai.

Junior's personal support for these efforts reflected an interest in China that went well beyond medical education, influencing the work of the IEB and the Rockefeller Foundation. According to Mary Brown Bullock, it contributed to the Foundation's decision to "look beyond PUMC and its medical ivory tower toward a more culturally sensitive and populist approach to China's social and economic challenges."

In 1928, after listening to Yen's appeal for help, Junior gave $100,000 to support the Mass Education Movement. Rockefeller's gift led to contributions by other American philanthropists.

Junior's interest in Jimmy Yen and the Mass Education Movement paralleled efforts by two key Rockefeller Foundation program officers: John Grant and Selskar Gunn. Grant had been born and grew up in China as the son of Canadian medical missionaries. He attended Acadia College in Nova Scotia, Canada, and earned his medical degree at the University of Michigan before joining the Foundation's International Health Board (IHB). For two years he worked on hookworm campaigns in the American South and then in China. These experiences cultivated a passionate commitment to an integrated approach to community health. Returning to the United States in 1920, he enrolled in the Johns Hopkins School of Public Health, which had recently been established with Rockefeller Foundation support. After graduation, he returned to China as the newly appointed professor of public health at PUMC.

Throughout the 1920s, Grant worked to integrate Western ideas of public health with the values and traditions of Chinese culture. He created the Beijing First Health Demonstration in 1925 as a "social laboratory" for training public health professionals and medical students from PUMC in curative and preventive medicine. Grant saw this approach to public health as an integral part of socioeconomic progress.

Grant and his PUMC colleagues began working closely with Jimmy Yen and the Mass Education Movement in 1929. In Ting Hsien, a region of some half a million people in the countryside west of Beijing, known today as Ding County, they established a health station that folded integrated health work

into the more comprehensive rural education and reform movement that MEM already had underway. As Grant explained to Selskar Gunn—who was then vice president for the Rockefeller Foundation in Europe, prior to his transfer to China—medical success in China was "dependent upon progress in other fields of community activity, such as industry, agriculture, education, and transportation," making medicine only "one aspect of a larger plan of social reconstruction."

Working with Yen and the Mass Education Movement in Ting Hsien exposed the Rockefeller Foundation to other aspects of MEM's approach to rural development. MEM aimed to create an "integrated rural reconstruction attack on the four weaknesses of village life—poverty, disease, ignorance, and misgovernment. According to historian Charles Hayford, by the 1930s the rural reconstruction movement consisted of "some seven hundred rural projects, schools, institutes, stations, and agencies which took part in the nation-wide change of consciousness," but were "organized loosely if organized at all." By 1935 the government was giving Yen the "run of [this] county (*hsien*) of 400,000 population as a field for his experiments."

Dr. John B. Grant began work for the Rockefeller Foundation's International Health Division in 1918. He later became a professor of public health at Peking Union Medical College and an early advocate of its integrated approach to the field. He worked closely with the Mass Education Movement and later helped lead the Rockefeller Foundation's rural reconstruction program. He left for India after the Japanese invaded China. (Rockefeller Archive Center.)

The Foundation's initial partnership with the Mass Education Movement fed a dialogue within the Foundation that focused specifically on projects in health and agriculture, but also more generally on the Foundation's overall approach to philanthropy. As the Foundation entered the 1930s, top officers were increasingly frustrated with the narrow approach they were taking in many arenas. They recognized that problems related to public health, economics, and agriculture were interrelated. They discussed the idea of creating an experimental, multifaceted social program that would, as Mary Brown Bullock writes, "bring various foundation divisions together into a single project that addressed community development."

China seemed to offer the perfect venue for such an initiative. Many of the leaders of the Foundation subscribed to an idea that Chinese society in the 1920s and 30s was tremendously malleable, as China's leaders embraced efforts designed "to reconstruct a medieval society in terms of modern knowledge." Thus, larger forces would aid efforts to catalyze social change.

Following John Grant's initiative, public health students at Peking Union Medical College in 1930 focused on the relationship between public health and community development. Practicing curative and preventive medicine, they used health demonstrations to teach home health care to factory workers. (Rockefeller Archive Center.)

Specifically, the Mass Education Movement in China seemed to offer the perfect partner for an integrated effort to address the needs of rural Chinese peasants. As Gunn noted in 1935, Yen's work constituted one of the Foundation's "major interests in China." And given the Foundation's interest in selecting high-quality preexisting programs to support, a technique that Gunn described as "qualitative pump priming," the time seemed right for a major new initiative.

Rural Reconstruction

In 1934 the Rockefeller Foundation trustees approved a program of rural reconstruction in China. Integrating the conversations and work that had led to its development, the rural reconstruction program sought to provide a multifaceted set of social services, which would work in concert to improve the quality of life in rural China. In addition to agriculture, it

embraced "sanitation, preventive medicine, marketing, rural economy, rural administration, and community work." Training fellowships, indebted to the legacy of IEB fellowship support in the preceding decade, were essential to the program, as they could "add competent technicians to China's human resources." The Foundation inaugurated the program in 1935 as a separate, autonomous entity, to which they allocated $1 million (roughly $17 million in 2013 dollars) during the first year of operation.

The rural reconstruction program, however, differed from Yen's Mass Education Movement by giving greater emphasis to the role of scientific research. The Foundation wanted to accelerate the transmission of new learning from the laboratory to the field. In 1936 John Grant formed the North China Council on Rural Reconstruction (NCCRR). This organization represented leading Chinese universities, as well as Yen's organization. The Foundation saw it as a "more logical and permanent social training and investigative organization."

Improved agricultural production represented one pillar of the Mass Education Movement's integrated approach to rural development. Agricultural exhibits and prizes encouraged farmers to adopt better cultivation methods. (Selskar Gunn. Rockefeller Archive Center.)

The NCCRR created departments to handle varied social aid and research goals in the areas of economics, public works, social administration, and civil administration. It also offered programs in composting, farm implements, the control of gastrointestinal diseases, and plant and animal breeding, as well as elementary school funding and birth control. The NCCRR sought to bring Chinese intellectuals and academics working in these different disciplines into "direct contact with rural China," training them for "rural leadership and to coordinate the many existing rural reconstruction efforts."

The Foundation and Jimmy Yen continued to work together. Indeed, Yen supported the NCCRR and its mission. He argued that education went both ways, with reconstruction referring not just to improvement of rural life, but to the improvement of the universities and professors as well. The aim of the NCCRR, he once stated, was to "take these intellectuals from their ivory towers to the dirty villages" in order to get them to "give up their usual habit of burying themselves in the laboratories and archives to face day to day problems."

To complement rural reconstruction work the Foundation continued to devote a small amount of funding to university agricultural sciences. Its annual report for 1935 described the University of Nanking as a "pioneer in agriculture" and an "outstanding institution in China in this field," especially due to its contributions in "agronomy (wheat) and agricultural economics." In 1935 the Foundation also appropriated $34,600 to the College of Agriculture of the National Central University in Nanking, for work in animal husbandry and veterinary medicine. By continuing to fund the agricultural sciences at this institution, the Foundation sought to promote local research and train the next generation of agricultural experts in China. Consistent with the American model, these programs focused on both professional (university training, experimentation) and popular (rural reconstruction) education. In China, however, the program was deeply integrated with the institutions of rural life. Thus it could not help but become entangled with politics.

"Red China": The Rockefeller Foundation Confronts Politics

Rockefeller officers working in agriculture had confronted politically charged situations in the past. As we have seen, the General Education Board's farm demonstration work became the subject of a bitter debate in Congress over the appropriateness of accepting charity from wealthy capitalists to support public projects. International food aid

provided by the Rockefeller Foundation had to cross hostile waters into occupied territory during World War I. Yet no situation in the past had been politically charged in the way that China was in the middle of the twentieth century.

For the first time, agricultural work was not peripheral to the political conflict. It was not a symbol of philanthropy as a larger concept, nor a tool to relieve the effects of war on civilian populations. In China, agriculture was central to the political conflict. Questions of land ownership, agricultural production systems, basic sustenance, and quality of life were at stake. Indeed, Chinese communists, who were gaining strength in the 1920s, asserted that these issues were central to the future of their largely rural nation. In the late 1930s, as both the Communists and the Nationalists attempted to co-opt the work of agricultural reform, the Rockefeller Foundation hoped to steer clear of these politics.

The dissolution of imperial China had led to the establishment of the Republic of China in 1912, but political power remained fragmented. In the late 1920s the Kuomintang (KMT or Nationalist Party), under General Chiang Kai-shek, reunified the country, but rival factions kept the new government unstable. In 1927 the Communist Party of China (CPC) split the revolutionary ranks, sparking a civil war that would last until 1950.

Selskar M. Gunn had worked for the Rockefeller Foundation on health initiatives in Europe for almost 15 years before he traveled to China in 1931. Impressed by the integrated strategy for development that combined health, literacy, and agriculture, he became an ardent advocate for this approach. (Rockefeller Archive Center.)

Because rural influence was key to this conflict, both parties allied themselves with agricultural concerns in multiple incarnations. From the 1920s onward, the Communist challenge to the Nationalists was especially fervent in rural areas. By the late 1920s the CPC had shifted from an "unsuccessful effort to mobilize urban workers to embrace Mao Zedong's peasant revolution." It retreated to southeastern China to establish the Jiangxi Soviet, where it carried out experiments in land reform. Historian Mary Brown Bullock emphasizes the role of this experiment station as the "first rural revolutionary base area," key in that it gave the CPC the opportunity to "carry out agrarian and administrative reforms, and to actually govern a rural region."

By the early 1930s, however, Chiang Kai-shek's military campaign had pushed the Communists northward on their Long March north from Jiangxi. Settling in Shaanxi they implemented another

The Rockefeller Foundation's rural reconstruction efforts took inspiration from the Mass Education Movement's work in agriculture. MEM had helped farmers improve their crops, including cotton. (Selskar Gunn. Rockefeller Archive Center.)

campaign of land reform programs. The CPC never allied itself directly with the Rockefeller Foundation's work, which was centered on Ting Hsien. It did associate the Foundation's agriculture work with its political goals, but the CPC called for reform that went beyond improvements in agricultural productivity. It wanted fundamental reform that would redistribute land to the peasant class.

The KMT never made agricultural concerns the centerpiece of its campaign. As Mary Brown Bullock notes, Chiang Kai-shek "primarily sought military annihilation" of the Communists. Nevertheless, the Nationalists implemented a much slimmer program of rural reform that was also associated with Rockefeller Foundation work in agriculture. The Nationalist program aimed to compete with the work of the CPC in this arena, but it folded agriculture into its New Life Movement, a "social and

cultural promotion of traditional Chinese values." Though the KMT was not averse to rural reform, it could not champion it. As Bullock notes, the "leadership remained dependent upon the members of China's landlord class, who were unlikely to reduce their own economic and political power." Instead, the KMT loosely supported various private reforms, with Madame Chiang Kai-shek reaching out to "encourage and support many of these efforts, including those of the [Rockefeller Foundation]." In this way, the KMT could co-opt rural reform without ceding ground on the issue of land reform. As Bullock puts it, the KMT hoped to "blunt the radicalism" associated with Communist efforts.

Although Selskar Gunn, John Grant, and their Chinese colleagues knew that the concentration of land ownership contributed substantially to widespread rural poverty, they avoided this fundamentally political issue. Given the history and culture of the Foundation, they were opposed to radical economic solutions. Instead, they hoped that the Nationalist government would eventually tackle the problem of land reform.

The Foundation was inclined to cooperate with the KMT. It was, after all, the government in power and supported by American foreign policies. Moreover, as the offspring of one of the most successful capitalists of all time, the Foundation and its leaders were not communist sympathizers. Nevertheless, the Foundation was increasingly ambivalent about its relationship with the KMT. In 1933, for example, Gunn wanted to avoid close contacts with the KMT. Yet in 1935 he wrote positively of meeting T.V. Soong (Song Ziwen), who, as chairman of the National Economic Council, had asked to be updated on the Ting Hsien program. Gunn later reportedly reacted to Madame Chiang Kai-shek's public praise of rural reconstruction with skepticism in 1937, as he was increasingly aware of the "potent" Communist challenge. The Foundation did not have the opportunity to reconcile its relationships in China, however, because in July 1937 the Japanese bombed and invaded Nanking.

For a brief period in the immediate aftermath of the invasion, it seemed that rural reconstruction could continue, as the Nationalist government moved to western and southwestern China and the Mass Education Movement followed. When Gunn and Grant left China in 1938, Marshall Balfour of the Foundation's International Health Division replaced them, traveling throughout China and continuing to monitor NCCRR work.

But the continuation of the program in any real way turned out to be what one historian calls "wishful thinking." The outlook for the program was, as Gunn wrote to the Foundation's president, Raymond Fosdick, "pretty wretched." Even universities and experimental fields that had been able to relocate were effectively incapacitated by wartime conditions. By 1939 the NCCRR was completely inactive, and the Foundation tapered off its grants to remaining member institutions over the next few years. As World War II engulfed Asia, Europe, and North Africa, the Foundation's rural development program in China came to a halt.

As had been the case with GEB farm demonstration work in the United States, as well as with IEB food aid to Europe during World War I, the Rockefeller Foundation's programs in China had a lasting effect on United States government policy. The U.S. State Department's newly created Division of Cultural Relations commenced a China program in 1942. Historian Frank Ninkovich argues that, despite differences in political motivations (the U.S. government being concerned more with its own political interests), the "State Department's cultural efforts, which relied heavily on the enthusiastic cooperation of the philanthropic and educational establishments, closely resembled in conception and execution those of its philanthropic precursors."

Mary Brown Bullock, too, emphasizes the legacy of rural reconstruction, despite the interruption of war. Jimmy Yen's programs are often cited as the model for the post-World War II Sino-American Joint Commission on Rural Reconstruction, which did "address land tenancy issues and was highly successful in Taiwan." Indeed, Yen had lobbied Congress to fund this Commission, which operated in mainland China as the largest non-Communist rural reform before being removed to Taiwan in 1949.

Through this era, the Rockefeller Foundation's officers were often challenged to navigate a charged political context in China, and it was impossible to predict the outcome of international tension or civil war. Nevertheless, partnering with Yen for rural reconstruction advanced a new idea of agricultural prosperity that would remain influential in the 1940s as the Foundation began the work that would be known as the Green Revolution in the 1960s. John Grant had successfully advocated for pulling multiple aspects of rural social progress into the sphere of integrated public health in an international context. Rather than conceiving of agriculture as the mainstay of economic prosperity, the Foundation now had a reference point for wedding it to personal and social progress. The Foundation's work on nutrition in the United States during the Great Depression further cemented the idea that good agricultural technique had something very important to do with physical and social health.

Chapter IV

HARD TIMES, WAR, AND NUTRITION

In October 1929, the Wall Street crash signaled the beginning of the Great Depression. In the United States, the most iconic image of the Great Depression in rural areas was the Dust Bowl, where poor farm practices and prolonged drought led to soil erosion and massive dust storms that began in the wheat belt of the Great Plains and often blew all the way to the East Coast. In fact, the rural depression in the United States had begun well before the crash on Wall Street, and it lasted longer.

The crisis stemmed, in part, from the fact that Europeans had begun to grow their own food again after World War I. This new supply, coupled with continuing production by American farmers, caused market prices to drop precipitously. In the United States, farm income decreased from $17 billion in 1919 to $5 billion in 1932, at a time when farming still employed 30 percent of the American workforce and another 20 percent indirectly. As historian Nick Cullather points out, the "economic slump that deepened into the Great Depression hit first and hardest in the rural areas of the world, particularly in the single-crop regions."

Philanthropists and the government were aware of this crisis, but President Herbert Hoover's reluctance to pursue direct intervention resulted in little action by the federal government. On the philanthropic side, the Rockefeller Foundation struggled in the 1920s to find innovative ways to address the farm depression.

Drought and overfarming in the middle of the United States created Dust Bowl conditions in the 1930s. (Arthur Rothstein. U.S. Farm Security Administration/Office of War Administration. Library of Congress.)

Constrained by the Smith-Lever Act—which discouraged the Foundation from joint participation in farm demonstration projects that land grant college extension services organized—and resolved not to use its funds for short-term, direct food relief, the Foundation looked for other innovative opportunities. One of the most unusual materialized in Montana in 1923.

The idea for a tenancy program called Fairway Farms originated with Henry C. Taylor, a professor of agricultural economics at the University of Wisconsin, who was also the first head of the USDA Bureau of Agricultural Economics. According to historian Deborah Fitzgerald, Taylor believed that the "agricultural problems of the day stemmed from the fact that tenant farmers had little opportunity to both work on shared land and save up enough money to buy a farm," which led to a "tenant class of farmers" unconcerned with the "future of agriculture."

Taylor discussed this problem with Beardsley Ruml, the director of the Laura Spelman Rockefeller Memorial (LSRM), a sister organization to the Rockefeller Foundation that would be merged with the Foundation in 1929. In 1923, Ruml had asked Taylor what the LSRM could do for the good of agriculture. Taylor suggested that the philanthropic organization send someone to Montana to see the Fairway Farms project in its earliest stages and to meet M.L. Wilson, the project's director. Wilson was an extension agricultural economist at Montana State College, who would take charge of the USDA Division of Farm Management and Cost Accounting in 1924.

Ruml agreed to send a program officer to learn more about Wilson's plan to buy derelict, poorly managed farms that still had good soil, and provide needed capital to a farmer selected by the project to act as tenant and pupil. His idea was to help individual farmers, and, at the same time, develop a model of sustainable agricultural development. He and Taylor also wanted to address the "possibilities and dangers" of agricultural technology, specifically "tractors and other machines." With its sparse population, cheap land, and ideal conditions for growing wheat, Montana seemed to offer a promising venue for such an experiment.

Wilson wanted to provide all the capital needed beyond what could be borrowed under the Federal Farm Loan Act. John D. Rockefeller Jr. personally provided a line of credit, and Ruml agreed that the LSRM would finance the project "up to $100,000." But in an unusual move, the money was provided as a revolving loan fund, and Ruml expected that the LSRM would eventually get its money back to be given again in some other context.

Wilson spent 1924 scouting farmers and farms suitable for this experiment. By 1925 the program had developed seven operational farms, each "meant to explore a specific farming problem." Unfortunately, as historian Deborah Fitzgerald has shown, the project was not successful. Fairway Farms made it "clear that the realities of farm life in Montana challenged Wilson's high-minded optimism almost as soon as the contracts were signed." The capital that farmers needed did not arrive consistently, and bad weather interfered with planting. Though Fairway Farms generated "important findings regarding the correlations among such variables as farm size, farm finances, mechanization, and crop selection," Rockefeller philanthropists saw it as an economic failure. They had expected a small return on their investment, but as the agricultural slump deepened with the Great Depression, this became increasingly unlikely.

By 1932, after the Rockefeller Foundation had assumed responsibility for the LSRM's investment, the program officers realized they "could not recoup losses even by selling the farms." Instead, in 1937 the Foundation gave the Fairway Farm notes to the Farm Foundation as a "special gift." Because Taylor was director of the Farm Foundation, this symbolized an end to the experiment for the Rockefeller Foundation and seemed to signal a further withdrawal from direct involvement in efforts to develop new institutional structures for the agricultural economy. But it did not mean an end to Foundation efforts to improve agricultural production.

Rather than work with farmers directly, the Foundation increasingly focused its funding on agricultural science and research in partnership with large and stable institutions like universities and the federal government. Funding academic studies ensured that the Foundation remained engaged with the problems revealed by the Depression on a structural level. In a sense, these strategies were consistent with John D. Rockefeller's mandate to address problems at their roots. Supporting agriculture in this manner also preserved the possibility of influencing government policy, which would broaden the impact of limited philanthropic investment.

Through the era of the Great Depression, the Foundation also continued to invest in human capital in agriculture by providing grants and fellowships to scholars and outside institutions. It first awarded fellowships in agricultural science in 1923. Most went to Europe and China. In the late 1920s and early 1930s, however, the Foundation pursued a few extended programs of agricultural science in the United States. In 1929, for example, it gave grants to the Georgia State College of Agriculture and Mechanic Arts as well as the Iowa State College of Agriculture and Mechanic Arts. It also gave a small grant to the New York State College of Agriculture in 1934 for a "maize stocks clearing house," which stored information about and specimens of maize. And it continued to support the National Research Council, which, during 1930, funded 91 fellows in biology, agriculture, and forestry. Meanwhile, the

Foundation gave an additional grant to the Social Science Research Council in 1932, for which "social and economic research in agriculture" was one of the few "areas of intensive . . . effort."

All of these awards reflected a growing interest in finding ways to advance knowledge in agriculture and food sciences in a way that would stimulate basic research and farm productivity. But the Great Depression also raised issues for consumers as well as producers. In urban areas, poverty led to widespread hunger. In America's cities, the Rockefeller Foundation looked for innovative ways to address the needs of working and low-income classes.

Gardens in the City

Food shortage crises were not new to the Foundation. During World War I, destructive armies and belligerent governments had decimated food supplies in Europe. Although the Rockefeller Foundation had chosen to provide relief to prevent mass starvation, the Foundation's leaders had concluded that relief efforts in general should be undertaken by others. The greatest good the Foundation could provide to humanity would come from its efforts to address the root causes of humanity's problems. During the Great Depression, however, the crisis in America's cities tested this resolve.

With millions of workers unemployed in the United States, the Foundation looked for ways to work with government to ease the growing food crisis. In 1931 the Foundation funded an urban gardens initiative to encourage underemployed workers to produce food for their families. The U.S. President's Emergency Committee for Employment created the project, known as the Family Food Production Demonstration, and implemented it in cooperation with the U.S. Department of Agriculture, Ohio State University, Purdue University, and the Universities of West Virginia, Illinois, and Kentucky.

Initially, the Foundation provided $25,000 from a special fund of $1 million established to address unemployment problems. This money supported a one-year trial period, during which the collaborators investigated the feasibility of mandating a shortened workweek for employees in certain industries, so they could use the rest of the week to produce their family food supply. This food was to be "produced either in individual gardens or holdings of larger area, or on a tract handled by the industrial plant on a community basis." Arthur Woods, chairman of the President's Emergency Committee for Unemployment, chose collaborating institutions

to implement the experimental program in states that were most seriously affected by surplus labor conditions due to their mining and manufacturing industries. (Woods had notably been New York City Police Commissioner, served on the boards of the GEB and the Rockefeller Foundation, and would soon chair the board of Rockefeller Center.)

To support the project, the universities appointed agricultural experts from within their ranks who could draw on the USDA in an advisory capacity. These experts came from the extension services of their universities. Employing the teaching models pioneered by Seaman Knapp, these agricultural specialists demonstrated basic gardening techniques to industrial workers, teaching them subsistence agriculture on different scales. The federal government considered this project a "most effective and valuable piece of work." It continued the pattern of cooperation between the Foundation and the USDA that would develop further as Congress and President Franklin Roosevelt's administration looked for ways to address the deepening crisis in America's agricultural communities.

Beardsley Ruml directed the Laura Spelman Rockefeller Memorial from 1922 until its merger with the Rockefeller Foundation in 1929. Established by John D. Rockefeller Sr. in memory of his wife, the LSRM provided critical funding to the innovative Fairway Farms project in Montana in the 1920s. (Rockefeller Archive Center.)

Public Administration, the New Deal, and Agriculture

The Rockefeller Foundation had been created at the height of the American Progressive movement, and its leaders embraced the movement's efforts to strengthen rational, scientific management in policymaking and public administration. Rockefeller funding had supported the New York Bureau of Municipal Research (later known as the Institute of Public Administration), the Institute for Government Research (later known as the Brookings Institution), and the National Bureau for Economic Research, as well as a number of similar initiatives. After Franklin Roosevelt became president of the United States in 1933, the Foundation played a key role in helping to develop administrative capacity for the government's expanded role in the economy and society that was intrinsic to Roosevelt's New Deal programs. This work included new efforts to manage agriculture as well as food distribution and marketing.

Passage of the Agricultural Adjustment Act (AAA), for example, marked a significant turning point in American agricultural policy. The Act has been described as the New Deal's answer to farm problems. It sought to provide farm relief and stabilize agricultural prices at levels experienced in the years immediately preceding World War I by eliminating surplus production. The government paid farmers to leave part of their land fallow and to cull excess livestock. It created the Agricultural Adjustment Administration, under Secretary of Agriculture Henry Wallace, to oversee the distribution of subsidies.

With critical funding from the Rockefeller Foundation, the Brookings Institution undertook extensive studies of the AAA and its "effect upon agriculture and general economic life." Launched soon after the law was implemented, the studies were designed to help policymakers fine-tune federal rulemaking and administration. The effort resulted in the publication of a series of pamphlets. In 1935 Brookings also published an analysis of AAA accomplishments, focusing on various commodities (wheat, cotton, livestock, tobacco, and dairy products), along with a volume on agricultural marketing agreements. Although these studies were more descriptive than interpretive and critical, they drew attention to important issues, including the AAA's restrictive contracts and sometimes coercive efforts to convince farmers to participate. Overall, they helped explain the economic characteristics of commodity production and distribution, with an eye to aiding policymakers in the private and public sectors who "may contemplate further improvement of the condition of agriculture."

Although he took issue with some of the Brookings Institution's findings, Agriculture Secretary Wallace described the research and analysis as "conscientious." "In my opinion," he wrote, the work "will have real value to those who in the future seek information and advice as to opportunities for government service to agriculture," and, he continued, the "pitfalls to be avoided in attempting to provide such service."

National Investigation: Studying Government Science and Policy

Foundation initiatives also aimed to strengthen public administration in agriculture by supporting new research. In 1933 the Rockefeller Foundation gave a $50,000 grant to the Science Advisory Board, which had recently been created by executive order of President Roosevelt. The grant was for work on specific problems of various government departments through the National Academy of Sciences and the National Research Council. In arenas affecting agriculture, the Board appointed special committees and held conferences to formulate plans for land classification in connection with the programs of the Tennessee Valley Authority and the Departments of the Interior and Agriculture.

In the late 1930s the Foundation gave the Social Science Research Council (SSRC) Committee on Public Administration funds for an administrative study of the United States Department of Agriculture. Though the Foundation had already funded a study of the AAA, the new grant dealt with economic policies rather than the administrative machinery for effecting policy. This management analysis of the USDA's administrative organization and procedure offered a case study of what researchers called the "most pressing general problems in the field of administration today," using a particularly "inventive" American governmental agency.

The Rockefeller Foundation also gave a five-year $40,000 grant to the SSRC to offer special instruction in agricultural economics and rural sociology at the Brookings Institution. The grant helped provide continuing education to agricultural economists in Washington to deepen their scientific competence. The SSRC requested the grant in response to an evaluation by an advisory committee that had recommended the creation of new facilities in these disciplines comparable to outstanding centers of graduate instruction in medicine.

These efforts to strengthen and rationalize agricultural and food policies in response to the challenges of the Depression reflected an emerging role for philanthropic organizations like the Rockefeller Foundation and new institutions, "think tanks," that would increasingly help shape public policy in the United States. While most of these initiatives focused on agricultural production, food marketing and distribution, and quality of life in rural communities, new discoveries were being made in the field of nutrition that would play an important part in the Rockefeller Foundation's view of the relationship between agriculture and the well-being of mankind.

Nutrition: A New Focus

Just before Christmas 1941, Wilbur A. Sawyer, director of the Rockefeller Foundation's International Health Division (IHD), wrote to Dr. Cecil K. Drinker, dean of the Harvard School of Public Health, with good news. At their recent meeting, the IHD directors had designated $100,000 to help Harvard establish a department of nutrition. The object, Sawyer wrote, was to "bring about the teaching of professional public health students in nutrition," giving them a "proper balance between clinical and field investigations and the biochemical features of nutrition."

Henry A. Wallace served as U.S. Secretary of Agriculture from 1933 to 1940, and Vice President from 1941 to 1945. He oversaw the implementation of the Agricultural Adjustment Act. (Harris & Ewing. Library of Congress.)

Sawyer had big plans for this new department that went beyond Harvard. His enthusiasm revealed his dedication to the field as well as his concern over the lack of institutional support for the study of nutrition. "We are particularly anxious," he continued in his letter, "that there shall soon be in this country a Department of Nutrition" integral, in practical and scientific components, to public health study.

Scientific nutrition was still a budding science in 1941, and, as Sawyer recognized, it had not been integrated into the teaching of public health. Scientists had begun delving into the chemical composition of carbohydrates, fats, and proteins in the nineteenth century. Wilbur Atwater famously experimented with the calorie starting in 1896, defining it as a measure of energy. Meanwhile, scientists made progress in the art of food preservation to preserve nutritional content. Pioneers such as Nicholas Appert and Louis Pasteur had improved the art of canning by applying food science and studies of microbial control. However, it was not until 1912 that the first vitamin was discovered. Shortly thereafter, British and Polish biochemists Sir Frederick Hopkins and

Casimir Funk proposed the vitamin hypothesis of deficiency, theorizing that the absence of certain vitamins led to disease. The "vitamin era" followed as scientists raced to name and classify all vitamins, and consumers in developed nations embraced new diets that emphasized fresh fruits and vegetables.

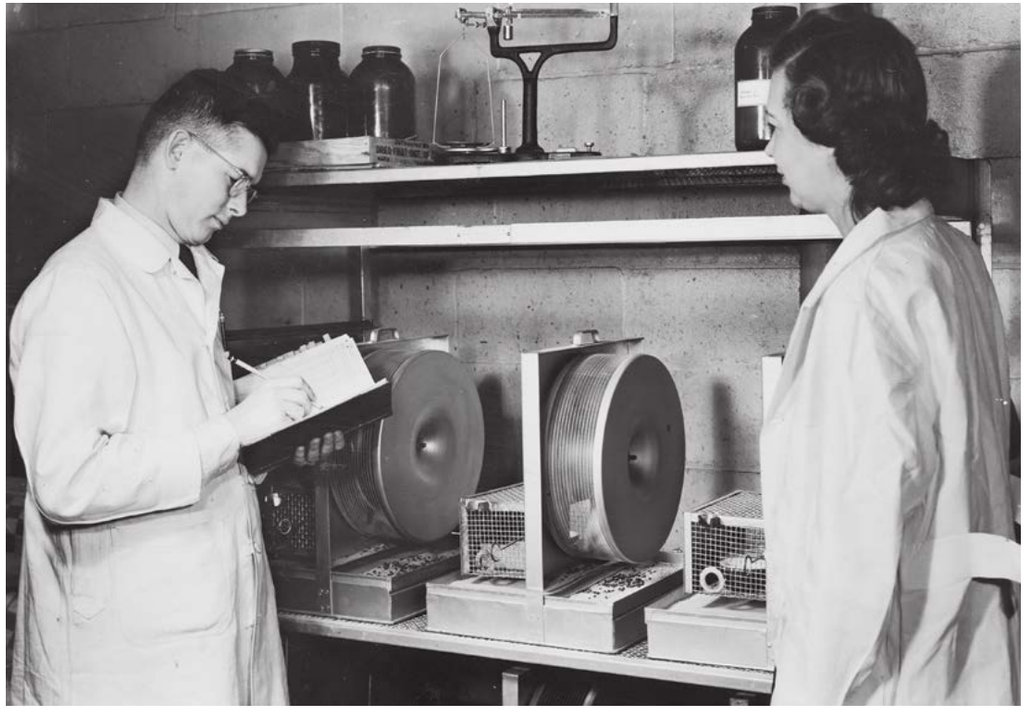
Establishing Harvard's Department of Nutrition was a big step for the discipline that came on the heels of this horizon-expanding era of discovery. The Rockefeller Foundation was not simply interested in technical research; it aimed more broadly to guide nutritional studies toward public health, making its benefits felt in people's lives. The professional education of public health officers was critical to this transformation.

Nutrition straddled the basic science and public health spheres, but was still poorly established in medical science. Professor Frederick Stare wrote to the IHD in 1944, for example, asking for advice on how to represent the new program on the institution's letterhead. In the Health School it was called the "Department of Nutrition," yet in the Medical School it was the Division of Nutrition of the Department of Biological Chemistry. "As yet," he wrote, frustrated, "I have been unable to figure out how we should have the letterhead on our stationery and what citations we should use for our published papers."

This little bureaucratic issue spoke volumes about the identity of nutrition as an applied science. It also suggested the challenges ahead as the Foundation sought to support a growing awareness of nutrition's role in public health and agriculture in the midst of a national and global economic crisis.

In 1935 the Rockefeller Foundation's Natural Sciences Division had recognized a special interest in a number of fields related to human life. For the first time, it named nutrition as an important part of its work. To that end, it began funding various nutrition projects on a small scale. These included grants for university research in biochemistry as well as research aimed at public health. The Foundation provided the grants through both its Natural Sciences and Medical Sciences Divisions, reflecting its two-part approach to this emerging field.

From 1935 through the early 1940s, the Foundation was particularly focused on laboratory research and the biochemical processes of nutrition. The first grant, for example, went to Columbia University for studies in nutrition. The Foundation then expanded funding in this arena in 1936 by providing additional grants for nutrition research at Johns Hopkins, Cornell, and the Universities of Pennsylvania and Illinois. At the University of Illinois, a grant of $75,000 over five years funded studies in nutrition with "particular reference to the function of the amino acids," a fundamental building block of nutrition science.



Dr. Frederick Stare was the founding chair of the Harvard Department of Nutrition. With Rockefeller Foundation funding, the department promoted a new scientific approach to diet and nutrition. (Rockefeller Archive Center.)

In addition to providing research grants, the Rockefeller Foundation worked to institutionalize the field of nutrition science. The grant to create Harvard University's Nutrition Department played a leading role in giving new visibility to the field, just as the Foundation's grants to Johns Hopkins University in an earlier generation had helped establish the academic discipline of public health. To bolster the new department at Harvard, the Foundation gave 14 "special fellowships" in 1943, forming a "special group studying nutrition at the Harvard School of Public Health." This group included four physicians, four public health nurses, and one "highly trained nutritionist." Research projects at the school in these early years dealt with nutrition in relation to such topics as Atabrine, malaria, protein, calcium, and riboflavin, as well as community nutrition. By 1945 the Foundation described as a goal of its funding a "proper balance between clinical and field investigations."

The Foundation supported the expansion of nutrition research in a third way—by funding individual fellows. It offered fellowships less frequently than research and lab grants. One in 1938 from the Natural Sciences Division supported a fellow working in the "physiology of nutrition." In that same year, the Medical Sciences Division funded a fellow to study "nutrition in relation to alcoholism."

These efforts to strengthen the institutional foundations for research aimed to make nutrition an increasingly important component of public health. But here too the Foundation had to act as a catalyst for change, convincing academics and bureaucrats that this new research and these new professionals could influence the health and well-being of individuals and communities in North America and, ultimately, around the world.

Changing Attitudes in Public Health

To increase the attention paid to nutrition in the field of public health, the Rockefeller Foundation provided incentives to public health officials and researchers working with public health agencies. These efforts began in Canada in 1935, when the Foundation awarded a grant to the Quebec Provincial Bureau of Health to establish a division of the hygiene of nutrition. The three-year project sought to promote the "health of the population by an adequate diet and the observance of modern scientific rules of hygiene susceptible of favoring good nutrition in the population generally." The success of the project in helping to reshape the policy environment was evident in 1937, when the Canadian Council on Nutrition was created as a federal advisory body.

Success in Canada was followed in 1939 by the Foundation's first nutrition-related public health grant in the United States. Vanderbilt University in Tennessee proposed, and the Rockefeller Foundation funded, a "study of nutrition as a public health measure." The field study focused on nutritional deficiencies and remedies in two rural districts just outside of Nashville, and provided new information on the metabolism of thiamin. It also helped further what the Foundation called the "increased recognition of the fact that the status of human efficiency and well-being is directly influenced by the standards of nutrition."

With Rockefeller Foundation support, the Washington-based Brookings Institution undertook a study of the Agricultural Adjustment Act that was published in 1935. Rockefeller philanthropy helped Robert S. Brookings create the Institute for Government Research in 1916, the first private organization for fact-based study of national policy issues. It merged with two other organizations in 1927 to form the Brookings Institution. (Leet Brothers. Rockefeller Archive Center.)

Building on the history of the Rockefellers' philanthropic work with hookworm, malaria, and other diseases, the Foundation's growing interest in field research in nutrition led to additional grants for projects in the American South. In 1940, in North Carolina, the Foundation began support of a nutrition study jointly undertaken by the State Board of Health and the Duke University School of Medicine. The study pursued exploratory research to "determine the nature and extent of the nutrition problem among selected groups from different areas of North Carolina." It surveyed local populations regarding personal history and dietetic intake, and performed physical and laboratory examinations. After discovering that a segment of the rural population had a low blood content of Vitamin C, the project implemented a "three meals a day" feeding program that targeted both black and white children. The low-cost diet it employed led to "marked improvement" among children in the area.

These initiatives in North Carolina came together to begin a process of systemic change by 1945. During this year the Foundation funded three parallel initiatives: a cooperative nutrition study, which conducted another survey of people in the state; the School-Health Coordinating Service, which taught nutrition in schools; and the Nutrition Division, which disseminated information to the public. With these three projects, the Foundation once again sought to integrate efforts to assess nutritional needs and then redress them, in this case by disseminating knowledge.

After initial success in the mid-1930s, the Rockefeller Foundation continued to support public health efforts in Canada. In 1942 it funded a nutrition study in the East York Health District and supported laboratory work at the University of Toronto, where this silt-lamp eye examination was used to find evidence of riboflavin deficiency. (Rockefeller Archive Center.)

Increasingly, program officers at the Rockefeller Foundation, academics in the fields of nutrition and public health, and policymakers came to recognize that access to a balanced and nutritional diet was deeply dependent on economic status. In early 1942 the Foundation gave a grant to the Mississippi State Board of Health and the Delta Council to study the state's Delta area. The specific aim was to ascertain the "nutritional status of tenant farmers." To address the

Vanderbilt University was an important partner with the Rockefeller Foundation in promoting nutritional public health in Tennessee. Foundation grants supported fieldwork and laboratory research, such as this preparation of serum for chemical estimation of vitamin levels in 1950. (Ken Spain. Rockefeller Archive Center.)

needs of these tenant farmers and their families, as well as others in Mississippi, the Foundation's International Health Division, working with its General Education Board, funded a joint project of the State Board of Health and the State Department of Education in Mississippi. This grant helped to establish a "coordinated school-health-nutrition service."

The Foundation ultimately recognized that it did not have the resources to bring about wholesale systemic change in nutrition and public health. As with the farm demonstration programs in the early part of the twentieth century, however, the Foundation hoped that grantee success in Tennessee, North Carolina, and Mississippi would be emulated by state and federal authorities who had the ability to affect many more communities. In 1942 the Foundation's leaders were hopeful. "Recently," the annual report noted, "the techniques of *nutrition* study have been sufficiently advanced to warrant their adoption by official health agencies." In that year the Vanderbilt nutrition activities in

Tennessee were transferred to the state health department, which organized a nutrition service under the direction of Dr. J.J. Hanlon.

Whereas the work in Tennessee was developed privately and then handed over to the state government, projects in both North Carolina and Mississippi were intentionally developed in collaboration with state officials. This collaboration ensured that field research results were "promptly placed at the disposal of State and local agencies," according to the 1942 annual report, "including particularly the administrators, for use in the formulation of programs to correct deficiencies." The Rockefeller Foundation also promoted the development of institutions to manage these nutrition projects. In 1943, for example, it started funding the North Carolina State Board of Health to establish a Division of Nutrition, which worked with the state's Cooperative Extension Service.

In the pre-war years, when the effects of the Great Depression constrained government budgets in the United States, the Foundation's efforts to cultivate

The Rockefeller Foundation continued to fund food programs for children to correct dietary deficiencies and to help families understand nutrition. The first-graders at Bain School in Mecklenburg County, North Carolina, enjoyed many "vegetable parties" in 1947. (Rockefeller Archive Center.)

greater attention to nutritional issues proceeded slowly. But as in many other arenas of American life, World War II would accelerate the pace of change and offer dramatic opportunities to push new innovations into the mainstream of American culture and public policy. This was particularly true in the field of nutrition.

War and Nutrition

From 1935 to the beginning of World War II, the Rockefeller Foundation valued nutrition as one in a constellation of interests supported by the Natural Sciences Division that focused on the science of human life. It chose each of these interest areas in the natural sciences to "contribute directly to, or form the necessary basis for, an understanding of behavior." While Medical Sciences emphasized "studies of the physical aspects of behavior," grants in Natural Sciences emphasized "studies of the somatic aspects." Other areas of study included embryology, physiology, genetics, and internal secretions. A key motivation for selecting these focus areas, besides their applicability to human behavior, was the empirical, scientific nature of their study. "The choice of these fields," the annual report stated, "reflects a confidence that findings of lasting significance will continue to result from the application to biological problems of the quantitative and analytical techniques of chemistry, physics and mathematics."

By 1936 the Foundation had elevated nutrition as a topic of great value in its own right. The annual report stated that the "problems of nutrition are world wide and are engaging the attention of scientists everywhere." It was at this time that the Foundation pursued its initial buildup of laboratory research by funding academic studies, institutional construction, and fellowships, as discussed above. Yet this emphasis on nutrition by itself was not enough to inspire widespread funding of the public health aspect of nutrition work. For that, Foundation policymakers would require the new dimension that nutrition took on as World War II began and the prospect of U.S. involvement loomed.

The influence of the war was felt even before the United States entered the growing global conflict. In the last years of the 1930s and the first years of the 1940s, laboratory research in nutrition shifted to focus on wartime needs, and public health nutrition work became a major beneficiary of Foundation funding. An expansion of the Foundation's bureaucratic capability to take on nutrition made this shift possible. The annual report of 1943 stated that, despite Natural Sciences' long interest in nutrition

"chemical research," it was "not until 1938 that technical knowledge and personnel were considered sufficient to warrant the support of nutrition studies in relation to public health."

The Foundation's annual report of 1940 articulated this new dimension of nutrition work. It named "nutritional deficiencies" as a specific affliction "arising from the war and constituting major health disasters," for which it aimed to render services. The linkage of nutrition to wartime needs became stronger as the war continued. By 1941 the Foundation stated that "among the calamities imposed by war comparable to violent destruction and to epidemics of infectious disease, is the damage from malnutrition, ranging from plain starvation to the various manifestations of the lack of essential food elements."

Though the scope of its support for laboratory research did not significantly shift as a result of this reconceptualization of nutrition, the Foundation linked its grantmaking to wartime needs. The Natural Sciences Division, for example, provided a grant to the Massachusetts Institute of Technology in 1941 for the development of a "scientifically sound concentrated food." The Foundation named a practical application of the resulting food to be its "use in wartime by parachute troops and forces stationed in remote areas, and for the emergency feeding at any time of populations that become the victims of famine, flood, earthquake, or other destructive forces." Indeed, the goal of the Division in funding basic research at this time was to foster "discoveries of practical value, which are finding adaptations to war needs." Even funding to support institutional development was often connected to this goal. For example, Harvard nutrition fellows were funded in 1943 "in view of the probable usefulness of such a group in postwar reconstruction." Likewise, the head of the Nutrition Department at the Harvard School of Public Health, Dr. Frederick J. Stare, spent the summer of 1945 in Europe as a "consultant in nutrition to the Surgeon General of the United States Army."

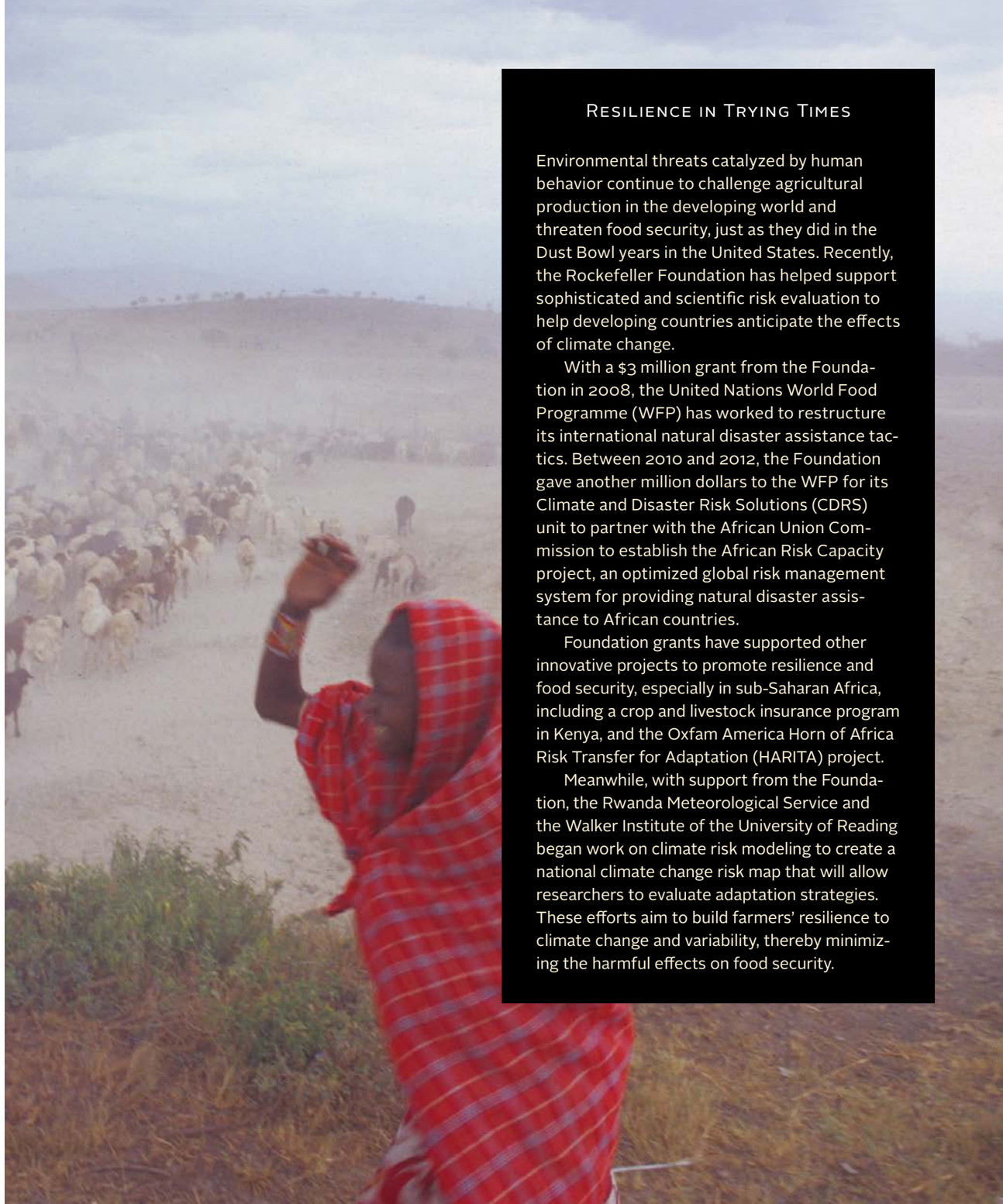
The School Health Nutrition Service in Mississippi, funded by various Rockefeller philanthropies and state entities, included nutritional correction efforts that focused on children. One of the measures involved weighing students to assess their nutritional health. (Rockefeller Archive Center.)

Surveys were a key part of public health work on nutrition, providing an ongoing gauge of the general population's needs. The Rockefeller Foundation helped fund a study of children between the ages of nine and eleven at Greensboro, North Carolina, City School in 1947 to determine what types of school programs should follow. Survey data was collected by a nutritionist. (Rockefeller Archive Center.)

Thus, as wartime leaders pushed for nutrition studies that would help battlefield commanders maintain the fitness of their troops, the Foundation determined that nutrition studies were essential to fortifying populations at a time when national governments desperately needed workers and military personnel. In Europe, for example, the Foundation's Health Commission studied "urgent nutrition problems which the war would undoubtedly create." One of the leading commission scientists was Dr. John B. Youmans, who had conducted the Foundation-funded Vanderbilt nutrition study.

Expanded Focus, Limited Involvement

Throughout the inter-war period, the Rockefeller Foundation stepped back from agriculture and took on the science of nutrition. Though nutrition received more funding, emphasis, and expansion, its program was similar to the limited agriculture work the Foundation had supported in the 1910s and 1920s. In both cases the Foundation worked through large and stable institutions—usually the federal government or universities—to do research with limited and well-defined goals. The public health component of nutrition appeared early on, with its attendant focus on practical results, but did not eclipse the theoretical interests that many agriculture and nutrition projects had in the early years of the rural depression. World War II helped accelerate this process of change, especially in the arena of public health. To be sure, the links between nutrition and agriculture were still primarily tied to the quantity and availability of agricultural production. But in many parts of the world, even those only lightly touched by the conflagration of war, the issue of nutrition was basically a problem of food supply. To address this issue, as described earlier, the Rockefeller Foundation turned to Mexico.



Resilience in Trying Times

Environmental threats catalyzed by human behavior continue to challenge agricultural production in the developing world and threaten food security, just as they did in the Dust Bowl years in the United States. Recently, the Rockefeller Foundation has helped support sophisticated and scientific risk evaluation to help developing countries anticipate the effects of climate change.

With a $3 million grant from the Foundation in 2008, the United Nations World Food Programme (WFP) has worked to restructure its international natural disaster assistance tactics. Between 2010 and 2012, the Foundation gave another million dollars to the WFP for its Climate and Disaster Risk Solutions (CDRS) unit to partner with the African Union Commission to establish the African Risk Capacity project, an optimized global risk management system for providing natural disaster assistance to African countries.

Foundation grants have supported other innovative projects to promote resilience and food security, especially in sub-Saharan Africa, including a crop and livestock insurance program in Kenya, and the Oxfam America Horn of Africa Risk Transfer for Adaptation (HARITA) project.

Meanwhile, with support from the Foundation, the Rwanda Meteorological Service and the Walker Institute of the University of Reading began work on climate risk modeling to create a national climate change risk map that will allow researchers to evaluate adaptation strategies. These efforts aim to build farmers' resilience to climate change and variability, thereby minimizing the harmful effects on food security.

TURNING TO MEXICO

When asked why they had accepted the Rockefeller Foundation invitation to serve on its Survey Commission to Mexico in 1941, the three main agricultural scientists all referred to scientific potential. Soil specialist Richard Bradfield saw it as an avenue for "broadening my experience with agriculture." Corn expert Paul Mangelsdorf perceived an opportunity "handed to me on a silver platter" to study corn in "one of the most important countries in the hemisphere" with respect to its origins. Plant pathologist Elvin Stakman cited his "scientific interest" in Mexico.

Yet there was another reason, above and beyond pure science, that these men joined the Commission. "I literally grabbed at the chance," Mangelsdorf said, because over and above scientific potential, it offered him a way to improve agriculture in a "backward" country, which "appealed to me very deeply." Stakman called it a "godsend," the "answer to a scientist's prayer," in its objective of helping the "hungry countries" alleviate the "tragedy of hunger." He felt a sentimental and moral obligation to accept, concluding that "I certainly would have been almost wicked not to have done what a person could do to help out."

The idea that Mexico needed help derived from the confluence of two strains of thought: that it did not adequately employ scientific agriculture in farming techniques and that its food supply was not nutritious. In both cases, Rockefeller Foundation scientists drew on their expertise and the U.S. experience of discovering the science of agricultural production and nutrition to argue that Mexico could progress along the same lines.

All three Survey Commission scientists were born in the American Midwest in the late nineteenth century. Stakman, the oldest, recalled veterans of the Civil War in the United States telling stories around the fire; he also remembered the forests near his pioneer farming community in Minnesota being cut down and the prairie ploughed for farmland. All three were educated and worked at land-grant colleges or experiment stations, where scientific popular education and government intervention increasingly promoted large-scale farming. They made an explicit connection between their own professional development and their approach in Mexico, to advocate for the technology and technique of scientific agriculture. "From the ox to the tractor, from back-breaking peasant farming to the intelligent business of farming, is a long and happy step," they wrote in *Campaigns Against Hunger*, the book they later co-authored. The Survey Commission, they recalled, "had faith that Mexico could take the same kind of step in an even shorter time." They had seen the scientific revolution in U.S. agriculture, which yielded increasingly industrialized and commercialized agriculture through the late nineteenth and early twentieth centuries, and enthusiastically used it as a framework for Mexico, or, as they called it, a guideline for progress.

All of them also understood that breakthrough discoveries by nutritional scientists had implications for agricultural science. Even in the 1920s, Stakman said, people did not pay attention to nutritive qualities of basic crops. When scientists grew high protein corn or sorghum, it was only for baking strength. To feed people meant to "fill their stomachs," to work toward bulk. Yet by the 1940s agricultural scientists had begun to consider the nutritional properties of food crops, to think in terms of quality in addition to quantity. Mexico offered a laboratory to study crops as food on a large scale, or, as Stakman later called it, "plant public health."

Just as agriculturalists sought to straddle crop science and public health, nutrition research inspired medical scientists to redefine the scope of public health to include food and, by extension, agricultural production. The agricultural scientists of the Survey Commission clearly saw their counterparts in public health make this shift. The Rockefeller Foundation medical officers had begun to realize that "better nutrition was essential if they were going to improve the health of many countries very much," Stakman said. He agreed that many diseases in Mexico were "due partly to the predisposing effects of poor nutrition or of hunger." It was no accident that the associate director of the Foundation's International

Health Division became an early and ardent advocate of starting agriculture work in Mexico.

Yet just because American scientists and philanthropic policymakers saw Mexico in this way does not mean their perceptions were accurate. Indeed, the experience of the Survey Commission in the summer of 1941 demonstrated how foreign the agricultural scientists were to the Mexican land. They found the farms and people unfamiliar, and Mexican farmers saw them as strangers. Two years later, the agriculturalists who went to Mexico in 1943 to start the Mexican Agricultural Program (MAP) would have a similar experience of trying to spread scientific knowledge.

The program that the Rockefeller Foundation built in Mexico arose out of new ideas that agricultural science in the 1940s could be tied to public health through nutrition, and could also be a leading agent for progress abroad. The way the program functioned in action, however, resulted from negotiations between strangers who were serving internationally for the first time in the history of the Foundation's agricultural programs as a technological and cultural bridge between the U.S. and foreign countries.

Public Health & Politics: Early Advocates of Mexico

The earliest proponents of a Rockefeller Foundation Mexican agriculture program argued in the 1930s that agricultural reform was a public health issue. Their approach would not catch on until 1941, when the Foundation's priorities shifted, both by choice and necessity. In 1933, John Ferrell, associate director of the Foundation's International Health Division (IHD), had embarked on what would be the first of three failed attempts to convince Foundation leaders that this was a worthy cause. Ferrell was formerly a teacher, public school administrator, county health superintendent, and state director of the Rockefeller Sanitary Commission's anti-hookworm campaign in North Carolina, before helping to lead the IHD for three decades. His interest in agriculture stemmed from public health concerns about nutrition; he realized that "in most countries it would be impossible to increase the food supply without making fundamental improvements in the agricultural system." Ferrell went to Mexico in the spring of 1933 for exploratory purposes, eventually turning in trip notes to his divisional director, but without any proposal for action. One Foundation officer later characterized this visit as "little more than an exploratory gesture."

Ferrell found a supportive partner in Josephus Daniels, who had just been appointed U.S. Ambassador to Mexico—assuming his post a mere six days before Ferrell's departure. President Franklin Roosevelt had recently outlined his "Good Neighbor Policy," which aimed to keep Latin America in the U.S. sphere of influence by friendly diplomacy and non-intervention. Daniels, coincidentally, already had ties to the work of the Foundation in both agriculture and public health. Born in 1862, he had experienced in childhood the poverty and despair of the American South following the Civil War. As a Raleigh newspaper editor and publisher, and early advocate of the North Carolina State College of Mechanic Arts, he had witnessed Seaman Knapp's farm demonstrations and Ferrell's anti-hookworm campaign. Daniels also served as U.S. Secretary of the Navy during World War I, where he mentored Franklin Roosevelt, then a young under-secretary. Daniels' friendship with and support of Roosevelt eventually led the president to appoint him Ambassador to Mexico in 1933. Daniels arrived in an environment of suspicion toward American interference in Mexican affairs, and was met with violent demonstrations. He pursued his interest in agriculture, however, visiting the Mexican National School of Agriculture shortly after his arrival.

John Atkinson Ferrell was the associate director of the Rockefeller Foundation's International Health Division from 1914 to 1944. He played a key role in advocating for the creation of the Foundation's Mexican Agricultural Program. (Rockefeller Archive Center.)

Two years later, in the spring of 1935, Ferrell made his second failed attempt to convince the Foundation of the necessity of fundamental agricultural changes in Mexico. This time he voiced his recommendation more directly, and in concert with Daniels. The two men had meetings in Mexico that convinced them both of the need for a more formal effort. They outlined the contours of their proposal, agreeing, among other details, that it should be modeled on the Knapp farm demonstration method that the GEB had funded in the U.S. in the early twentieth century. Ambassador Daniels wrote a letter to Raymond Fosdick (who would assume the presidency of the Rockefeller Foundation the following year), outlining the need for a Mexican agriculture program funded by the Foundation. He couched his request in terms of U.S. national interest, in line with Roosevelt's Good Neighbor Policy, which sought to engage Mexico on friendlier terms. However, by summer's end, the Foundation was still not receptive to this proposal.

Ferrell and Daniels again tried to convince Fosdick the following year. This time Ferrell submitted a memo on his own, once more comparing the historic farm demonstration program that the GEB had funded in the southern United States to the proposed Mexico work. Instead of outlining

the structure of the program, as the 1935 recommendation had, the 1936 request suggested that a few qualified Foundation representatives might be sent to study Mexico's agriculture and then "outline broadly a constructive program." Though this would be the approach the Foundation eventually followed, it would take another half decade, and a greatly changed international context, before it was approved.

Shifting Priorities

During this period in which the Foundation rejected multiple requests to fund a Mexican agriculture program, its interests lay elsewhere, both topically and geographically. Overall, the Foundation's priority was research science, and its geographical focus areas were the United States, China, and Europe. It was not until World War II foreclosed opportunities in China and Europe that it began to seriously consider work in Mexico. By late 1940, Foundation research funding had completely collapsed in Europe and was greatly diminished in war-torn China.

The Foundation had been forced to pull back from virtually all of its major commitments in the two regions of the world where it had done its most important work. War relief was not a substantive option. John D. Rockefeller had not founded his philanthropies to provide short-term relief, no matter how desperate the demand. He had been interested instead in the root causes of mankind's problems. Rather than having the Foundation's resources and creativity marginalized for the duration of the war, President Raymond Fosdick began searching for new regions and new problems.

This led first to a more general redirecting of efforts toward Latin America. "As the Foundation is driven out of Europe, and perhaps out of Asia," Fosdick wrote in 1941, "its greatest opportunity is going to be in Central and South America." It was at this time that the Division of Natural Sciences recalled its European representative and reassigned him to Latin America.

In the midst of this reorientation, the Rockefeller Foundation came to see Mexico as a natural starting point. The country offered an opportunity to do good work outside of the theaters of war, and to do so in a manner that did not conflict with U.S. interests. In fact, it was very much in line with security concerns. President Roosevelt's Good Neighbor Policy had aimed at improving relations with Latin America mostly through a non-intervention policy and economic agreements. During World War II, with the rise of a small fascist movement in Mexico, the policy took on a more explicit political dimension. It targeted Mexico in 1940 to secure a stable southern border, but also because the new president, Manuel Ávila Camacho, was considered to be more moderate and pro-American.

Ávila Camacho was the first Mexican president receptive to Roosevelt's efforts at friendship. The Mexican Revolution of 1910 had triggered a revolving door of revolutionary governments, each more suspicious of the United States than the one before. Succeeding governments had nationalized the railroads and oil fields and introduced radical land-reform policies. Unequal distribution of property remained a chronic problem for modern Mexico. The country was home to movements of both the revolutionary left and the reactionary right. The U.S. saw Ávila Camacho's election as a turning point. Roosevelt sent Henry Wallace, his vice president-elect, to Ávila Camacho's inauguration in December 1940.

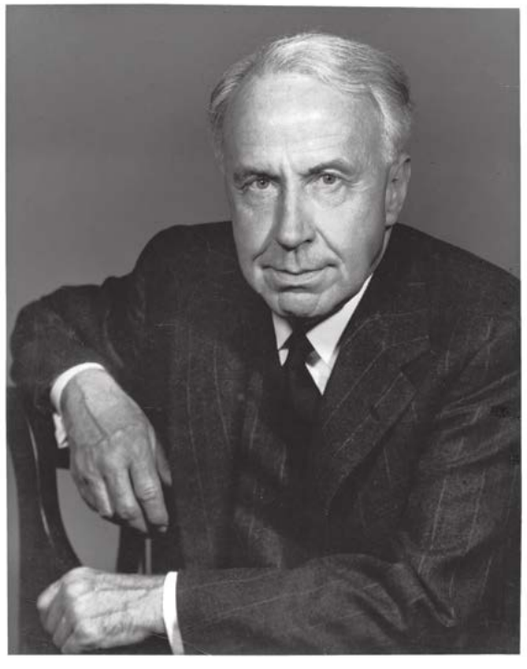
As the Rockefeller Foundation's Survey Commission would do soon after, Wallace drove the whole way south, crossing the border and then stopping to look at various farms along the way. Wallace was more than vice president-elect of the United States; he was also the former Secretary of Agriculture and one of the world's leading experts on corn. Ambassador Daniels hosted him upon his arrival in Mexico City, noting that Mexicans liked him because he "represented modern scientific agriculture, both officially as a former Secretary of Agriculture and in his own person as a man closely identified with the popularization of hybrid corn in the United States." Wallace spoke before the Mexican legislature, affirming Roosevelt's commitment to the Good Neighbor policy. Enthusiastic as his reception was from Mexican politicians, however, his reception from farmers was overwhelming. Many traveled to the U.S. embassy to ask his advice, forming a kind of impromptu "corn clinic." Daniels stated that the embassy "looked more like a county fair than a diplomatic establishment, because many Indian farmers had brought their corn to show it to Wallace, not as a visiting vice president, but as a world-recognized authority on the breeding of corn."

Rather than rushing home to prepare for his inauguration, Wallace spent a full month in Mexico conducting a personal tour of Mexican agriculture. "He traipsed up steep hillsides to see the corn grown in mountainous areas," wrote Wallace's biographers, John C. Culver and John Hyde. "[He] talked about hybrid breeding with Indian farmers and eager students, visited the leading agricultural college at Chapingo, and studied the Mexican diet and farm implements and work patterns." Wallace was shocked by what he found. The best corn farms he saw, in a lowland area near Zacupa, about two hundred miles northwest of Mexico City, produced only twenty bushels to the acre. "A generation earlier it had produced

twice that amount," Culver and Hyde wrote. "Most Mexican farms yielded only ten bushels per acre, and the human labor needed to garner even that amount was heart sickening." Farmers planted corn with a pointed stick, then had to weed, harvest, and husk by hand, before hauling their product to market. The farmers in Zacapu required two hundred hours to produce a bushel of corn. In contrast, an Iowa farmer produced the same amount with about ten hours of labor in 1940.

In Wallace, Daniels and John Ferrell had found a powerful voice to help convince the Rockefeller Foundation to begin a program in Mexico. This time around, President Fosdick was more receptive. One Foundation historian characterizes this shift in the reception of the Daniels-Ferrell proposal in absolute terms, stating that in 1935 it was greeted with "stony indifference." By 1941 attitudes had been "transformed into an eager search for programs in less vulnerable parts of the world to replace those which war had shattered." Fosdick requested background information on Mexico and the history of the Foundation's work there. He also agreed to accompany Ferrell to Washington, D.C., to meet with Wallace.

Raymond Blaine Fosdick served as president of the Rockefeller Foundation from 1936 to 1948. He came to the job after serving on the boards of various Rockefeller philanthropies and was a close confidant of John D. Rockefeller Jr. Winning Fosdick's support was critical to the creation of the Mexican Agricultural Program. (Rockefeller Archive Center.)



This meeting took place on February 3, 1941. Wallace later reported that "I said I thought it would be a fine thing if they went to Mexico." He advocated for agriculture work that went beyond the health concern of nutrition and focused directly on increased agricultural production. He reportedly stated, "if the yield per acre in corn and beans could be increased, it would have a greater effect on the national life of Mexico than anything that could be done." The means to achieve this ambitious goal would be the application of "modern scientific methods" to Mexican farming, which these men saw as a natural way to improve agriculture. Indeed, both the Rockefeller Foundation and the U.S. government had played a role in creating the system of research and education established in the land grant universities in the nineteenth century, and in further developing scientific research in the twentieth century. The meeting was pivotal. It was the first time Fosdick agreed that the tactic of funding agricultural research and education should be extended to Mexico as a way to "greatly benefit the welfare of the Mexican people," by increasing production of basic food crops.

From the Survey Commission to the Mexican Agricultural Program

Just because Raymond Fosdick had agreed to fund a Mexican agriculture program did not mean that he, or anyone else at the Rockefeller Foundation, had a clear idea of how exactly this should be done. Fosdick began by discussing the proposed work with various programmatic division directors. Warren Weaver, head of the Natural Sciences Division, was just as lost as Fosdick when first approached for direction. "I told him," Weaver later stated, "that I did not have the faintest idea as to whether there was anything we could do." The Foundation developed the idea of a survey commission as a way to approach policy, given that it had the motivation and opportunity to work on agriculture in Mexico but no idea how to do so operationally. "We can not possibly ourselves have exact and dependable information on many subjects," Weaver went on to tell Fosdick, "but we have developed the contacts and the techniques through which we can get such information."

He recommended that the Foundation send a few competent scientists, "quietly," to study the Mexican situation. Other advisors also emphasized the need for knowledge of this foreign country. Dr. A.R. Mann, a former Dean of Agriculture at Cornell who had worked on the IEB's agriculture program in Europe (1924-1926) and later became vice president of the GEB (1937), suggested that "efforts to improve the agricultural economy must be indigenous and arise out of native abilities, native plants and animal stocks, and the cultural characteristics of the people." Professor Carl Sauer, a noted geographer from the University of California, Berkeley, echoed this sentiment from outside the Foundation, writing in 1941 that "this thing must be approached from an appreciation of the native economy as basically sound."

Fosdick mobilized an internal study. The staff agreed that any Mexican agriculture help should fall under the Foundation's Division of Natural Sciences. They recruited Stakman, Mangelsdorf, and Bradfield, the three first choices for the Survey Commission.

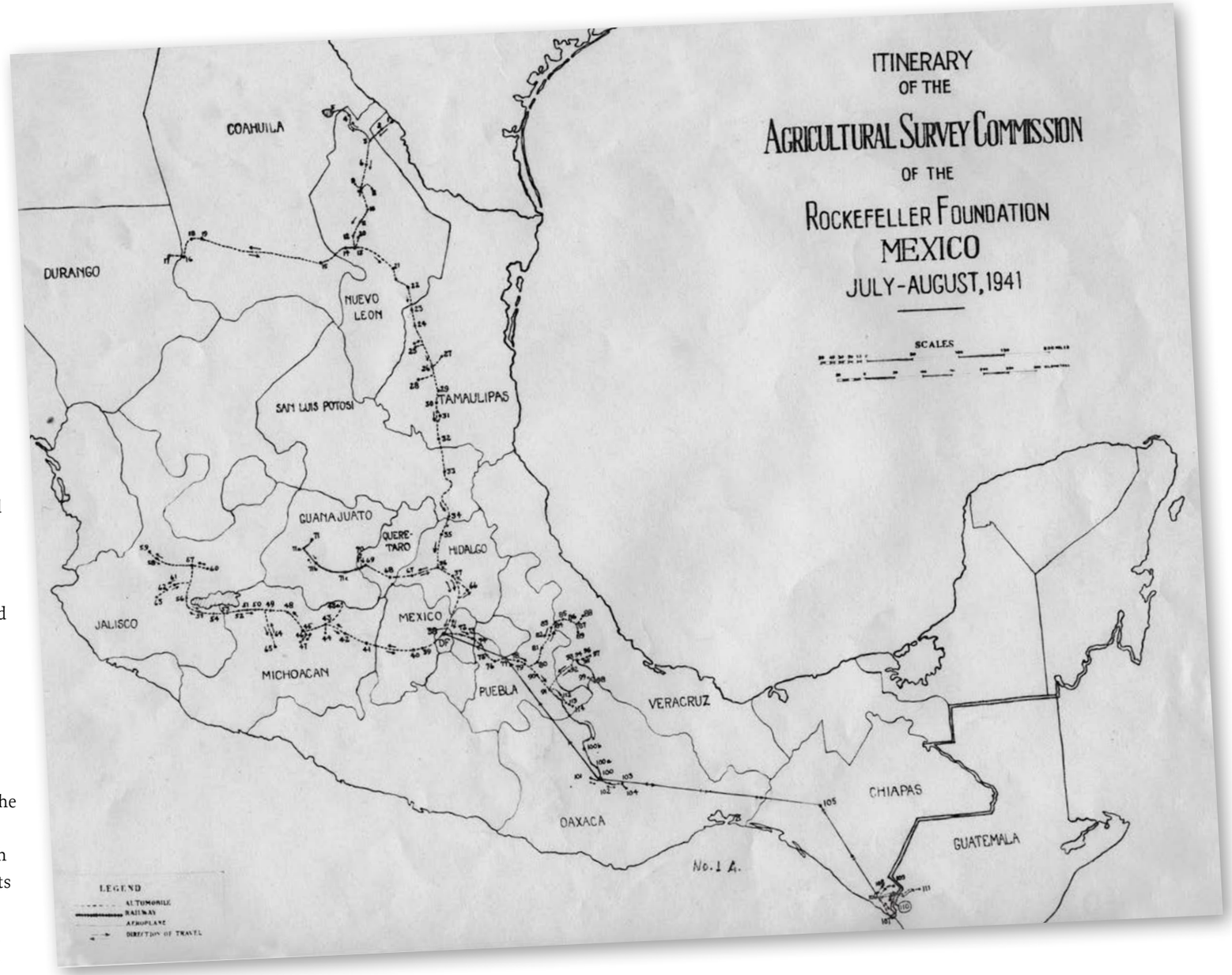
The trip itself was intended to be comprehensive. Over two months in the summer of 1941, the Survey Commission traveled 5,000 miles through Mexico and made over one hundred stops, from the arid north to the tropical south.

In its final report the Survey Commission included a map detailing its route through Mexico in the summer of 1941. Altogether, the Commission visited more than a hundred communities from Northern to Southern Mexico. (Rockefeller Archive Center.)

Mangelsdorf marveled at how quickly the landscape changed after crossing the border. Mexico was nothing like the border towns he had experienced. When they could not navigate remote country roads, they let the local governor take the wheel of the station wagon. They swam in the Pacific Ocean and gawked at the Zapotec ruins of Mitla. They traveled by airplane, on trains, in the back of trucks, by horse and mule, and even on foot. Years later, the scientists remembered Bradfield's voice from behind the steering wheel as they pounded over the broken road. He would point out the window of their green station wagon and yell, "That soil needs nitrogen!" Then they would hear the bang of the tires in another pothole.

Like Henry Wallace, the scientists were mystified by Mexican corn-planting. It was not grown on commercial farms as it was in the United States. It was grown all over the place, for subsistence, wherever people had small "backyards." "Corn is planted everywhere in Mexico," they reported. Mangelsdorf, who was in charge of photographing the expedition, captured stands of corn cultivated between tall pine trees in the forest, on nearly vertical mountain terraces, and surrounding churches. Corn was so much more than a food commodity in Mexico. It was woven into the culture.

Mangelsdorf reported that Mexican farmers patiently answered the scientists' questions and revealed a strong knowledge of their native vegetation. The Survey Commission found itself less impressed with the agricultural scientists of Mexico, whose research and lifestyles were remote from the farmers they served, a product of the more sharply defined class system in Mexico. Staff members of the National Extension Service did not even have means of transportation, and so were bound to work mostly behind desks. The experiment station at Chapingo was institutionally stagnant and evidenced little quality control, while farming was performed with ineffective tillage and harvesting methods. In Mexico, the scientists noted, agronomists wore suits and worked inside. The American commissioners rolled up their sleeves, held the dirt in their hands, and shared lunches with locals in broken Spanish. Every day made it apparent that any program the Foundation established would have to work out myriad cultural interactions on the ground, bridging the



gaps between American science and Mexican tradition as strangers learned to work together.

The report that the three scientists produced in October 1941 advised that basic research and scientific education must precede popular demonstration in Mexico. Unlike the GEB farm demonstration work, which "inherited the fruits of a half-century of agricultural research" from the land-grant college and extension system in the U.S., Mexico had "no comparable body of reliable information." The Commission reported that the "primary need is to acquire a body of facts and principles relating to Mexican agriculture and to educate men and women who are willing and able to disseminate it effectively through teaching and demonstration." In short, the Commission recommended that the Foundation first support research and fund the teaching of teachers.

During a Rockefeller Foundation conference on the Mexican report on November 25, 1941—which included members of the Survey Commission, Warren Weaver, and a few other officers who had helped with the trip—a decision was made to propose a Mexican research unit, rather than a grant to the Mexican government. This meeting also included William I. Myers, who had become a Foundation trustee that year. Myers was head of the Department of Agricultural Economics at Cornell and had served with various farm agencies, including the Farm Credit Administration. He was the only trustee with a background in agricultural science, and for the next 15 years he would be an important advocate for shifting the Foundation's policies toward public health, defined broadly to include food production. Myers once said that despite his great admiration and affection for Warren Weaver, one of Weaver's remarks "makes me crawl—when he said that farming is just applied biology."

Myers had been invited on the Survey Commission trip to Mexico that summer, and, though he could not attend, he helped shape its recommendations. In December 1941 he assisted divisional officers, including Weaver, in presenting the Mexican project to the Foundation for approval. "I had a very small part in it," he later said, but "I was the only trustee that was reasonably familiar with agriculture." The Foundation adopted the Survey Commission recommendations for starting an agricultural project in Mexico, including what it described as its "country unit model." Under this concept, the Foundation would operate the project directly and intimately, with program officers in Mexico working closely with the Mexican government and agricultural scientists. This programmatic infrastructure composed of Foundation representatives was so unprecedented that it constituted a "new pattern of technical assistance."

The Survey Commission built several specifics into its proposal. The four-member team it recommended consisted of an agronomist, a plant breeder, a plant pathologist/entomologist, and an animal husbandryman. These scientists

"Even the land of the forests is used for agriculture in Mexico," the Survey Commission wrote of this pine tree and cornfield on the mountaintops near Hidalgo, Michoacán. (Rockefeller Archive Center.)

were to address poor soil management, low-yielding grains and legumes, pest and disease control, and quality breeds of farm animal. Yet the newness of the endeavor, and the Commission's own experience with unexpected encounters, inspired the scientists to advocate for flexibility as well. "We didn't try to blueprint everything that should be done," Stakman said, characterizing the proposal as a mere guideline for an action program. The "next problem," he continued, "was, of course, to implement it."

MAP in Action: Negotiating a New Working Model

The All-American forward on the University of Michigan hockey team burst through the defense and fired the puck at Minnesota's goalie. This last line of defense threw his hand up, half-stopping the shot, but not completely, and Michigan won the game. J. George Harrar, a young agricultural scientist, was in the stands that night in the winter of

1942, riveted. That goalie was also a football player, and in both sports he was known to be a wonderful competitor who would fight to the last moment, fairly and cleanly, while keeping his head at all times. This was not just any night for Harrar. He had come to Minneapolis from his teaching post in Washington to meet Elvin Stakman, his old professor and mentor who still taught at Minnesota, and Frank Hanson, associate director of the Rockefeller Foundation's Division of Natural Sciences. Stakman had recommended Harrar to direct the Foundation's new Mexican Agricultural Program. Hanson had come from New York for an interview to assure himself that the recommendation was sound.

Stakman and Hanson both found themselves impressed by Harrar's reaction to the hockey game, attributing it to the young man's similarity to the goalie. You could tell by his reaction, Stakman said, that Harrar, too, was a "wonderful competitor who would fight very intelligently and to the last ditch, but always fairly." In the excitement, Harrar lost his new hat. "Well," Hanson remarked afterwards, "the young fellow lost his hat, but I don't think he'd ever lose his head."

Hanson set the wheels in motion for Harrar to be appointed, calling him to New York to meet with Paul Mangelsdorf and Richard Bradfield. The two scientists were also impressed with him. The Foundation offered Harrar the position, and waited until he could take leave of his job at Washington State College to commence the program under his leadership in February of 1943.

If the Foundation chose Harrar for the personal qualities he displayed at the Minnesota hockey game (on top of his professional qualifications), it was a judgment well made. Harrar, like the Survey Commission scientists, was from the Midwest, born and raised in Ohio. He was a fierce athletic competitor at Oberlin College, where the track team nicknamed him the "Flying Dutchman" (or "Dutch") for the records he set in 1928. It was well known, however, that Harrar's success derived more from perseverance and competitiveness than athletic prowess. One of his classmates said that he "seemed to give every ounce of energy to it and I always feared whether his endurance could hold out." Harrar matched his athletic discipline with a steely intellect that was readily discernible to others. He was known for his "steady, low voice" and his "blue and sharp" eyes that "divined instantly what one might be thinking."

Harrar's tenacity, consistency, and good judgment would serve him well in Mexico, as would his professional abilities. He had studied botany at Oberlin, then taught and studied plant pathology in graduate school at Iowa State College of Agriculture and Mechanic Arts and the University of Minnesota, where Stakman became Harrar's mentor. He gained more hands-on experience with farming and administrative management as head of the Division of Plant Pathology of the Agricultural Experiment Station at Washington State College in 1941. And Harrar spoke Spanish, having spent four years teaching biology at the University of Puerto Rico's College of Agriculture before completing graduate school training.

When Harrar went to Mexico in 1943 to start the Foundation's agriculture project, he was met with the same set of challenges in serving as a cultural bridge that the Survey Commission had encountered. Yet he reacted to them with skill and perseverance. The colleagues he selected often spent much of their career at the Rockefeller Foundation, the most notable of whom was Norman Borlaug (who had also studied with Stakman at Minnesota). These scientists trained at MAP, and in turn contributed to professional development abroad. "An untrained man," Harrar said, "is the human counterpart of an unproductive acre." He created a social life with frequent house or bowling parties for the expats under his supervision, which relieved tension, cultivated interdisciplinary cooperation, and brought scientists' wives into the loop. His motto promoted his own ethic of balance: "work hard, play hard, but above all, work hard."

Harrar also dealt with Mexican officials, controlling his "fiery temperament" and making friends in the right places. One of his first achievements after arriving in Mexico was to write a memorandum of agreement between the Rockefeller Foundation and the Mexican government. Because government consent had been verbal until then, he asked Dr. Harry M. Miller Jr., of the Foundation office in New York, to travel to Mexico to support him in working out a more formal arrangement. The memorandum that both parties signed in March 1943 was simple—not a contract but a "documented intent." Mexico, he said, "indicated they wanted assistance," and the Rockefeller Foundation "indicated we were willing to try to be helpful."

However, "neither of us really knew what we were agreeing to," Harrar said, because "we didn't know exactly what we were going to do." Indeed, this was the first time in the Foundation's history that it had "sent agricultural specialists into a foreign land to work side by side with the scientists of that country in raising the level of national food production." As they began, MAP administrators had to create a smoothly functioning organizational structure. To be sure, the Foundation's experience in public health around the world provided context and insight for this new venture, but Harrar and his colleagues were not doctors or public health officials, and they had not been involved in these earlier efforts.

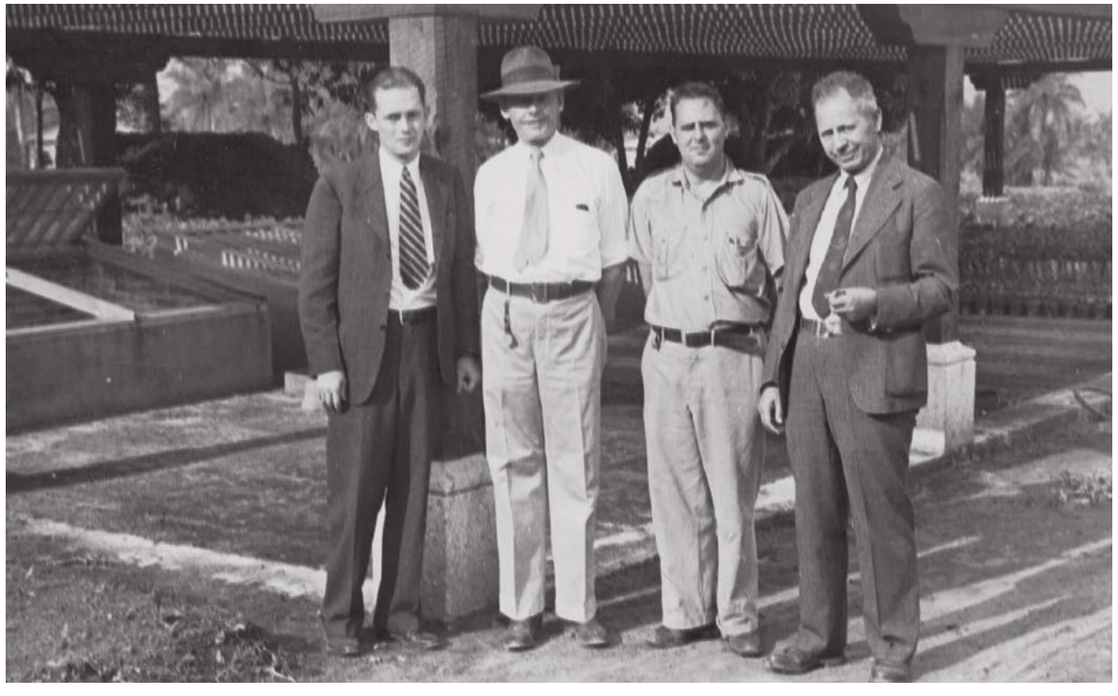
Harrar's first action in Mexico was to go on survey trips of his own, often with colleagues as his guide. He traveled in the spring, summer, and autumn of 1943, through a landscape that yielded moments of disconnect as well as wonder. When visiting a volcano with Mangelsdorf, the car got stuck in the mud, causing their Mexican driver to get out, open the trunk, and pull out a small boy to help him push the car, much to the Americans' shock and horror. Another evening, Stakman and Harrar walked into their hotel after a banquet to see a man who was "enormous . . . around the equator," wearing a big hat, long coat, and "pegtopped" trousers. They immediately recognized Diego Rivera, the famed Mexican muralist. They conversed extensively with him, discussing, among other things, his mural at the National School of Agriculture at Chapingo. (When Stakman woke his wife at 3 a.m. to tell her he had met Rivera in the lobby, Mrs. Stakman responded: "Did you have something to drink at that banquet? . . . You've got hallucinations.")

As the Survey Commission had discovered on its journey, Harrar realized that he was the real stranger in the new landscape. He often encountered "attitudes of suspicion" and "obvious difficulties in communication." Misunderstandings ranged from linguistic, when farmers spoke colloquially, to theoretical. Harrar found it impossible to explain to any "villager, who hasn't the slightest concept of what a philanthropic organization is, what you are doing there." He settled on telling farmers he was studying corn, or that he was a *técnico* (a technical person).

Yet Harrar found that farmers eventually warmed up to him. He engaged them personally, asking how they stored their corn or about other small details on their farms. He found that "showing an interest in those things that are part of their life in the village" endeared him to people. As he visited and revisited areas, many people who had been reluctant or suspicious became more relaxed, on both big and small farms. "I'm not sure," Harrar said, "but what they thought we were a little nutty, but harmless nuts." Out of this friendliness grew working partnerships, which then became closer friendships as MAP developed new seeds and distributed them in rural communities.

The scientists likewise had to build collegial relationships with officials in the new Mexican government. Politicians were different from farmers. They had a better understanding of the Foundation's intentions, but they also had expectations that didn't necessarily align with those of MAP administrators. Harrar recognized that he needed a functional relationship with the Ministry of Agriculture for MAP to run smoothly, but he first had to figure out how the Ministry operated internally. He worked with Minister Marte R. Gómez as well as his subsecretary, Alfonso González Gallardo, and business manager, Eduardo Morillo Safa, eventually navigating their different roles. González Gallardo handled the technical relationships, and Harrar had to go to him for program matters, including the what, where, and how of future work. Morillo Safa handled business affairs within the Ministry, so Harrar had to see him constantly in order to get help from the Mexican side. With the Minister he had to talk policy matters and overall planning.

Though Harrar found these men "competent, sympathetic, and friendly," he realized early on that they believed the Americans had some "secrets to success" that could yield immediate and brilliant results. Perhaps, he later said, they "expected us to perform at least one miracle daily, and maybe a couple on weekends." They did not conceive of breakthroughs as an evolutionary process, that "you could not do it by magic." Though Harrar tried to move quickly, the landscape was strange and science offered no blueprint.



J. George Harrar (left), a young agricultural scientist picked by the Rockefeller Foundation to run the Mexican Agricultural Program, joined a survey trip with his mentor Elvin Charles Stakman (right), an expert in plant pathology. In April 1943 they traveled throughout Mexico and also visited the School for Agriculture in Tegucigalpa, Honduras. (Rockefeller Archive Center.)

"Climatic and ecological conditions," in summary, "were different." Once the politics had been negotiated, the scientific task was to figure out ways to breed crop varieties from different locations in order to adapt them to the Mexican landscape, creating through hard science that "magic" sought by the politicians.

A Working Program

Harrar's team commenced work under the Office of Special Studies (OSS), established by the Mexican government as a joint responsibility of the Mexican Ministry of Agriculture and the Rockefeller Foundation. The OSS was primarily housed in a General Bureau of Agriculture building in a suburb of Mexico City. Both the government and the Foundation provided funding, with the Foundation also contributing trained personnel. The Ministry gave "land, labor, office and laboratory space, funds for buildings, certain pieces of machinery, fertilizers and other materials," as well as their own "technical personnel."

The OSS was the central headquarters of MAP, where scientists performed some laboratory experiments; it also contained exhibit rooms and an agricultural library. Complementing the OSS was an experiment-field system that included formal stations and more informal locations. The first station and, later, the heart of the research system was at the National College of Agriculture at Chapingo, about 25 miles east of Mexico City. This site included field labs, greenhouses, and planting projects, with 260 acres of experimental plots. Other stations were at Guanajuato, north of Mexico City, and Morelos, which was subtropical, enabling winter growing. Additional experimental locations took a variety of forms, some connected to schools of agriculture while others were on the land of "hacienda owners and small farmers" who "offered facilities for experimental work." These were extremely plentiful. In 1948, for example, MAP established over 500 experimental sites.

Though the Survey Commission had given MAP a wide range of research areas, its work was more limited in practice. Historian Deborah Fitzgerald argues that subsidiary goals were cast off as the program developed; the "focus . . . became research and advanced training." Research itself initially centered on two issues: wheat stem rust (a common blight on Mexican wheat) and the improvement of maize varieties (corn was a staple food crop). MAP gave other areas less attention, though substantial resources still were devoted to alternative crops such as potato, sorghum, beans, and vegetables, and to subsidiary topics such as animal husbandry.

Advanced training addressed what Harrar saw as the dearth of U.S.-style agricultural scientists in Mexico and, moreover, the lack of cultural value attached to this field.

Wheat

The aim of the wheat efforts was to "find or develop varieties which would resist fungus diseases." Because wheat was largely a commercial crop in Mexico, grown on larger farms and consumed less frequently than corn, MAP conceived of wheat rust in financial terms. Harrar stated in his six-year assessment report that "wheat rusts have cost Mexico millions of dollars annually." He began work on improving wheat in 1943. His team inoculated 700 varieties of wheat with stem rust, planted them in autumn, harvested them in spring, and then replanted the 500 survivors. This work led to the conclusion that Mexican varieties ripened early but were not rust resistant, whereas, they knew, American varieties of wheat ripened later but were resistant.

Harrar brought Norman Borlaug to MAP in 1944, initially as the team's plant pathologist. A native of Cresco, Iowa, Borlaug grew up on his Norwegian-American family's farm. Like Harrar, he had earned his Ph.D. under Elvin Stakman and, also like Harrar, he was a competitive athlete in his undergraduate days (also at the University of Minnesota). "Wrestling taught me some valuable lessons," he later said. "I always figured I could hold my own against the best in the world. It made me tough." Stakman saw this perseverance in Borlaug and recommended him to Harrar, writing that Borlaug had "great depth of courage and determination," adding that he "will not be defeated by difficulty and he burns with a missionary zeal." Borlaug would draw on this strength to serve him well in the early days of MAP.

Soon after Borlaug's arrival, Harrar assigned the junior scientist the task of crossing the Mexican and North American strains of wheat to create a hybrid that was not only rust-resistant but also ripened early (enabling multiple cropping). In the meantime, MAP distributed the best seeds from Harrar's experiment, which, according to Borlaug, were superior to the strains that local farmers were using.

To create the desired hybrid, Borlaug pioneered an innovative system of "shuttle breeding." It was common practice in agricultural science at this time to raise experimental crops not only in the location where the resulting varieties would be grown, but also through the duration and climactic conditions of an actual growing season. Borlaug realized that the time it took to develop effective hybrids would be halved if he could create

Rockefeller Foundation scientist Norman Ernest Borlaug joined the Mexican Agricultural Program in 1944. His scientific research on wheat helped support a dramatic increase in food production in Mexico and other nations. Borlaug won the Nobel Peace Prize in 1970 for his efforts to avert widespread famine. (Rockefeller Archive Center.)

two growing cycles per year. Because he was breeding wheat that was usually planted in the winter (due to summer conditions creating a fertile climate for stem rust to grow and spread), he replicated winter conditions during the summer by working at high altitude. His team first planted experimental strains on a normal growing cycle near sea level, sowing wheat seeds in autumn and harvesting in spring at Ciudad Obregón in the Yaqui Valley of Northwest Mexico. He then took the seeds from the most resistant plants, transported them hundreds of miles to the highland environment of Toluca in central Mexico, and sowed a new crossbreed in spring for an autumn harvest.

Harrar initially protested this more expensive regional approach. He wanted to confine wheat work to central Mexico. He and Borlaug had heated arguments, both drawing on their competitive spirits in an effort to hold their own. Borlaug later recalled that Stakman appeared early in the morning one day, fuming. “Have you ever seen Stakman at 7 o’clock in the morning?” Borlaug interjects in his story. “I have never before or since.” Stakman snarled, “You people act like children!” After Stakman's intervention, Harrar relented. Borlaug implemented shuttle breeding and repeated the process for two harvests annually.

By 1950 MAP’s efforts had created 12 new varieties, whose virtue was their suitability for the Mexican climate and resistance to disease, with special attention to stem and leaf rusts. Because of this resistance, they could even be grown in the summer rainy season. MAP had distributed these seeds to farmers as it developed them, so that by 1949 improved varieties were estimated to seed about 110,000 acres, or eight per cent of the total wheat acreage of Mexico. The Rockefeller scientists believed that the key to the rapid spread of these wheat varieties was the fact that although they had employed hybridization (crossing different strains) to create new varieties, the end products were true-breeding varieties. Farmers could thus save, use, or sell any portion of the harvested grain as seed for the next planting.

Corn

A major element of the MAP was a project focused on corn (maize). This project aimed to increase the supply of Mexico’s most basic food crop by improving yields. Harrar’s six-year assessment described maize as the “national food,” reporting that “approximately 58 per cent of Mexico’s cropland is given over to corn.” Despite this large growing area, MAP characterized low yield as a major impediment to sufficient food supply, especially when compared to corn grown in the United States. Corn grown in Mexico, Harrar reported, was “poor in both quantity and quality.” Researchers first tested hundreds of native corn samples for “vigor, growing period, climatic adaptability, yield, and other cultural factors.” They selected superior strains for immediate distribution and planting, keeping some for experimentation. The scientists then utilized these seeds to create synthetics (crossing inbreds or single crosses with superior open-pollinated varieties) and hybrids. Corn is not amenable

Wheat hybridization experiments in July 1958 at Santa Elena, Toluca, Mexico, were monitored by researchers in the field. (Neil MacLellan. Rockefeller Archive Center.)

Edwin Wellhausen offered tips to farmers at the Chapingo field day in 1954. Wellhausen joined the Mexican Agricultural Program in 1943 as the geneticist in charge of corn breeding. He served as director of the program for most of the 1950s. Wellhausen's colleagues in the early days of MAP included John Niederhauser (potato breeder), William E. Colwell (soil scientist), John J. McKelvey (economic entomologist), and Lewis M. Roberts (corn breeder). (Rockefeller Archive Center.)

to the production of true-breeding varieties due to its propensity for cross-pollinating in the field rather than self-pollinating, as occurs with wheat and rice.

Synthetics were reportedly better suited for the Mexican environment, as they were highly adaptable to a range of climatic zones and were more genetically diverse. They could be replanted for several years "without significantly reducing yield and vigor." By 1948 MAP had distributed various improved varieties to farmers, including four open-pollinated, eight synthetic, and 16 hybrid, all of which it considered "superior for yield and resistance to disease." MAP reported that for the 1948 crop, 500,000 acres were planted in new varieties and the yield increased by 125,000 tons. Consequently, for the "first time in thirty-five years, Mexico did not have to import corn." The increased harvests could also be used as feed for livestock to improve the supply of meat and milk.

Other Projects

MAP also worked in subsidiary areas that included different crops and different problems. The other major crop it focused on was beans, which the program considered secondary to wheat and corn but which nonetheless was bred for higher yielding and more resistant varieties. The program attached a nutritional goal to bean development—to help provide adequate protein for those in the population who could not afford the more luxurious items of meat and milk. Nutrition was one of many different subsidiary areas MAP sought to address, which included soil and crop studies (fertilizers, herbicides, and crops such as grasses, sorghum, soybeans, clovers, and peas), plant diseases, insect pests, and farm machinery.

Advanced Training Program

There were many Mexican agricultural scientists at the time that MAP commenced work, but Harrar, Borlaug, and the other scientists running the program faced a difficult problem when they discovered that agricultural science meant something quite different in Mexico than in the United States. Historian Deborah Fitzgerald argues that Rockefeller Foundation officers characterized this as a technical and cultural issue that stemmed from a lack of fieldwork experience. Harrar was of the opinion that "Mexicans seemed to feel that agriculture was a science best learned in the laboratory and classroom rather than the field, and a social stigma was apparent toward fieldwork generally." MAP scientists also perceived that many Mexicans were either mystified or awed by American agricultural science, which could be both positive and negative for the MAP team. Fitzgerald argues that some Mexican agriculturalists were offended by the presence of MAP scientists, perceiving an implication that "Mexican scientists did not know what they were doing." On the other hand, some in the government and the universities "harbored unrealistic expectations of American science."

The MAP professional training program worked to create technical personnel, but also to institutionalize an entire new ideology of working methods. Harrar characterized this as "perhaps the most significant and far-reaching feature" of the Mexican Agricultural Program. The Mexican Department of Agriculture assigned about a dozen young men each year to work with the OSS. These promising scientists would spend one or more years with MAP scientists in both the laboratory and the field, gaining

valuable technical and practical experience. Many wrote dissertations and earned degrees from Mexican agricultural colleges for this work. The Foundation also provided study-abroad opportunities in the United States for those trainees who had shown an aptitude for research and mastered the English language. The scholarships were given with the understanding that recipients would return to Mexico to fill posts as agricultural researchers in government service. Twenty-six scholarships of this type had been awarded by 1949. The Foundation saw both components of the training program as successful, stating in 1950 that "this growing body of eager, young, competent scientists forms the vanguard of future agricultural progress in Mexico."

Extension and Popular Education

Much of MAP's measurable success came from the ability to disseminate its improved seed varieties to farmers. Mexico did not have an extension system akin to that of the United States, where agricultural colleges, experiment stations, and extension agents brought scientific findings to farmers in their home state. Harrar attempted to make the Mexican experiment stations into the "channel through which the results of research can be brought directly and quickly to the farmer," but they did not perform effective extension work. Thus the Ministry of Agriculture and the OSS pursued other means, which were largely successful with regards to wheat. The OSS initially distributed seeds informally, but there were issues with bad publicity and a competing black market of seeds that undercut the effort. In 1947 the Ministry assumed the distributor role, creating a Wheat Commission that enjoyed marked success. Within ten years, 90 per cent of Mexico's wheat acreage was growing improved MAP seeds. These farmers were, in many ways, predisposed to accept distributed seeds. Wheat farmers were mostly commercial, with larger plots of land, and had greater ability and willingness to take risks and invest in seed, irrigation, and fertilizer. Historian Deborah Fitzgerald argues that, within Mexico, they were most similar to American farmers, creating an "effective 'fit' between the wheat farmers and the OSS" that made dissemination easy and successful.

The Mexican Agricultural Program focused primarily on corn and wheat, but also funded research on beans – another staple of the Mexican diet. In this experimental garden plot at Ciudad Obregón Experiment Station, researchers cultivated new varieties of beans in April 1961. (Rockefeller Archive Center.)

Corn growers did not receive the fruits of MAP labor to the same extent, though there was much activity directed toward the crop. Two different corn commissions sought to, as Harrar bluntly phrased it, "put the new corn varieties in the hands of farmers." Richard Acosta, a Chapingo graduate and commercial farmer, founded the Corn Commission in 1947. This was an independent agency that increased the production and distribution of OSS seeds, which President Alemán Valdés (1946-1952) supported until Don Nazario of the Ministry of Agriculture started a rival commission. The OSS eventually gave an equal share of seeds to his National Commission for the Increase and Distribution of Improved Seed. These entities also pursued popular education for corn farmers, instructing them on "approved tillage methods, disease and pest control and irrigation." To do so, the two commissions held field meetings and contests, screened educational films, and produced bulletins. In one instance, they even created and sent an educational ballet on tour, based on the "legend of the Aztec corn goddess."

Despite these efforts, corn farmers did not adopt MAP seed varieties at anywhere near the level that wheat farmers did. By 1963, less than 12 percent of corn acreage grew hybrids, or 36 percent if selected varieties and synthetics are included. Corn growers were subsistence farmers, with small farms. In the same way that wheat growers were predisposed to adopt new seeds and methods, corn growers were unlikely to do so given their situation. They could not take on the risk or expense of hybrid seed, irrigation, and fertilizer. No elaborate extension system existed to promote adoption widely enough, and the agencies that did attempt to serve this role had much less success with corn growers than with wheat farmers.

No Miracles, Only People, Patience, and Persistence

Despite the tensions and challenges inherent in Mexico's agricultural economy, the overall expansion of agricultural production was enormous. Even corn production rose, owing to improved seeds and farming methods. In 1948 Mexico did not import corn for the first time. By 1956 it was a net exporter of corn, wheat, and cereal, while still meeting the food needs of its own growing population. MAP had trained a new generation of agricultural scientists in the expertise it believed most valuable to approach the problems of Mexico's agriculture and food supply. It had created an infrastructure for scientific research, experimentation, and education.

Based on the data showing increased production, the Foundation soon extended the MAP model to many locations around the world. In Mexico, new initiatives would continue to be motivated by a theoretical wedding of agriculture and public health through nutrition, which sought to increase the quantity and the quality of agricultural harvests. The working model created in Mexico contained vestiges of its theoretical underpinnings, yet its operational components arose primarily from adapting to conditions in the field. The Foundation continued to use its own officers as a bridge between cultures as well as pioneers of technology and science, because George Harrar, as program director, had operated effectively by negotiating with both Mexican farmers and government officials.

Foundation leaders knew that adept navigation of cultural differences in the interest of science lay at the heart of their success in Mexico. When asked what they believed was the "x-factor" in MAP success, most officers named the people with whom they implemented the program—citing their personal friendliness and professional capabilities. Like Harrar, the scientists who worked under him encountered their own strangers and navigated through their own moments of unfamiliar wonder. John J. McKelvey Jr., a plant pathologist, said that everyone was "intrigued" and "starry-eyed," because Mexico was an "unknown" and the "whole business was completely new to us." Yet by the time they were done, they had contributed to creating a functioning program that enjoyed its own successes.

"There is no miracle involved in it," Elvin Stakman concluded. "Men make a program," and the Rockefeller Foundation had "some remarkable men who knew how to make a program and knew how to carry it out." For the officers in the Foundation's New York headquarters, the greater test of the Mexican Agricultural Program would be whether or not it was replicable in other countries. They would soon find out.

Forming New Partnerships in an Expanded Third Sector

The Rockefeller Foundation's Mexican Agricultural Program in the 1940s was a pioneer in the field of international agricultural assistance. Since the 1970s, aid organizations focused on agricultural development have proliferated and the Foundation has worked with many partners around the world.

In 2008, for example, the Meridian Institute, an independent non-profit organization, formed the Foundation Working Group on Food and Agricultural Policy. The effort brought together nine U.S.-based foundations, including the Rockefeller Foundation, to help shape U.S. policies related to food and agriculture. The group's work focused on nutrition, rural development, and environmental quality within the United States and abroad. The Foundation has funded various projects that grew out of the Working Group's efforts including Meridian's AGree initiative, Global Dialogue on Agriculture and Climate Change, and Initiative on Food and Agriculture Policy (IFAP), all of which promote food security through public policy or donor networks.

The Foundation also continued to fund large-scale agriculture efforts spearheaded by other international agencies. In 2005, it gave almost $200,000 to the Food and Agriculture Organization for policy research to strengthen market linkages and supply chains in Africa and Asia. Four years later, $1.5 million went to the same organization to promote resilience among vulnerable populations in Ethiopia, Kenya, and Uganda. Additionally, the Foundation gave more than $300,000 to the United Nations Economic Commission for Africa between 2006 and 2010 to develop land policy reform as a contribution to African food security.

Some of the 1,200 farmers, teachers, and agronomists who attended a field day at the Bajío regional center in April 1964. The Mexican Agricultural Program organized field days to teach farmers about new high-yielding wheat varieties. Though the percentage of farmers who attended the events was small, studies showed that these farmers took the lead in introducing new seeds and improved practices in their communities. (Rockefeller Archive Center.)

EXPORTING SUCCESS

The Rockefeller Foundation had embraced the Mexican Agricultural Program (MAP) as a way to invest in the future while the chaos of world war consumed the present. But remote from publicity and urgent expectations, isolated from the daily pressures of war, the Mexico program thrived quietly as a scientific search for fundamental solutions to the intractable problem of hunger. The purpose of MAP was two-fold and elegant, as Warren Weaver described it in 1948: "to bring modern scientific methods to bear on the improvement of the quality, yield and production of the basic food crops of Mexico; and to aid the Government in developing the scientific personnel, research facilities and methods essential to the effective utilization of the agricultural resources of the country for an improved society."

In five short years, the program had studied 1,500 native varieties of corn, found 15 superior types, and released six to farmers for planting on 270,000 acres, representing six percent of the total corn belt in Mexico. Yields were often 20 percent and sometimes even 50 percent higher than they had been a decade earlier. For the first time in decades, Mexico did not need to import corn.

Scientists at MAP began to extend their research into the effects of soil composition and management, fertilization, climate, humidity, and altitude, as well as into the nutritional qualities of corn. The challenge was not just to grow more corn, but more nutritional corn. President Raymond

In 1955 many Mexican farmers were able to substantially increase their yields of corn, wheat, and other crops, including potatoes, with the assistance of the Mexican Agricultural Program. (Rockefeller Archive Center.)

Fosdick had even begun to expand the ideological rationale for MAP by making a direct link between increased agricultural productivity and the persistent growth of human population.

MAP had started with a small operational staff in 1943, embedded in the Mexican countryside with no clear plan for how they would address Mexico's agricultural problems. But by 1948 the focus was razor sharp. The Foundation had assigned ten American scientists from its staff to Mexico, and the Mexican government had assigned 47 young scientists to MAP. Six Mexican agronomists were pursuing post-graduate study in the United States, and seven fellows from other Latin American countries were studying side by side with American scientists in Mexico.

Since 1945, the Foundation had sponsored two graduate students from the agriculture school at Medellín University in Colombia to spend a year in Mexico doing research on soil, plant pathology, plant breeding, and applied entomology. By 1948 two of the first three fellows had returned to Medellín to join the faculty. The Foundation expanded the fellowship program from two to six students, and started a new program at the University of Cali, also in Colombia. On many levels, from research to improved harvests to expanding professional expertise, the Mexican Agricultural Program had been a success. A spirit of cooperation and partnership pervaded the program. Hundreds of visitors arrived at MAP test plots to study their progress. In 1949 the Foundation funded the Inter-American Institute of Agricultural Sciences in Turrialba, Costa Rica, and invited agricultural scientists from 11 Latin American countries to join MAP leaders in Mexico City for an "Inter-American Symposium on Plant Breeding." A year later, in 1950, the Foundation sponsored a second symposium, the "Inter-American Symposium on Plant Pests and Diseases."

Scientists from established universities attended these conferences, in stable Latin American countries that shared a common language, cultural traditions, and dependence on corn. They had also avoided the worst direct impacts of World War II. For the first time since the Rockefeller Foundation's international campaign against yellow fever in the years between World War I and World War II, scientists worked toward common purposes across national borders. Agricultural research is based on universal principles, and scientists shared the same research methods. They read the same technical literature. A breakthrough in Mexico could be applied in Colombia. The discovery of native high-altitude varieties in Bolivia held the potential to unlock secrets that might improve yields in Guatemala. What had begun as an experiment with a narrow focus on the food production problems of Mexico was ready to emerge onto an international stage.

Taking the Model to Colombia

In 1948 the president of Colombia officially requested the Foundation's assistance in setting up a MAP-like program in his country. Dr. Lewis M. Roberts, a corn specialist from MAP, and Dr. Joseph A. Rupert, a wheat expert, were assigned to launch the project. The initial Foundation investment of $40,000 in 1949 increased to $135,600 by 1951.

The Colombia program followed the blueprint of MAP as precisely as possible. It put emphasis on improving the yield and quality of corn and wheat, and on increasing the opportunities for Colombian agronomists to conduct post-graduate research in the United States and Mexico. "We plan to use it [MAP] as a hub for training and, as it were, seeding the extension of the work to other countries," new president Dean Rusk wrote in the 1951 President's Review. "The men who are operating the program in Colombia were trained on the job in Mexico, and the personnel to man the proposed projects in other Latin American countries will similarly be trained through a year of experience on the staff in Mexico."

The Colombian Agricultural Program (CAP) developed its principle centers of research in Medellín and Bogotá, near existing university research facilities. By 1954 there were four substations for high-altitude research, three stations in the intermediate altitudes, and three tropical stations. In its first years, the Colombia program received seeds from Mexico and adapted them to Colombia's climate, but researchers quickly developed a "corn germplasm bank" to store indigenous Andean varieties that could be used for experimentation or sent to corn researchers throughout the world. Seeds were distributed to Colombian farmers through the Caja Agraria, a government- owned credit bank, which formed part of the extension system and sold the seed "literally and figuratively by demonstrating to the farmer the advantages of the improved varieties." By 1960, 80 percent of the corn acreage in Colombia's most advanced agricultural region, the Cauca Valley, was planted with hybrid seeds sold through the Caja Agraria. The Colombians also developed an emphasis on potatoes, which scientists pointed out were a staple of the Colombian diet.

Expansion to Chile

Successes in Colombia were quickly followed by a request from the government of Chile, and in May 1955 the Foundation established its third agricultural operation. Upon entering the country, in collaboration with the federal government, the Foundation helped establish a cooperative unit, the Office of Special Studies, under the aegis of the Ministry of Agriculture. The Foundation began work on the premise that there existed a food supply shortfall in Chile that could be fulfilled by improving agricultural productivity. The "consumption of agricultural products . . . was increasing at the rate of 2.3 per cent annually," Foundation researchers explained, while "agricultural production was going up at the rate of 1.6 per cent."

The Chilean program focused on wheat, the "basic staple of the national diet," which had been imported annually in recent years. As the program

developed, it also took on "forages for livestock feed," which the Rockefeller Foundation considered the second major focus by 1956. Forage crop work included alfalfa, subterranean clover, red clover, white clover, crimson clover, trefoil, ryegrass, *Phlaris*, and sorghum. Pasture and range comprised over 50 percent of Chilean land, about 14 times the acreage under cultivation.

The Chilean program established its headquarters in Santiago, with experimental stations in Paine (near Santiago), Temuco (in the "winter wheat region"), and Los Andes (some distance from Santiago). These locations intentionally spanned a variety of Chilean climates and the "three chief agricultural regions of the country." The program consolidated research in 1957, when the Rockefeller Foundation gave the Ministry of Agriculture a grant to group the stations together at a new site near Santiago, which included an agriculture library. With Foundation help, the Ministry later purchased land and erected new experiment stations near the old ones outside of Santiago and Temuco.

In addition to corn and potatoes, the Colombian Agricultural Program researched wheat. In the mid-1950s, local boys helped to harvest a variety known as "Menkemen." (Rockefeller Archive Center.)

As in Colombia, the Chilean program's first step was research to adapt already improved seeds. Wheat varieties were bred for high yield and disease resistance at specific climatic regions of the country. Later, as in Mexico and Colombia, they were also bred to create "short-stemmed 'dwarf' varieties" to utilize nutrients more effectively, and avoid "lodging."

Wheat formed one pillar of the Rockefeller Foundation's crop program in Chile. At the La Platina Experiment Station in February 1963, researcher Ernesto Hacke checked plants for their resistance to rust. (Neil MacLellan. Rockefeller Archive Center.)

Following the model set by Mexico and solidified by Colombia, the Chilean program provided for agricultural college students to work with Foundation staff members on research projects, as well as scholarships or fellowships for advanced study in other countries, usually in Latin America or the United States. Popular education that aimed to teach farmers improved methods of cultivation—including crop rotation, with an emphasis on forage crops such as clover, alfalfa, and grasses—also formed a key part of the program.

Though the Chilean program progressed less rapidly than the program in Colombia, the Foundation nonetheless considered it a success. In 1963 it reported that Chilean farmers harvested 1.2 million metric tons of wheat to "meet the country's requirements, eliminating the necessity of importing this basic cereal." The gains were achieved by better farming techniques and improved seed varieties adapted to Chile's agricultural regions. The Foundation also reported that successfully improved alfalfa, red clover, ryegrass, and orchard grass were "adding to the carrying capacity of Chilean pastures," and that demand for these new seeds was high.

Developing a Multilateral Vision Based on Agriculture

The Chile program sparked a more integrated approach to Latin America as a whole. The programs in Mexico, Colombia, and Chile—together with the Central American Corn Improvement Project, a collaboration among five nations—had, by 1955, "gradually developed, through extensive intercooperation, into a single Latin American agricultural operation" or "regional unit." The Foundation extended the

operation more widely, and more officially, by creating the Inter-American Food Crop Improvement Program in 1959. Some non-participating Latin American countries, including Ecuador and Peru, had benefited from advice and guidance provided by scientists in countries participating in Rockefeller Foundation-funded programs. And all the programs had gained by exchanging personnel; the director of wheat improvement in Colombia, for example, had become the director of the Chilean program in 1955.

The Foundation aimed to reach sustainability and then turn each project over to an appropriate government agency. "The parallel development of local governmental and institutional support of the project," it stated in 1958, "and of a corps of qualified professional agronomists to man them, will make it possible for the Foundation gradually to withdraw from the enterprise."

Students visited a garlic plot undergoing an herbicide test in Santiago in July 1957. Professional development proved critical to the agriculture program in Chile. As in Mexico, the Rockefeller Foundation encouraged agronomists in Chile to leave the office and laboratory and go into the field to perform their research and extension duties. (Neil MacLellan. Rockefeller Archive Center.)

The success of the Mexico program also had organizational consequences within the Foundation. President Dean Rusk announced a dramatic shift away from its program in experimental biology in the United States so that funds could be applied to the agricultural program. The Foundation did continue its commitment to experimental biology in Europe, where basic research had been devastated by the war. But in the United States, where new government agencies now sponsored scientific research at a scale that dwarfed the Foundation's capabilities, its experimental biology budget was cut by over 50 percent. At the same time, the budget for experimental biology in Latin America, where 70 percent of the research focused on agriculture, jumped from $400,000 to $700,000. Rusk expected the funds to be used "to upbuild their departments of agriculture."

Rusk also attempted to stretch the creative boundaries of MAP by investing in a highly interdisciplinary experiment in Mexico. MAP had succeeded because it kept its focus narrow: to improve the yield of basic food crops including corn, wheat, potatoes, and beans, and to train professional agricultural scientists. In 1951, however, Salvador Sánchez Colín, the Governor of the state of Mexico—in the rich agricultural valley just outside Mexico City—approached the Foundation with a new idea that reflected themes from Rockefeller work in China and the American South.

Sánchez Colín was himself a trained agronomist. He proposed to set agricultural programs in the broader context of community development. Rusk described the project as a "human ecology approach to the intertwined problems of food, health, education, and social relations, and possibly other factors in a population that is predominantly rural." The program would not be restricted to one interest, Rusk suggested. It would represent a commitment to deeper social reform and encourage work in public health, medical science, social science, and education. Rusk described the proposal as "warmly welcomed" by the trustees, who approved an investment of $100,000 over six years.

As the focus of the agriculture program expanded beyond the improvement of basic crops to a broader interest in the food problems of mankind, the Foundation appropriated grants for work in solar energy, the purification of brackish water, the study of cloud physics and rainfall patterns, and the commercial development of food sources from the oceans. By 1956 the Foundation had established operating programs and other agriculture-related grants in ten Latin American countries. Five years later it was also working in the Philippines and India, with outreach activities in dozens of other countries including Kenya, Thailand, and Indonesia.

By the mid-1950s the Rockefeller Foundation operated its in-country programs as part of a larger, regional Latin American unit. Research and staff were shared across established programs and different locations. Under this system, Foundation scientists visited the Grigo Izafulto Experiment Station in Quito, Ecuador, in April 1961. (Rockefeller Archive Center.)

As Foundation leaders increasingly articulated a more strategic approach to agriculture on the international stage, Dean Rusk pushed the Foundation "away from problems of health and disease, because he believed that governments could now handle these." Instead, the Foundation's president encouraged movement toward agriculture as a means of conquering hunger. But this shift took place within a highly charged political context.

MAP had been nurtured in a stable, non-controversial setting. Scientists had not been forced to navigate their way through political minefields, and the program's successes were not overtly politicized or controversial. The scientists shared an idealistic conviction that improving crop yields was a moral imperative. But as World War II ended and the Cold War began, Foundation staff found themselves in the middle of conflicts as volatile and widespread as those they had hoped to avoid.

Everywhere the Foundation turned in the early 1950s, the postwar world seemed as if it was spiraling into chaos. In China, the nationalist government had been swept away by communist revolution. The Soviet Union found its more ardent supporters in the nationalist movements of former colonies of Africa and Asia, the very leaders Rusk hoped to influence with his agricultural programs. The Viet Minh had declared independence in Vietnam and were fighting the French. The Mau Mau rebelled against the British in Kenya. In the Philippines, the Huk insurgency threatened the government and U.S. military occupation. Above all the regional conflagrations, the threat of nuclear holocaust hung over the future of humanity.

Foundation trustee Chester Bowles grasped the magnitude of the Cold War and its implications for the Foundation's program, which he articulated in a letter to John D. Rockefeller 3rd and Dean Rusk in 1954. "Our civilization may be blown to smitherines [*sic*] next week, or next year, or next decade. Thus, it seems to me that saving our civilization has become at least as fundamental as improving it." In this context, it was hard for the Foundation to keep focused on the development of high-yield seeds.

In addition to worldwide political instability, the global population kept growing at exponential rates. The population of Mexico had doubled in less than half a century. In Colombia, the population had tripled from nearly four million in 1900 to almost 12 million in 1950. In India, with the second largest population on earth, 345 million at independence in 1947 had grown to 395 million in 1955, an addition of 50 million new mouths to feed in just eight years. In the former British colony of Nigeria, the population had exploded from 16 million in 1900 to 33 million in 1950.

Dean Rusk wanted to invest heavily in the new nations that were emerging from former colonies, and he wanted to invest in applied science—science with a practical value that might contribute to economic development. "The emergence of dozens of newly independent countries after World War Two was having a major effect on the 'well-being of mankind,'" Rusk wrote later in his autobiography. "I believed we should spend less at home, get involved with the great mass of humanity in the Third World, and especially concentrate on public health, public education, and agricultural productivity."

Rusk's own life experience influenced his perspective on development. "My memories of Cherokee County and how rural Georgia was transformed in a few decades helped convince me that the keys to Third World development lay in these areas. I also thought the foundation should focus less on original research and more on extending knowledge already gained. The Third World, where two-thirds of the world's population live, was a time bomb for the entire human race."

Dean Rusk became president of the Rockefeller Foundation in 1952. He had worked at the State Department from 1946 to 1952, including service as Assistant Secretary of State for Far Eastern Affairs. Rusk led the Rockefeller Foundation for almost ten years, overseeing a significant increase in international agriculture work. In 1961 he became U.S. Secretary of State under President John F. Kennedy. (Rockefeller Archive Center.)

A focus on agriculture met all of Rusk's criteria for a successful program. Famine and food shortages held the potential to be politically and socially explosive as well as destabilizing, while agricultural research was practical and could be applied across national boundaries. In the context of the Cold War, using science to increase harvests supported U.S. foreign policy initiatives by promoting food security, and it helped to ward off communist revolution without forcing nations to confront the more explosive strategies of land reform and land re-distribution favored by insurgents.

Colombia had become something of a cautionary tale about the kind of minefields that could lie ahead. The Mexican Agricultural Program had never taken a position on land reform in Mexico. The focus had stayed on improving crop yields. But in Colombia, a

violent civil war that took land reform as its central issue began in 1948, just as the government invited the Rockefeller Foundation to set up a new program. During the ten years of *La Violencia*, 200,000 Colombians lost their lives in the fighting. Liberal candidates for the presidency were assassinated. Riots paralyzed the capital city of Bogotá. Conservative military leaders seized power in a *coup d'état*. Communist rebels organized guerrilla armies. Through the course of the civil war, Foundation staff focused on developing high-yield crops in the hope that improved harvests and more food at the markets might improve living conditions and forestall demands for more radical land reform.

Even as he tried to get his arms around the rapidly changing, unstable landscape of the Cold War, Dean Rusk spent his first months as president of the Rockefeller Foundation preparing for a congressional investigation into the work and loyalty of non-profit, philanthropic organizations. Some critics contended that tainted money from the Rockefeller oil empire had built the Foundation. Others claimed that it invested in subversive, anti-American programs. The Foundation had experienced congressional investigations before, but the Cox Committee investigation of 1952 was specifically organized "to determine which such foundations and organizations are using their resources for un-American and subversive activities or for purposes not in the interest or tradition of the United States."

Rusk had come to the Foundation from the State Department, and he would return to the State Department in 1961 as John F. Kennedy's Secretary of State. Throughout the 1950s, the Foundation was a revolving door for government officials passing in and out of government service in the State Department or Treasury, or at the highest levels of the Executive Branch. The former chairman of the Foundation's Board of Trustees was John Foster Dulles, who left in 1951 to become President Dwight Eisenhower's Secretary of State.

In his testimony before Congress, Rusk made it clear that the Foundation "would never knowingly participate in or support un-American or subversive activity." Likewise, "no grant has ever been made by the Foundation to a recipient organization whose name appears on the Attorney General's list of subversives." But the boundaries between government policy and the Foundation's independence were not always easy to navigate. Rusk often traveled to Washington to receive private briefings from Dulles. But when Dulles's brother Allen, who was Director of the CIA, suggested that Rusk turn over the confidential field diaries of Foundation staff officers working around the world, Rusk, with the support of John D. Rockefeller 3rd, refused.

Over and over throughout the 1950s, trustee discussions related to program planning in agriculture eventually ended up involving the sticky politics of the Cold War. American diplomat Chester Bowles joined the Trustees in 1954, and subsequently attended a meeting with Rusk concerning the possibility of launching a rice research program in Asia. Rusk was excited about extending the Foundation's agricultural work to Asia, and to rice. Bowles had just completed a three-year assignment as ambassador to India, and argued forcefully that a new rice research institute should be placed in India for humanitarian and political reasons. In a letter written to Rusk on November 4, 1954, Bowles confessed: "Although I hope and believe that we would be taking such actions as this [establishing a rice research center] if all the Communists handed in their cards tomorrow, the fact remains that things we do can have a most positive effect in the political field." Bowles praised the work of the Ford Foundation in India for "maintaining a basis of respect and of understanding for America among thoughtful Indians, both in and out of government."

Solid arguments could have been made for locating a new rice research facility in either Japan or India based on the capacity of the scientific community in each country, but Bowles believed that political issues should be considered as well. "If these two nations remain outside of the Communist orbit over a period of years and develop their own indigenous strength and confidence, the odds are that the remainder of free Asia which lies between these two political poles will also remain outside of the bamboo curtain. On the other hand," Bowles continued, "if either India or Japan succumbs to Communism, democracy in Asia will have its back against the wall. I do not imply that this is a primary function of the Foundation, but I do feel that it should be considered on every major step that we take."

Partnerships in India

In conversations among trustees and senior staff at the Rockefeller Foundation, Bowles' arguments were influential and earned support from others in the organization. Rusk was an Asia expert. He understood the Cold War stakes of launching a program in India. But the difference between working in Mexico, Colombia, or Chile and working in India were enormous.

Until 1947, India had been a British colony. After independence the new government was built on a complex foundation of ancient monarchies, the remnants of British administrative boundaries, and religious divisions. Prime Minister Jawaharlal Nehru studiously navigated his country through the Cold War, refusing to take sides between the United States and the Soviet Union

while founding the Non-Aligned Movement with leaders of other developing countries. Nehru was a thorough modernist. He organized a centralized economy and poured investments into local industry and agriculture infrastructure. To combat the constant specter of famine, he introduced land redistribution policies, constructed dams and irrigation canals, and promoted the increased use of synthetic fertilizers. But even modern India remained a land of more than a thousand languages and dialects as well as myriad ecosystems, from the Himalayan Mountains in the north to the tropical forests of Madras and the rolling plains of the Punjab. Moreover, India's religions and castes were alien to American sensibilities.

The Rockefeller Foundation began cautiously. In 1956, after the government of India appealed for support, the Foundation helped to establish a cooperative program designed to focus on corn, sorghum, millet, and other cereal crops basic to solving the threat of widespread hunger and famine. The program was based at India's premier research center, the Indian Agricultural Research Institute in the suburbs of New Delhi, where it would be able to combine crop research projects with ongoing research and training activities at the school.

The first Foundation representatives sent to India were Ralph W. Cummings, a soil scientist from Cornell who had directed the experimental station at North Carolina State University, and Ulysses J. Grant, a plant breeder from Oklahoma who had earned his Ph.D. in agronomy from Cornell. Grant had also worked for five years as a geneticist in the Colombia program. Unlike George Harrar and his colleagues, who had entered Mexico with only a wealth of knowledge and the best of intentions, Cummings and Grant arrived in India knowing exactly what had been accomplished in Latin America and what they had to live up to. In India, however, culture shock and the scale of the challenge quickly tempered their idealism. "It would take ten years to begin from the beginning," Grant warned during his first visit in 1956, though he speculated that it might take only "an estimated three years to test an American hybrid."

Perhaps feeling the pressure of urgency, or the pressure to live up to the accomplishments of other programs, Grant and Cummings found themselves easily discouraged during the early days. The Americans and their Indian counterparts had to learn to work together. "Several times," Cummings wrote, "we have wondered if an operating program is going to be really practical under local circumstances." And yet, within a year, they had reason for "substantial optimism" that the program was moving forward.

The India project developed a new strategy. Instead of beginning with Indian seeds, the scientists solicited high-yielding seeds from other countries and adapted them to the Indian environment. They created an All India

The Rockefeller Foundation's Indian agriculture program had helped to boost wheat and rice yields dramatically by the mid-1960s. Indian Prime Minister Lal Bahadur Shastri was presented with a sheaf of grain by a village cultivator at a Field Day during celebrations at the Indian Agricultural Research Institute. (Rockefeller Archive Center.)

Coordinated Maize Improvement Program in 1957, and focused on corn. They drew heavily on the Mexican Agricultural Program for their work on wheat. They also developed an emphasis on rice. Since the end of World War II, the Foundation had been interested in rice research in Asia. It had supported India's efforts to establish the Central Rice Research Institute at Cuttack in 1948. There was a widespread recognition that food security in Asia was inextricably tied to improved production of rice.

Despite the slow start and the initial culture shock of Foundation staff, the India program had become a success by the 1960s. In 1961 the Foundation announced the "record breaking creation in four years of hybrid maize varieties adapted to all the major agricultural regions of India." In the 1964-1965 harvest, India produced 89 million tons of food grains, up from 51 million tons in 1950-1951. By 1971, food grain production reached about 110 million tons as a result of planting about 32 million acres with the new and improved varieties of wheat developed in Mexico as well as rice developed at the International Rice Research Institute in the Philippines. Foundation officials and policymakers in India saw these trends as very promising.

Voices of Caution

Despite the astounding successes of the agricultural programs in Latin America and Asia, cautionary voices emerged. As early as 1953, the trustees called on George Harrar to slow down, consider ecological consequences, examine alternative approaches, and be mindful of local culture in the rush to increase production. In 1957 the trustees formed a special committee to review the Foundation's program. Henry Allen Moe, president of the Simon Guggenheim Foundation and a Rockefeller trustee, chaired the committee. Moe visited the agricultural programs in Mexico, Guatemala, Colombia, and Chile. He talked to national and local leaders as well as Foundation field staff. He praised the "productive, smoothly-working teams of scientists, technicians and students" in each country and the "superb" leadership provided by Harrar and other program directors. But Moe also expressed concern that the staff focused too much on technological fixes related to insecticides, fungicides, soil management, and plant breeding. He believed that the emphasis on technology undermined morale and would eventually diminish the quality of the Foundation's field staff. To sustain the program's gains and retain good staff, Moe suggested that more attention be paid to basic research.

Rockefeller Foundation scientist Ulysses J. Grant (left) inspecting a farmer's field near Karimnagar, Andhra Prardesh, with Mr. M.S. Pawar (right) in 1957. After a rocky start, Grant and his colleague, Ralph Cummings, would help lead the Foundation's Indian agriculture program to significant success. (Rockefeller Archive Center.)

The trustee committee also noted that a "slower" approach might reduce the number of mistakes, and that critics of the Mexican program suggested that the Foundation and its partners pursued intensive corn production to the point of exhausting soil fertility. Basic research on tropical soils would take longer than developing hybrid seeds, but addressing the criticisms made it necessary. Similarly, the board called for more research regarding the nutritional quality of the new higher-yielding varieties of corn and beans developed by the Foundation's programs.

A humanist by training, Moe included a recommendation in the 1957 report that "RF agronomists should have ecologists, botanists, ethnobotanists, anthropologists, and the like to work alongside them for *depth* of understanding." Moe expressed concern, for example, that in Vera Cruz the Mexican Agricultural Program had bulldozed burial mounds rich with artifacts, to flatten large fields for cultivation. He suggested a program of visiting scholars to work with field staff in Latin America to promote "more understanding in depth, some widening of philosophy, some cross-fertilization between the practical and the impractical which warms the heart and inspires the head."

The trustee committee also called for closer integration of agricultural developments and public health. For children, especially, the trustees noted that the advantages of increased food supply could be completely undermined in places that lacked basic sanitation and public health facilities. "It would not take much money," the trustees suggested, "to plan ahead so that food supply and public health may come out with successes in balance."

The tone and content of the trustees' report was similar to the approach advocated by Governor Salvador Sánchez Colín in the State of Mexico in 1951. The Foundation had supported Sánchez Colín's "human ecology" approach for six years, investing $100,000, but the results of his experiment were never reported by the Foundation. In 1960, the integrated approach to community development couldn't gain traction with the scientists who ran the agriculture program.

It's not hard to understand. The results of the Rockefeller Foundation's focus on applied science and technology were spectacular. The harvests were large. Millions of lives had been saved. Nations that had suffered the threat of widespread famine were suddenly able to feed their citizens and trade surplus production on the international market. In this context, the Foundation focused instead on reaping even further benefits for humanity by increasing its investments in agricultural science and technology—especially if the effort could be expanded to promote international collaboration.

The Colombian Agricultural Program began in 1949 with Rockefeller Foundation funding. American scientists were trained in Mexico before traveling to Colombia to work with local agronomists and farmers. (J. Sarmiento. Rockefeller Archive Center.)

INTERNATIONALIZING RESEARCH

If any question remained about the long-term role of agriculture in the Rockefeller Foundation's portfolio—or its relationship to the other powerful programs in public health, medical education, and population science—the organization answered it in 1961 with J. George Harrar's appointment as president. Harrar had joined the Foundation in 1943 to run the nascent Mexican Agricultural Program, ramrodding it to stunning scientific breakthroughs and increased corn and wheat yields. His team proved themselves in both the laboratories and the fields. Harrar returned to New York in 1952 as deputy director of agriculture under Warren Weaver. He became director in 1955, vice president of the Foundation in 1959, under Dean Rusk, and president in 1961 when Rusk accepted John Kennedy's appointment to be Secretary of State. Harrar was the first staff person to ascend through the ranks of the Foundation to become president.

When Harrar arrived in Mexico in 1943, small farmers still planted their corn crop with long sticks, one seed at a time. In Asia, rice farmers were following traditions that had not changed in 4,000 years. Farming, the world over, was essentially a subsistence activity on a small scale, and many farmers lived perpetually on the edge of poverty. By the time Harrar retired in 1972, he had helped engineer a global revolution in agriculture tied to a network of international research institutes, national extension programs, and a fraternity of hundreds of well-trained agricultural scientists who shared the same scientific values and often the same field experiences.

Asian farmers shared seeds and research innovations with Latin American farmers half a world away. Scientists working on tropical agriculture in Colombia could see the consequences of their research played out in Africa or Asia. Agriculture became intensively capitalized and the markets global. Production was mechanized and dependent on synthetic fertilizers, pesticides developed in international laboratories, and government-sponsored irrigation systems. In the frantic race between harvest and famine, Harrar's program had kept pace, but it had not been easy or without controversy.

Harrar had been somewhat reluctant to move to New York in 1952. But leaving rural Mexico and his small band of brothers to take a leadership position within the Foundation allowed him to explore agriculture in a global context, and to consider the potential for extending the technical and organizational lessons of Mexico to other nations. What he discovered was an uncoordinated, inefficient, ecologically damaging, haphazard approach to local agricultural problems around the world—what he called "a disordered food supply" and "inadequately developed agricultural practices" that could not keep pace with the world's rapidly expanding human population.

J. George Harrar, first director of the Mexican Agricultural Program, served as the Rockefeller Foundation's president from 1961 until 1972. He started the Conquest of Hunger program in 1963. (Rockefeller Archive Center.)

His first instinct was to build agricultural innovation on local culture. "The upgrading of a primitive agricultural system is a complex process in which social, economic, and political factors play parts as important as the improvement of technology," he wrote in his first President's Review in 1961. "The problems that impede progress must be solved within the local environment and improvement must start where the people are. The challenge in areas where improvement projects are planned is to learn more about the environment and to fit reforms into it."

The work in Mexico had taught Harrar that focusing on local problems, training local scientists and technicians, and recognizing that agriculture was as much an "art" as a "science" together constituted the most effective

John D. Rockefeller 3rd (right) chaired the Rockefeller Foundation's board from 1952 to 1971 and was deeply concerned about the world's growing population. He founded the Population Council as a separate philanthropic entity in 1952, working to bring the issue of overpopulation to the global stage. During his travels abroad he frequently visited Rockefeller Foundation projects, including the Colombian Agricultural Program in 1964. (Rockefeller Archive Center.)

way to improve agriculture. His instincts tapped long traditions of interdisciplinary thinking within the Foundation. Yet Harrar soon saw that a nation-by-nation, region-by-region approach to agriculture development could not keep pace with population growth.

Successful public health campaigns, higher standards of living, and more food seemed to be speeding the rate of growth. The world population was 2.2 billion in 1940. A decade later it had risen by 300 million people to 2.5 billion. Harrar had spent most of that decade in Mexico. By 1960, when Harrar was working in New York, the world's population had jumped by 500 million people to 3 billion. Between 1960—when the lessons of Mexico made it clear that scientific agriculture held the potential to dramatically increase crop yields—and 1970, the global population increased by another 700 million. Former colonies saw the most rapid growth, as they grappled with developing the institutions of governance in their first years of independence.

The link between agricultural development and population had undergirded the Foundation's work for decades, but the rapid growth of the global population (an increase of 68 percent between 1940 and 1970) inspired a shift in thinking. For decades John D. Rockefeller 3rd had questioned whether the advances in public health supported by the Foundation had contributed to the rise in population. Now the success of the Mexican Agricultural Program raised similar concerns. In the mid-1960s no one believed that the Green Revolution could forestall famine in the poorest nations of the world. Natural scientists argued that growing populations would always be held in check by disease, famine, and environmental degradation. It was a basic law of ecology. In places like China, India, and Africa, the worst fears seemed to be coming true. Half the world's population lived in hunger every day. But, over time, what if civilization did conquer famine as it was conquering disease? Could the productivity gains of the Green Revolution keep up with the exploding populations that were a consequence of increased harvests? George Harrar joined a long list of philosophers—from Thomas Malthus and Benjamin Franklin to Adam Smith, Charles Darwin, and modern ecologists like Paul Ehrlich—who were concerned about the consequences of exponential population growth. Harrar wrote that the Green Revolution could "buy time" for humanity to address uncontrolled growth, but eventually, "all efforts to provide food and other material requirements adequate for man's life will fail unless the rate of world population increase can be significantly reduced."

Over a period of 20 years Harrar had come to realize that the pace of population growth narrowed the Foundation's options. The slow, patient, culturally sensitive approach the Foundation had taken in Mexico could not be duplicated on a global scale. "The mid-twentieth century finds more than half of the world's population living as precariously on the edge of hunger as did their ancestors," Harrar concluded in 1964. "Great strides toward the conquest of hunger cannot be made without parallel efforts to stabilize runaway populations, a goal which today is only barely foreseeable." The Foundation's president did not mean to suggest that developing and marketing high-yield seeds, following the protocols of industrial agriculture, and training agricultural scientists constituted the only solutions to the problem of food security. They were simply the best contributions that the Rockefeller Foundation could bring to the table. Governments and international agencies would also need to play a part, especially on

economic, infrastructure, and cultural issues. National laboratories, extension agencies, and experimental farms were also essential. "If substantial advances are to be made," Harrar suggested in 1964, "it is necessary for local governments to systematically plan and encourage the development of agriculture's essential substructure within their overall economies."

Throughout his years of leadership, Harrar tied the Foundation's agriculture program to the urgency of the population problem and the specter of famine. He focused the Foundation's energies on what it could do best: expand upon the lessons of Mexico and cultivate international scientific cooperation. Increasingly, the Foundation built this strategy on a network of international research centers and affiliated university training programs. It worked primarily through its Conquest of Hunger and University Development Programs, which were created with Harrar's reorganization in 1963. The Foundation assisted in creating the first of these new institutions to address improvements in the most important food crop in the world—rice.

International Rice Research Institute

While the Foundation had previously backed limited agriculture work in Asia, trustees and staff began to "take the South and Southeast Asian region more seriously" after communists came to power in China in 1949. Thus when the Philippines' Secretary of Agricultural and Natural Resources, P.L. Mapa, asked John D. Rockefeller 3rd to send Foundation officers to "look into conditions here in our country" in September 1950, the Foundation asked the advisory committee on agriculture to evaluate the situation. The committee concluded that there was a "special problem in the Philippines in regard to the relations of hunger and the appeal of communism."

The situation called for attention primarily from the U.S. government, which sponsored a Cornell University program at the University of the Philippines College of Agriculture in Los Baños. Though Cornell researchers had worked in the Philippines since its independence from Spain in 1898, U.S. government sponsorship began in 1952, when Cornell and Los Baños signed a contract for agriculture programming.

Initially, the Foundation's role was limited by the influx of funding and resources from these other entities, but its work complemented their efforts in subtle ways. It performed surveys and policy reviews, concluding that rice should be the major focus of agriculture in the Philippines, as well as the rest of Asia. Following its own advice, the Foundation pursued a policy

The International Rice Research Institute was established in 1960 with major support from the Rockefeller and Ford Foundations. Among other things, that core funding provided state-of-the-art buildings and experimental rice plots. (Rockefeller Archive Center.)

of "strengthening existing rice-research institutions" in basic research and professional development, which in the Philippines meant investment in the Cornell-Los Baños program. The focus remained on funding the agricultural school and extension service at the university until the Foundation began to contemplate the creation of a separate international rice research center in the late 1950s.

The Philippines was not the only place in which the Foundation pursued an interest in rice. It sponsored small rice-research projects all over the world in the 1950s, including in the United States and Latin America. But by 1959 these locally focused projects seemed insufficient. "In discussing the problems of rice production with agricultural leaders throughout the world, and especially in Asia," the annual report stated that year, "Foundation officers found that rice improvement is a question of real concern everywhere rice is grown." Officers agreed on the "desirability of an international effort directed toward increasing the supplies of this vital food." The Foundation concluded that an international research institution represented the "best method for meeting the urgent need for rice improvement."

Ideally, the center would be "dedicated to the study of the rice plant and of its improvement, protection, production, and utilization." It would also be located in Asia but be "international in scope from the outset," serving as a research, training, documentation, and dissemination center. The Foundation's trustees were acutely aware of the geopolitical implications of conducting rice research in Asia, and engaged in broad discussions about where a rice research institute should be located. Some trustees favored Japan. Chester Bowles favored India. Yet the Philippines offered notable advantages. The country had a 60-year history with the United States, and its university system was strong enough to support an international research initiative. In an insecure world, the Philippines offered political security.

One Foundation officer reported that he had conducted an informal poll of scientists from several Asian countries. Each scientist said that his first choice would be for the institute to be located in his own country, but, when forced to pick a second choice, most said the Philippines. Foundation decision makers came to agree with this consensus emerging among the nations of Southeast Asia. The Philippines, the Foundation concluded, offered an "excellent combination of advantageous factors."

In conducting their exploratory surveys with agricultural experts around the world, the Foundation's officers realized that the Ford Foundation was "similarly preoccupied with this urgent problem." The two foundations entered into a joint agreement to establish one large, central rice institute. As with the in-country operating programs, they began negotiations with the Philippines government only after the latter had extended a formal invitation in 1959. The government then furnished land for buildings and an experimental farm close to the College of Agriculture at the University of the Philippines at Los Baños. The new International Rice Research Institute (IRRI) established close ties with the College of Agriculture. Graduate students did their thesis research at IRRI, and the institute staff members who supervised the research were given the title of "visiting professor." The Philippines government also granted IRRI exemption from taxes and duties in "recognition of its scientific and humanitarian purpose."

The Ford Foundation geared its funding toward set-up costs and provided a large initial grant of nearly $7 million (roughly $55 million in 2012 dollars) for construction, furnishings, and equipment. The Rockefeller Foundation supported the operation and maintenance of the Institute, including appointing an officer as director in 1959. In addition to monetary support for IRRI's operation, the Foundation was involved in the mechanics of daily work, accepting responsibility for the conduct of research as well as recruiting personnel.

The Institute's governing body reflected diverse support. The board of trustees included representatives from the government of the Philippines, the Ford Foundation, the Rockefeller Foundation, and the University of the Philippines, as well as "leading figures in the field of agriculture from a number of the countries of Asia."

IRRI broke ground in 1960. By 1961 many staff, including several seconded by the Rockefeller Foundation, had arrived and begun their research. The center was formally dedicated in early 1962, and construction was completed in 1963. Its state-of-the-art facilities were spacious, including administration, laboratory, and service buildings, a library, dormitories for trainees, offices for visiting scientists, seminar rooms, an auditorium, dining rooms, and a lounge. Laboratories were in a single-story, air-conditioned building, with separate areas for such distinct fields of interest as plant breeding, genetics, agronomy, soil chemistry, plant pathology, and agricultural economics. Experimental facilities included paddies with an irrigation-drainage system as well as laboratory plant growth chambers that allowed scientists to "vary the length of daylight and the temperature of air and ground." Dormitories, a residential compound for staff, a nearby elementary school, a swimming pool, and tennis courts fulfilled the goal of making IRRI a "complete living community for the scientists who staff it" as well as their families, graduate students, and visiting scientists. The modern complex was designed to be a symbol of science and progress, but it was very different from the early days in Mexico when George Harrar put a premium on interacting with local farmers, placing the children of staff in local schools and integrating the scientists into local village life.

Rice occupied a place in Asia similar to that of corn in Latin America. It was *the* basic food crop. Just as the Mexico program had transferred its advances to other Latin American countries, the founders of IRRI hoped the institute could easily transfer rice discoveries to other Asian nations. Harrar outlined IRRI's goals in the 1960 President's Review, echoing the language he had used to describe the Mexico project in the 1940s. He said the new institute "is dedicated to basic and applied research on all aspects of rice improvement, protection, production, and utilization, and to training of young scientists who can bring their knowledge to bear on the solution of rice production problems in their own countries." Archiving and circulating findings were to be equally as broad in scope. IRRI staff, the President's Review continued, "will assemble a comprehensive collection of the world's literature on rice and disseminate research results to interested workers in all countries where rice is grown."

Staff, fellows, and even trustees were not just from the Philippines. They were recruited from many of the other rice-producing countries of

Parasites like the stem borer caused significant damage to rice crops. Searching for ways to control these pests, International Rice Research Institute scientists artificially infected a cut rice stem with a freshly hatched stem borer larva in 1966. (Rockefeller Archive Center.)

South and Southeast Asia, including Indonesia, Taiwan, Thailand, India, and Japan. The Rockefeller Foundation hoped that, owing to the international origins of IRRI staff, professional development could be stimulated by international scholars "who will carry new thoughts and new vigor to already existing programs on their return to their countries." The institute offered a masters of science as part of its professional development, in conjunction with the College of Agriculture at nearby University of the Philippines, which included one year of full-time work at the institute. IRRI also assisted cooperative research projects in other countries, including Japan, India, Vietnam, and Thailand, in order to determine whether results achieved in Los Baños could be replicated in different climates. These projects turned into sub-centers supported by IRRI, for which the Ford and Rockefeller Foundations financed the staffing.

In the mid-1960s, IRRI became focused on the development of an "ideal rice," which it described as "early ripening, disease- and pest-resistant, stiff-strawed to take fertilizer without lodging, high in protein, and suited to local culinary tastes." Researchers experimented with genetic crosses from the institute's extensive germ plasm bank, which by 1965 contained over 10,000 rice varieties. By 1966 Peter Jennings and Henry Beachell, two researchers seconded to IRRI by the Rockefeller Foundation, along with Te Tzu Chang, a geneticist from Taiwan, and S.K. De Datta, a young Indian agronomist, had collaboratively created and tested IR8, a variety of high-yielding, short, stiff-strawed rice. The scientists produced it by crossing a tall Indonesian tropical rice with a Taiwanese dwarf variety. This strain was close enough to the ideal rice to distribute seeds to interested governments, including that of the Philippines but also India, Pakistan, Thailand, and even Latin America, where farmers planted it widely. IR8 and similar semi-dwarfs famously produced increased yields, and were consequently dubbed "miracle rice" in the Philippines. Scientists later discovered that IR8 had the added benefit of being insensitive to photoperiod, or day length, and so could be grown in many latitudes, at any time of the year.

Also by the mid-1960s, IRRI entomologists had found an effective control for a major crop parasite, the devastating rice stem borer, and pathologists had attacked the deadly rice blast disease by working with plant breeders to create resistance in the new rice strains. Part of IRRI's work in the Philippines was the creation of an informal extension service, with the aim of bringing fertilizers and new farming techniques to local rice farmers along with the new seed varieties. IRRI trained scientists and technicians to teach extension workers on a regional basis, and conducted intensive training courses for rice researchers and Asian farmers.

The interrelationship of research and training, and their mutually far-reaching effect, undergirded IRRI's mission. "Envision a pool of water into which a pebble is tossed," a Foundation employee wrote of IRRI, describing a "concentration of agricultural scientists in various disciplines, devoting their efforts to increasing the production of rice." The pebble created circles in that figurative pool, he continued, symbolizing, first, the visitors and students who came to learn; second, the agricultural extension effort to train farmers in rice production; and third, the "community effect" tangibly affecting farmers, agribusiness, and government. Though IRRI's work was necessarily limited, its focus on human infrastructure of different varieties made its potential influence, like those many circles in the water, ever-widening.

In the decade after IRRI's establishment, the Rockefeller and Ford Foundations continued to devote major funding to its operation. The Rockefeller Foundation contributed over $8 million to the Institute's core budget in the first 12 years of operation, as well as nearly half a

million dollars for special projects. Though the Rockefeller Foundation alone funded IRRI's core budget for the first five years of operation (after the Ford Foundation funded the Institute's substantial start-up costs), the two foundations agreed to become equal partners after 1964. By the early 1970s, Ford contributed over $5 million to the core budget and another $3.5 million to special projects, including training, foreign travel for IRRI staff, symposia, cooperative research, and rice development programs such as those in Pakistan and Bangladesh.

Though there were additional smaller-scale contributors throughout the late 1960s and early 1970s, IRRI's funding base became more diversified in 1972. It received substantial annual contributions from subsidiary donors, including the United States Agency for International Development (USAID) and the Canadian International Development Agency (CIDA). The institute's work continued to pursue similar goals even with this shift in funding. For example, IRRI engineers focused on mechanization and irrigation systems in 1972, while agricultural economists defined the costs and returns involved in rice production. IRRI economists also assisted in the formulation of national policies to stimulate production in different Asian countries. Both the Rockefeller and Ford Foundations continued to support IRRI, and staff from one or the other of the two foundations chaired IRRI's board until 1982.

International Maize and Wheat Improvement Center (CIMMYT)

Unlike IRRI, which started from scratch in 1960, the International Maize and Wheat Improvement Center (CIMMYT) grew out of the solid foundation of the Mexican Agricultural Program. By 1963, when the center was established, scientists had already been working on the problem of corn and wheat yields for 20 years in Mexico. The Foundation enjoyed a strong relationship with the Mexican government. Scientists trained at MAP had dispersed throughout Latin America and Asia. Secondary programs had been established in Colombia and Chile. The Foundation had even sponsored international gatherings of scientists. It saw CIMMYT as the logical extension of work already being done.

The center was established in October 1963 through an agreement between the Mexican government and the Rockefeller Foundation. CIMMYT fell under the auspices of the Mexican Ministry of Agriculture until it became independent in 1966, after which it was operated under the supervision of an international board of trustees. It accepted funding from the Rockefeller Foundation, Ford Foundation, and other organizations.

CIMMYT focused primarily on basic research in the two crops. The Foundation considered it not only a way to perpetuate professional development, but also to disseminate scientific findings. "In essence," Foundation officials noted in 1964, "the center is an 'open door' through which Mexico can share its great advances in the improvement of maize and wheat production with other countries whose conditions and problems are similar." This included countries in the rest of Latin America as well as Asia and Africa, all of which requested and received improved seeds in the first years of the center's work. By 1969 the high-yielding disease-resistant wheat developed in Mexico was considered to be responsible for record harvests in India and Pakistan. Middle Eastern scientists were also well represented among those being trained at CIMMYT, which the Foundation attributed to "intensifying local efforts" in that region. As in the Philippines, Mexican efforts included extension work through the research center. The Puebla Project, for example, successfully brought techniques developed at CIMMYT to small farmers in the state of Puebla through demonstration plots.

Part of CIMMYT's professional development work relied on close cooperation with academic institutions. The graduate program at the National School of Agriculture in Chapingo became a center for post-graduate study, as did the Mexican National Institute of Agricultural Research. CIMMYT work reflected the already advanced nature of maize and wheat science due to the in-country operating program. However, unlike the original Mexican Agricultural Program, which focused on the country's internal needs, CIMMYT aimed to make new, universal discoveries that could be applied in or easily adapted to other nations.

By 1966 the center had developed six basic corn complexes from 250 Latin American strains and distributed them internationally. It had also developed local crosses with high-yielding Mexican wheat varieties from such disparate countries as Paraguay, Kenya, Afghanistan, and India. By 1969 the center had created corn that was insensitive to the length of daylight, making it adaptable to widely different ecological conditions. CIMMYT also developed new varieties of "triple dwarf" wheat that were short, high-yielding, and disease-resistant, as well as a species called triticale, created by crossing wheat and rye, which promised high yields, nutritional quality, and drought resistance. The Foundation built on its previous work by investigating the nutritional properties of wheat and corn, and adding other crops to its roster. A Foundation specialist, for example, headed the International Potato Improvement Project, based at CIMMYT, cooperating with Mexican, United States, and Middle Eastern schools and scientists.

Indeed, CIMMYT picked up where other agencies left off. The Office of Special Studies (OSS) had been the centerpiece of the in-country Mexico program started in 1943. As the Rockefeller Foundation decreased funding for OSS, which moved completely under the auspices of the Mexican government, the Foundation increased funding to the non-governmental CIMMYT. This represented a successful shift in policy, ensuring that the Foundation continued to promote research and educational capacity in Mexico while allowing the government to bear full responsibility for popular education and extension services. CIMMYT also furthered the Foundation's general policy goals by making the research that took place in Mexico more connected and relevant to the international agricultural science world. By training scientists from other countries at the maize and wheat center, and working with local plant varieties from around the world, the center furthered educational capacity and scientific knowledge for other developing countries.

The results of international cooperation were dramatic and swift. "A corn breeder in Nigeria who needs a genetic strain resistant to certain kinds of pests or diseases, a geneticist in India in need of a drought-resistant strain, or an Egyptian scientist looking for lines giving high yields under irrigation, can find these in Latin American germ plasm banks," the Foundation reported in 1965. In that year, seed shipments from Mexico alone went to 39 countries and 19 states in the U.S.

Despite the creation of two important international research institutes—and despite their record of success with rice, wheat, and corn—scientists could not outrun the specter of famine. Human populations were growing too fast. By 1965 India had suffered through several years of severe drought. Famine seemed imminent. George Harrar reported, "In 1965 the world as a whole had less to eat than the year before. World food production grew by one percent while the number of people increased by two percent. It is already too late for even the most vigorous programs to increase food production and lower birth rates to offset the food deficits that loom for 1970, and only far greater efforts than those presently under way in either area can affect the 1980 gap between numbers and nutrition."

In 1963, at the request of the Indian government, Harrar had dispatched Norman Borlaug from Mexico (where he had successfully developed high-yielding dwarf wheat) to India, in a desperate attempt to fight back against the impending famine. Borlaug had been frustrated at every turn by suspicious farmers and government bureaucracy. But the drought had grown so severe by 1965 that the Indian government relented and allowed Borlaug's project to proceed. In 1966, India imported 18,000 tons of seed wheat from Mexican farmers, the largest purchase in history at the time, and a half-ton of "miracle rice" from IRRI. By 1967 Indian farmers had turned that half-ton into enough seed to plant 250,000 acres of rice; and Borlaug's dwarf wheat, planted in irrigation fields, produced double and quadruple the harvest that traditional strains had produced. India backed away from the precipice. Farmers wanted more seed, and once the Indian government made the decision to import it, the dissemination moved rapidly. Farmers already grew the wheat varieties in Mexico and the rice varieties in the Philippines, so large quantities could be purchased, treated as seed, and shipped to India. The Rockefeller Foundation had already helped to establish the National Seeds Corporation in India to facilitate the dissemination of new corn varieties, and it had the capacity and know-how to do the same for wheat and rice. And because these were true-breeding varieties, farmers themselves saved and traded seed varieties for further planting.

In 1967 Turkey purchased 22,000 tons of wheat seed from CIMMYT. Pakistan imported seed from Mexico. Yields doubled and tripled from previous averages. Kenya's national corn production program moved from deficit to surplus with the help of high-yield varieties from CIMMYT. Also in 1967 the Philippines achieved self-sufficiency in rice for the first time in many decades, and Pakistan followed close behind. "The hoped-for catalytic and multiplier effects of early Foundation contributions are now occurring in many nations in many ways," Harrar reported in 1968.

The turnaround had been so swift and so widespread that Borlaug became an international scientific celebrity, known as "the man who saved a billion lives." In 1970 he won the Nobel Peace Prize for his contribution of high-yield wheat to the war against famine.

Responding to Green Revolution Issues

It was hard to second-guess success. The threat of a population explosion and famine had forced the Foundation to narrow the scope of its agricultural work, to focus intensely on increasing yield and production rather than sustainability or environmental degradation. There had been winners and losers, however. Some farmers made more profits and expanded. Some found themselves excluded from the new agricultural economy. The global food system became even more dependent on a perilously small number of commodity crops. Myriad traditional crops that added nutrition and diversity to the diet had been left behind, or not increased at fast enough rates to keep pace with growing populations. But the infrastructure of international research and cooperation that the Rockefeller Foundation

had created was working. Having found success at what it did best, the Foundation kept doing it.

In 1967 Harrar realized that the innovations of the so-called "green revolution" were not boundless. They bought time for long-term planning, but there was a limit to the ability of wealthy nations to create agricultural surpluses that could be shipped to poor nations. High-yield seeds needed expensive fertilizers and pesticides. They required irrigation infrastructure. Farms could not be tied to markets without roads and railroads. The emerging nations of the world would have to develop sustainable systems to feed themselves.

Harrar offered a three-point program. He took as his first principle that governments, scientists, and farmers needed to think about agriculture as an industry, supporting agricultural development in the same way they supported industrial development. High-yield seeds were important, but his second principle emphasized the need for scientists to improve the nutritional quality of crops. His third principle focused on finding ways to expand agriculture into the tropics and arid lands. Since 1964 the Foundation had supported the Arid-Lands Research Institute at the University of California, Riverside. The program became a successful post-graduate training center for international students from arid nations, but research results came slowly. In 1967 the Foundation made a decision to establish two new international institutes for the study of tropical agriculture in Latin America and Africa.

Tropical Agriculture

Work on the International Center for Tropical Agriculture (CIAT) began in 1967 near Cali, Colombia. Like the other research institutes, it was established in cooperation with the government of Colombia, but it functioned autonomously, governed by an international board of trustees. The W.K. Kellogg Foundation joined the Ford and Rockefeller Foundations in funding the new center. CIAT devoted its program to research on the improvement of tropical agriculture with the "hope of developing ways to exploit the vast unused tracts of land in the lowland tropics of this hemisphere for increased food production," including rice, corn, grains legumes, and root crops. A parallel focus was livestock, with the aim of increasing beef and swine production through research on grassland and forage improvement, animal health, nutrition, management, and herd improvement. The center aimed to serve as a training base for people from other areas of the world interested in tropical agriculture, with a special focus on cooperative research and information exchange in Latin America.

The International Institute of Tropical Agriculture (IITA) also began development in 1967 as a result of a joint effort by the Ford and Rockefeller Foundations. It was located in Ibadan, Nigeria. IITA leased land from the Nigerian government, and then, with the government's cooperation, built the Institute. More than $14 million (over $80 million in 2012 dollars) from the Ford Foundation supported construction costs. Then Ford and Rockefeller shared the cost of paying for annual operating expenses. Like CIAT, IITA concerned itself with agricultural research and training in the tropics. This included a rice research and production program for West Africa as well as an additional concentration on grain legumes, root crops, corn, and a germplasm bank for important tropical food crops. When it was up and running, the institute housed researchers who worked in plant breeding, agronomy, soil science,

Norman Borlaug (left) visited Pakistan in March 1968 with Elvin Stakman (third from left). Wheat research in Mexico led to the introduction of new high-yielding seeds in countries like India, Turkey, and Pakistan, where rapid population growth threatened to lead to famine in the 1960s. (Rockefeller Archive Center.)

Lessons at the International Center for Tropical Agriculture (CIAT) near Cali, Colombia, included horticulture. The Center was formally established in 1967 with support provided by the W.K. Kellogg, Ford, and Rockefeller Foundations. (Neil MacLellan. Rockefeller Archive Center.)

plant pathology, entomology, and nematology. Its long-term objectives included promoting high-yield farming systems and new methods of managing soils, weeds, pests, and diseases. The Rockefeller Foundation intended the Institute to be a "hub for cooperative research" for all interested nations in its region.

By the late 1960s, the Rockefeller Foundation found itself tied to four major international research centers and a revolutionary new ideology of farming. "Much of the future success of efforts in agricultural improvement will depend upon the degree to which international centers can continue and expand cooperation with strengthened national institutions," Harrar wrote in 1969. "Throughout the world traditional or subsistence agriculture can and must be replaced by a highly productive, market-oriented system."

Over the next several decades, this model would be replicated in 16 other international centers, and funding would come from a variety of foundations, governments, and quasi-governmental international organizations.

Conferences: Sharing & Institutionalizing

Though the Rockefeller Foundation aimed to form a collaborative international network through the research institutes, this result did not spring organically from the institutes' creation. As it sought to more actively promote shared and standardized agricultural science in its quest to raise food crop productivity, the Foundation sponsored three basic types of conferences: those held in the research centers, topical symposiums, and those promoting the permanent networks that would be created in the early 1970s.

The first of these conference types was presented by the institute itself, on its own site. Many of the institutes contained conference facilities to reinforce the idea that international collaboration formed an essential part of their mandate. They had a responsibility to promote formal meetings to bridge institutional divides. IRRI, for example, provided meeting facilities for this purpose from its inception in 1960. It convened "international symposia to bring working scientists together for a thorough review of research in a given specialty," such as rice blast disease or agricultural engineering problems. The Rockefeller Foundation saw these conferences as a chance to share findings, but also an opportunity for scientists from all over the world to network, to "meet face to face and discuss, across the conference table and informally, their professional activities, concerns, and problems." CIMMYT likewise held two international conferences in 1970, with the goal of bringing together leaders of agricultural and economic development to consider how strategies utilized in small farmer demonstration projects might be adapted to other areas.

The second of these conference types, topical symposiums, began in the late 1960s, when there existed enough institutes to form a network and when international agriculture work had expanded to include other non-governmental autonomous entities and philanthropic organizations, as well as governments and even agribusinesses. In the spring of 1968, the Foundation hosted its first agriculture symposium, "Strategy for the Conquest of Hunger," at Rockefeller University. Three hundred United States educators, government officials, businessmen, and editors attended, while Rockefeller Foundation officers and a dozen leaders from developing nations addressed the symposium. The proceedings were published to further the goal of open collaboration. Harrar observed that "all were convinced that if governments, national planners, and investors pay proper attention to the modernization of agriculture in the developing countries, it will be possible during the next few years to meet growing food needs." He summarized that the "consensus of the speakers was one of cautious but justifiable optimism."

The third conference type expanded the concept of a topical symposium to encompass a more permanent and widespread international network. It began in April 1969 when the Foundation hosted a gathering at its Bellagio Study and Conference Center in Italy. Fifteen national and international assistance agencies were represented, including the World Bank, the

Asian Development Bank, the Food and Agriculture Organization of the United Nations, the United Nations Development Program, the Inter-American Development Bank, the Economic Commission for Africa, the United States Agency for International Development, the Ford Foundation, and several bilateral donors. During the three-day conference, the representatives discussed the means and methods required to increase agricultural productivity to support the growing world population in the decades to come. Participants focused on the human as well as institutional infrastructure necessary to support a continual increase in worldwide crop yield.

Over the next few years, representatives of this so-called Bellagio group met three times to review their goals and set policy to achieve them. They focused primarily on technology, having agreed that, based on special reports, "with the exception of rice in the lowland tropics and spring-type bread wheat, the world's agricultural technology is extremely weak." They concluded that there was no institutional infrastructure for comprehensive assistance with many other basic food crops—including sorghum, millets, potatoes, yams, beans, peanuts, legumes, and tropical vegetables or fruits—or any of several tropical animal species. Thus the Bellagio group recommended new international efforts to study these plants,

With funding from the Rockefeller and Ford Foundations, construction began on the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, in 1967. (Rockefeller Archive Center.)

as well as upland crops suited for dry areas in Asia and Africa. The group also called for new efforts to evaluate agricultural policies and water management strategies. Additionally, the representatives recommended that the four Rockefeller Foundation institutes then in existence (IRRI, CIMMYT, CIAT, and IITA) be provided with "necessary continuing support by the international community of donors."

The cornerstone of this final recommendation was not substantive, but structural. The Bellagio group suggested formation of a more permanent body of donor agencies. The Consultative Group on International Agricultural Research (CGIAR) was thus established in 1971 under the co-sponsorship of the World Bank, the United Nations Food and Agriculture Organization (FAO), and the United Nations Development Program (UNDP). It consisted of 28 organizations with a "declared interest in helping to stimulate the agricultural sectors of the developing world." These included the four international research institutes launched with Rockefeller Foundation funding, as well as new ones in Peru, India, and Kenya. Governmental and international organizations continued to participate as well, all informally associated as part of the network. They met twice a year to set the forthcoming agenda and pledge funds for the work of the international agricultural research centers.

The Rockefeller Foundation greatly valued the creation of CGIAR, seeing it as a milestone and an achievement in itself. The "coming together of nations, lending agencies, and foundations toward the support of international agriculture," it stated, "is an event of great meaning to the Rockefeller Foundation." Whereas in 1943 the Foundation was one of very few organizations working internationally to improve crop yield, in 1971 the "world's great development agencies have joined in the recognition that without a thriving agricultural sector the world cannot meet even the minimal expectations of hundreds of millions of its people." Truly worthy of this initial excitement, the CGIAR continued to thrive. By the late 1990s it served as the focal point for contributions from 39 international donors to support the international research centers.

Investing in Human Capital

In addition to the financial support they received from the Rockefeller Foundation and other donors, the agricultural research centers were also infused with human capital. Agricultural scientists trained in universities supported by the Foundation's University Development Program, or who benefited from Conquest of Hunger scholarships and post-doctoral fellowships, became deeply involved in research and the transmission of agricultural science from the laboratory to the field. These scientists were meant to be the recipients of educational aid, but also to form a new international scientific network, often returning to their home countries to staff universities or staying on in the institutes to teach and conduct further research.

The educational component of agriculture work preceded the international institutes and conferences, with many in-country universities funded as a lead-up to the more hands-on infrastructure that the institutes embodied. By 1963, when the institute system was just starting, the Foundation had already assisted in the creation of graduate schools of agriculture in Mexico, Peru, India, and the Philippines, in order to "help meet the need for greater numbers of well-qualified agricultural specialists to man programs of accelerated development." The Foundation continued funding to these countries through the 1960s, in tandem with institute development, expanding its support to agricultural colleges in Uganda and Kenya, both attached to the University of East Africa. By 1970 the Foundation also supported universities in Colombia and Nigeria that were attached to CIAT and IITA, respectively. And the Foundation created scholarships to aid in this professional development, awarding 544 grants in the agricultural sciences from 1963 to 1968, all in "fields

Richard Bradfield (left), Paul Mangelsdorf (center), and Elvin Stakman (right) attended the Rockefeller Foundation's Conquest of Hunger conference in 1968, nearly 30 years after their original trip to Mexico to survey agricultural conditions. (Ted Spiegel. Rockefeller Archive Center.)

important to the conquest of hunger and all to persons who hold essential positions in key institutions." Though education aid included some funding of facilities, it ultimately focused on people. It "takes ten years for a recently graduated Ph.D. to become a full-fledged scholar and educator," the Foundation acknowledged in 1969, but, still, "men are more important than dollars."

Education and agricultural development were connected through the demand for expanding human infrastructure in emerging nations. The Foundation stated in 1966 that its "efforts to strengthen educational and research institutions within the developing countries and scholarship programs" were both "designed to increase scientific competence." The Foundation fundamentally linked this goal to the planned withdrawal of its own involvement through the cultivation of self-sustaining local capacity. The "most effective aid," it stated, "is that which develops leadership within the nations themselves and enables them to assume responsibility for their own agricultural and economic development."

The Benefits of Internationalized Agriculture

The development of international research centers in the 1960s was intended to complement national research facilities. As the Rockefeller Foundation pointed out in 1968, the "total technological needs are so vast, and requirements often so localized, that only through establishment of strong national production-oriented research programs, backed up by international centers, can adequate progress be made."

Indeed, the Foundation's turn to a more multilateral approach did not suggest a desire to abandon local efforts, but rather to find new ways to promote and transfer agricultural science. The institute model also reduced the need for diplomatic skills, since the institutes were less likely to be challenged by political forces. Even if nations turned to communism or fell victim to social unrest, the international human network of trained agricultural scientists would still exist. The downside to these efforts, however, was the increased isolation of scientists from the communities and countries they sought to help. By the late 1960s, concerns first raised by the Foundation's own board of trustees were increasingly echoed by people and organizations preoccupied with the social and environmental consequences of the Foundation's agricultural work. In the 1970s, the Foundation would take fundamental steps to address these misgivings.

Honoring Innovators, Past and Present

From Seaman Knapp to Norman Borlaug, the Rockefeller Foundation has a long history of backing innovators in agriculture. In 2012 the Foundation teamed up with the World Food Prize Foundation to offer the Norman Borlaug Award for Field Research and Application. With a one million dollar endowment provided by the Rockefeller Foundation, the annual award recognizes a young extension worker, research scientist, development professional, or other individual who best emulates the dedication, perseverance, and innovation demonstrated by Norman Borlaug.

With the creation of this award, the Rockefeller Foundation sought to recognize men and women under the age of 40 who are working closely and directly in the field or at the production or processing level with farmers, animal herders, fishers, or others in rural communities. It also wanted to honor the personal characteristics evidenced by Borlaug and other Foundation scientists in the Conquest of Hunger program including determination, persistence, and courage in the fight to eliminate global hunger and poverty.

In 2012 Dr. Aditi Mukherji, who was a senior researcher with the International Water Management Institute in New Delhi, became the first recipient of this prestigious award. Her work on groundwater led to changes in policy that helped thousands of farmers in West Bengal.

TAKING STOCK

Despite tremendous increases in agricultural production in the 1960s and the prevention of mass starvation in many critical regions, the world food crisis persisted. Crop failures in 1972 and 1974 caused world cereal and other food prices to skyrocket. Inflated prices for fertilizer and increasing demands for water and irrigation systems compounded a growing concern over food security. In 1972 the Foundation realized that per capita food supply had remained basically flat because population growth since 1962 had been keeping pace with the increase in food supply. In fact, in the two decades between 1955 and 1975, despite the successes of the Green Revolution, a substantial number of nations actually moved from food surpluses to deficits.

The outlook seemed bleak. Some social scientists predicted that the world population of four billion in 1975 would increase by 25 percent by 1990, and could reach eight billion by the turn of the century. Even Mexico, the birthplace of the Green Revolution, was once again an importer of basic food commodities by the late 1960s.

The issues in Mexico reflected concerns that would be expressed elsewhere. By the early 1970s it was clear that the benefits of increased agricultural production in Mexico were not broadly distributed. Large, commercial farmers reaped greater rewards than smaller, subsistence farmers. Domestic politics had factored heavily in the outcome, rather than any general increase in efficiency and productivity. In some cases, the Green Revolution had contributed to increased social stratification that led to widespread activism, unrest, and persistent rural poverty.

George Harrar acknowledged these concerns in 1969. "Large-scale programs designed to remedy massive national food deficits are necessarily geared to the farmer who can afford some investment in seed, fertilizer, and machinery," he conceded. As a result, "Many of the great advances in agriculture have bypassed the small farmer." The Foundation found itself in a position where it could control technological innovation but could not control local political and social factors that were just as critical in the success of agricultural development. Harrar encouraged efforts to reach out to and convert farmers from their "traditional methods," but he was not as forceful when it came to addressing the social and environmental consequences of the technological revolution.

Some critics of the Green Revolution pointed out that most high-yielding seed varieties need chemical fertilizer and pesticides for increased yield, which promotes widespread petro-dependent farming. This dependency fed a cycle of decline, as reliance on chemical fertilizers depleted natural soil fertility while pesticides generated resistant insects, creating a need for even more fertilizers and pesticides. Indeed, the Foundation reported in 1974 that worldwide consumption of chemical fertilizers had already tripled since 1960.

Meanwhile, intensive agriculture often depended on irrigation. As the demand for water increased, environmentalists raised concerns regarding water supplies. The extensive conversion of natural areas to cropland and the repeated planting of similar varieties of high-yielding food crops in certain areas also undercut the benefits of local biodiversity. "By eliminating the great number of genetically different types of wheat and rice," one critic stated in 1970, "and replacing them with substantially the same variety, there is a loss of variability from which to select resistance to new and still unknown diseases."

Some experts in agricultural development began to turn away from the core premises of the Green Revolution's narrow focus on increasing agricultural productivity. As the World Bank would later report, "rapid increase in food production does not necessarily result in food security—that is, less hunger."

Upon assuming the presidency of the Rockefeller Foundation, John Knowles (center) restructured the agriculture program to focus on second-generation problems of the Green Revolution, building on the work of past presidents Dean Rusk (right) and J. George Harrar (left). (Rockefeller Archive Center.)

Though this was a period of criticism and reconsideration, the Rockefeller Foundation did not reject the major assumptions supporting its agriculture initiatives, such as the central role of the agricultural scientist and the role of technology in improving seeds, fertilizer, pest control, and irrigation. If the focus on yield had proved too narrow, what else could be brought to the strategy to promote lasting food security? In the 1970s, the Foundation embarked on a serious study and reorientation of its Conquest of Hunger program.

New Leadership and the Green Revolution

By the end of his tenure, Harrar was well aware of the mounting criticism. "Professional interest in, and press coverage of, the Green Revolution," he stated in 1970, was "keen and world wide." Though "some discern a new age of plenty," he said, to others "the Green Revolution appears to be fraught with potential dangers." Harrar suggested that some of the criticism came from people who simply resisted change. "Fundamental changes evoke fundamental fears," he said, and "such change often leaves behind those whose vested interests lie in the more traditional approaches and in analyses supporting the status quo." In 1971, his last year as president, Harrar conceded that "some observers" worried that the Green Revolution in many developing countries was "making the rich richer and the poor poorer, accelerating the migration of the rural poor to already overcrowded cities, aggravating problems of under-employment and unemployment, and presenting new threats to the environment." Still, as the father of the Green Revolution, it was very hard for him to undertake a fundamental reassessment.

John Hilton Knowles succeeded Harrar as president of the Rockefeller Foundation in 1972. A medical doctor by training, Knowles gained his administrative experience as the youngest-ever director of Massachusetts General Hospital. Soon after assuming his post at the Foundation, he undertook an intensive effort to evaluate all of the existing programs. In the course of this analysis, he took criticisms of the Green Revolution seriously.

Despite the upheaval of the late 1960s, Knowles believed that philanthropy could still be relevant and useful if it responded to the changing social context. His evaluation process aimed to provide the "wit and intellectual capacity" the Foundation would need to "maintain the richness of pluralism and heterodoxy which has strengthened our national life" and contributed to "social melioration." He started the process in December 1972 by appointing a program committee of trustees to conduct the first formal review of the overall program and policies of the Foundation since 1958.

As the review process moved forward, the trustees were forced to consider the effects of worldwide economic inflation and the declining asset values of the Foundation's investment portfolio. Steep drops in stock prices had contributed to a 52-percent decline in the constant-dollar value of the Foundation's endowment between 1964 and 1974. Meanwhile, double-digit inflation contributed to what Knowles called an "erosion of money power," so that even as the Foundation experienced a sharp decrease in its income and assets, it had to spend more on each individual grant or program to be effective. Knowles also believed that an explosion of specialized knowledge in the social sciences and development theory had created an "absolute increased cost of solving complex problems."

Even as these changes began to affect the Foundation and its work, changes in the institutional landscape of development suggested the need to reevaluate the Foundation's role. In the postwar context, new international organizations like the United Nations, the World Bank, and the International Monetary Fund, combined with foreign aid offered by the United States and other nations in the developed world, created an increasingly complex environment for work in global agriculture, health, and development. As Knowles pointed out, governments, nonprofits, and international organizations offered "huge sources of money available to work toward solutions of the nation's and the world's problems," that had not been available only 20 years before.

The combination of these changes in finances and roles suggested to Knowles that the Rockefeller Foundation needed to fundamentally restructure its approach. Rather than operate field programs with hundreds of employees in a few select nations or research centers, the Foundation should become a broker of ideas and a catalyst for change. "We must," he stated, "place more emphasis on our ability to influence policy and the allocation of resources" and "focus increased attention on leadership development." This new vision would heavily influence priorities in all of the Foundation's programs, especially in the Conquest of Hunger.

A Shift in Focus for the Conquest of Hunger

By 1971 the Conquest of Hunger program accounted for about 20 percent of the Foundation's grantmaking and programmatic spending. This included continued funding of in-country operating programs, international research institutes, conferences, and agricultural education. However, as a result of Knowles's policy evaluation, the Rockefeller Foundation shifted its focus to "second-generation" problems of the Green Revolution, including food distribution, nutrition, rural population

displacement to cities, employment and income distribution, and the "plight of the small farmer."

With this shift in focus came a change in strategy that reflected many of the concerns expressed by the trustees as early as 1957. The Foundation placed greater emphasis on interdisciplinary teams that included population experts, economists, and public health officers. One aim of this interdisciplinary strategy was to address multiple concerns through Conquest of Hunger while avoiding the overextension of commitments that led to unfocused and ineffective programs—a predicament that Knowles, echoing John D. Rockefeller's chief advisor Frederick Gates, called "scatteration." By working on well-defined projects with teams of experts, the Foundation could address multiple layers of second-generation concerns without spreading itself too thin. Interdisciplinary program evaluation would likewise more accurately reflect the problem itself, doing justice to its complex nature. "Increasing food production," Knowles wrote, "is, of course, a technical and scientific issue, but it is also an economic, medical, political, ethical (or value), and behavioral problem." It thus required teams of

While the Rockefeller Foundation worked to develop new varieties of maize in Guatemala and other Latin American countries, the Foundation and its partners also collected seeds for a germplasm bank of native and pioneer maize material for research and to prevent genetic erosion through monocropping. By the early 1970s, this collection formed the basis for an international bank of genetic material. (W. Wickham. Rockefeller Archive Center.)

experts, such as "the economist, the humanist, the political scientist, the demographer, the public health expert, and the cultural anthropologist, in addition to those of the plant breeder," all of whom could be organized into a focused attack on a big problem.

In one sense, this interdisciplinary approach was not new. It had been a core value of Conquest of Hunger since George Harrar created the program in the early 1960s. But the slow, integrated "human ecology" approach had always been in conflict with the urgency of the global food crisis and the rapid growth of populations. In the early 1970s, however, the Foundation moved towards institutionalizing interdisciplinary values within its working procedures.

Specifically, Knowles attempted to build interdisciplinary evaluation into program review and policy development. As Vice President Sterling Wortman noted in a memo to Knowles, the Foundation was moving into an era in which it hoped to "concentrate on finding those strategies and systems for major problems by which knowledge and action can be combined to accelerate human progress." Understanding systems was critical to this effort. "With regard to national agricultural research or national agricultural development, health care delivery or education for development," Wortman continued, "we are dealing with systems and it is these systems with which scientists have not developed much capability of handling."

Sterling Wortman played a key role in many of the Rockefeller Foundation's agricultural initiatives. He served as president of the International Agricultural Development Service (IADS) in the 1970s and helped run several of the agricultural institutes created by the Foundation. Director of the Agricultural Sciences Division from 1966 to 1970, he became vice president in 1970 and served as acting president in 1979, following the death of John Knowles. (Rockefeller Archive Center.)

Addressing problems from a systems perspective demanded cooperation and collaboration. Through its efforts to develop international agricultural institutions, and through much of its history, the Rockefeller Foundation, as Wortman pointed out, "has learned that one of the *unique* ways it can be helpful in the world is to facilitate means by which institutions and individuals of diverse expertise can be enabled to work in concert toward goals which they all have in common." In an inflationary era, when the income from the Foundation's endowment did not go as far as it had in the past, this kind of leadership required fewer dollars but could still be powerfully effective.

Over the next few years, rural development projects that reflected this way of thinking—such as those planned for Brazil and Thailand in 1973—embodied this more integrated approach to development.

Innovation, Collaboration, and Sustainability

In 1975 the Foundation took the leap toward implementing this approach by funding the establishment of the International Agricultural Development Service (IADS). The autonomous nonprofit organization was designed to function as a contracting agency rather than a funding or granting agency, providing consulting expertise in agriculture and rural development. The goal was to link low-income, food-deficit nations with existing technology as well as assistance from international institutes. IADS also provided assistance with financing projects through major international banking agencies, including the World Bank, Inter-American Development Bank, USAID, and various U.N. agencies.

The new organization worked to "improve cooperation between donor agencies and country needs for more effective contributions to alleviating the world's food problems." IADS specialized in working directly with developing nations to establish long-range cooperative production programs, agricultural research, education, or development efforts that were production-oriented. Teams of experts were created to ensure that new knowledge gained from research flowed to farmers and national agricultural programs.

By 1976 IADS had contracts with the governments of Nepal, Indonesia, Sudan, Ecuador, Brazil, Bangladesh, Botswana, and several other countries. The Foundation contributed almost $8 million to IADS's operational costs over the next decade, emphasizing long-term self-sufficiency. The Foundation described its goal in funding the agency as simply to "help countries design programs they themselves can carry out."

As the Foundation tackled the "second-generation" problems of the Green Revolution, it also sought to address concerns related to fragile environments and marginal lands. In 1978 the Foundation began exploring opportunities to contribute to "rational utilization" of land areas that were either mismanaged or underutilized, mostly in the rain forests, semiarid regions, and deforested hillsides of the tropics. "Millions of hectares of land," it stated, "remain totally unused or have been degraded by increasing intensity of primitive slash-and-burn agriculture or by inappropriate efforts to introduce mechanized agriculture."

This was a massive amount of land, especially in proportion to that being used for agriculture. Though much of it had been considered

The Rockefeller Foundation sent Ben Jackson (left) to Bangkok in 1966 to advise the staff of the Thai Department of Agriculture's rice-breeding program. Jackson worked with other agricultural scientists to achieve a major breakthrough in developing high-yielding varieties of "floating rice," which could add six inches of stalk a day during flood conditions and survive in fifteen feet of water. (Rockefeller Archive Center.)

nonproductive, the Foundation sought to develop "ecologically stable, energy-efficient systems for small farm agriculture" that would extend agriculture to these areas. It saw improved water resource management, use of both old and new crop species to stabilize soil, and use of livestock as tools at its disposal to achieve this goal. The Foundation took small steps in 1978 by supporting a study of deforestation in the tropics and sponsoring a national conference on range management in the American West as well as a demonstration and training program on the utilization of arid lands for grazing and livestock production.

As part of its effort to strengthen the Conquest of Hunger program, the Rockefeller Foundation began work on food policy and development. The Conquest of Hunger staff cooperated with the International Relations Division to support work on food and agricultural policy having "specific reference to production, distribution, and nutrition in the developing countries." These efforts included funding the establishment of the International Food Policy Research Institute within CGIAR (the Consultative Group on

The Rockefeller Foundation convened an Agricultural Sciences Seminar at Williamsburg, Virginia, in 1979. The meeting brought together the old guard and a new generation of agricultural scientists, including J. George Harrar (front left), Ralph Richardson (center), as well as Gary Toenniessen (front right), who would rise through the ranks to lead the Foundation's agricultural initiatives. (Thomas Williams. Rockefeller Archive Center.)

International Agricultural Research) along with selected food and agriculture policy studies in regions where "new technology or organizational innovation in input delivery and education is aimed specifically at providing better opportunities for the small farmer."

In 1979 the Foundation officially established a food and agricultural policy component of Conquest of Hunger to address food deficit problems at the policy-making level. The program hoped to address barriers to agricultural production and improved nutrition that could only be removed through government policy, such as poor transportation, weak extension services, and unfavorable agricultural credit.

Taking on these new issues did not completely eliminate the traditional Conquest of Hunger approach. The Foundation continued to value international agricultural research, strengthening and expanding the network of international agricultural research centers that had become its focus under George Harrar in the 1960s. By 1979 more than 570 scientists and a support staff of 7,000 worked in 11 centers all over the world, while the Consultative Group on International Agricultural Research (CGIAR) provided over $100 million to the institutes. One of the new institutes that took on different research subject matter was the International Laboratory for Research on Animal Diseases (ILRAD), established in 1973 in Kabete, Kenya, near Nairobi. The lab was created by an agreement between CGIAR and the Kenyan government.

The Foundation also supported numerous smaller research projects that aimed to "provide the tools for scientists and farmers to further enhance yields and to reduce production risks." The Foundation believed that pioneering research was essential for food security, and saw innovation as a key quality in the projects it funded. Research areas of emphasis in the late 1970s included legumes, hemoparasitic animal diseases, aquatic species, and new dimensions of plant-breeding, physiology, and disease resistance.

As part of its effort to bring leaders together to solve problems related to agriculture and food security, the Foundation continued to play a key role as convener. One such meeting in 1973 in New York focused on "Socio-Economic Aspects of Food Production and Distribution in Less Developed Countries." Conferences like these emphasized interdisciplinary research and the relationship between agricultural science and socioeconomic analysis.

The Foundation also continued to invest in human capital to promote innovation in agriculture. It spent about $1 million per year on fellowships related to agricultural sciences in the ten years following 1972. These fellowships focused primarily on plant science, agronomy, animal science, entomology, pathology, and genetics. In keeping with its interdisciplinary approach, the Foundation funded additional awards for work related to social sciences and human resources in the areas of economics, food policy, rural development, communications, and sociological/anthropological studies. "Investment in human capital," a Conquest of Hunger internal review stated in 1982, "is vital to the development process and preferable in the long term to providing foreign experts."

By the 1980s the lessons of the second generation of the Green Revolution were already becoming clear, and they would have come as no surprise to Wickliffe Rose, Raymond Fosdick, or other early leaders of the Rockefeller Foundation. Innovations in technology that increased agricultural yields were much easier to achieve than the fundamental changes in society needed to ensure that the benefits of greater agricultural production reached the poor and vulnerable in the world's developing nations. An integrated, systemic approach to change was required, and the Foundation did not turn away from what it had always been good at: promoting science-based innovations to improve the quality of life for millions of people. Building on its profound influence in the field of molecular biology, the Foundation would place even greater emphasis on science in the 1980s to lead a new wave of agricultural innovation based on biotechnology.

The Rockefeller Foundation continued to invest in international agricultural research institutes in the 1970s. Funding provided to The Consultative Group on International Agricultural Research (CGIAR) helped launch the International Laboratory for Research on Animal Diseases (ILRAD) in Kenya in 1973. Staff members included Dr. Dick Cook (left) and Clinical Assistant George Ngekenya (right). (Marion Kaplan. Rockefeller Archive Center.)

BEYOND THE POLITICAL DEBATE

Two dozen scientists sat around a table in New York in the early 1990s to discuss rice. The Rockefeller Foundation had invited them to talk about Vitamin A. Every day, an average of 6,000 children around the world died as a result of Vitamin A deficiencies, and hundreds of thousands went blind every year. Scientists had worked for years to improve the nutrient content of rice, searching unsuccessfully for a natural variant that produced beta-carotene, the precursor to Vitamin A. But these efforts had been unsuccessful. Gary Toenniessen, the Foundation's deputy director for Agricultural Sciences, had organized this brainstorming meeting to see if biotechnology could provide a solution.

Among those at the table was Peter Beyer, a German biochemist who studied the beta-carotene biosynthetic pathway. Just past his 40th birthday, he had earned his doctorate in cell biology from the University of Freiburg. On the flight to New York he met with another German scientist, 60-year-old Ingo Potrykus, who had earned his doctorate at the Max-Planck Institute. Potrykus had moved to Basel, Switzerland, in 1976 to establish the plant genetic engineering group at the Friedrich Miescher Institute. By 1985 he was a full professor at the Swiss Federal Institute of Technology in Zurich. Potrykus had been thinking about ways to use biotechnology to increase the nutritional qualities of rice for several years. In 1990 the Rockefeller Foundation had begun to provide funding to his lab at the Institute for Plant Sciences to help with the effort to develop an Indica rice transformation

Neglected by aid agencies in previous eras, sub-Saharan Africa became a focus of the Rockefeller Foundation's work in the 1980s. The Foundation's agriculture initiatives helped small-holder farmers like this Nigerian woman picking okra leaves. (Rockefeller Archive Center.)

protocol. As they talked during the flight, Potrykus and Beyer quickly realized that, with their combined skills and expertise, they might be able to offer some new ways to approach the Vitamin A problem.

During the conversation around the table in New York, Beyer and Potrykus articulated a strategy that involved engineering a rice plant to convert the precursor that already existed in rice to beta-carotene. From a researcher's point of view, it was a risky proposition. No one had introduced four genes into a plant before and gotten them to function in a sequential way that would produce a biosynthetic process not previously resident in the plant.

Norman Borlaug (right) visited Mexico in September 1981 with Rockefeller Foundation trustees. In the 1980s the Foundation reduced its field operations and ended direct support for many of the agricultural institutes it had launched. Instead, it provided direct funding to national agricultural research institutions in Africa to strengthen their capacity and for rice biotechnology research in Asia. (Rockefeller Archive Center.)

It would be an expensive process and require patient funding. For the scientists, it meant devoting years to an idea that might not work. But as he left the meeting, Beyer could not stop thinking about the children who suffered and died from Vitamin A deficiencies. "If, as a basic scientist," he said later, "you find out that you could make a contribution to the real world, that you have some tools in hand that might make a change, you go for it."

The decision proved equally difficult for the Rockefeller Foundation. Its board of scientific advisors understood the challenges that Beyer and Potrykus and their teams would have to overcome. But, in many ways, this project represented the culmination of a shift in the Foundation's program that had been a full decade in the making.

The Rockefeller Foundation Refocuses

As the 1980s dawned, agricultural development policies had remained caught in the crossfire of an increasingly political debate. Critics of the Green Revolution's environmental and social impacts, along with western conservatives less willing to provide aid to developing nations, continued to voice their criticisms. Support for agriculture from the industrial world consequently began to wane. In 1979, funding for agriculture accounted for roughly 12 percent of the official and private aid resources flowing from developed to less-developed countries. Over the next two decades, that support would lessen dramatically.

The decrease coincided with a change in leadership of the Rockefeller Foundation. Following the sudden death of John Knowles in early 1979, after his battle with pancreatic cancer, Sterling Wortman was appointed as interim president. A plant geneticist, Wortman had been a Foundation agriculturalist since the 1950s. He had worked in Mexico and at IRRI in the Philippines, and helped launch CGIAR. He had also served as director of both the Agricultural Sciences Division and IADS, as well as vice president of the Foundation. As interim president, Wortman avoided significant policy shifts, and in 1980 he was succeeded by Richard Lyman.

A historian by training, Lyman had been the president of Stanford University and had served as a Rockefeller Foundation trustee since 1976. He focused on stabilizing the Foundation's programs in the wake of a decade of changes, reducing the scope of its work and refocusing divisional programs to provide effective support and leadership. Like Knowles, Lyman saw the Rockefeller Foundation as an influential risk-taker, but pragmatically asked, "How do we intend to make our limited dollars count?" He reviewed the Foundation's divisions one by one, streamlining them so that they could work more effectively given the "sea change in our circumstances."

The gradual changes that Lyman's review inspired included doing away with the idealistic program titles of the 1960s in favor of a return to the more academic designations that reflected the Foundation's past. The Conquest of Hunger program became the Agricultural Sciences Division, for example. Despite this apparent return to traditional disciplines, the Foundation continued to promote interdisciplinary and systemic thinking. The Agricultural Sciences, Health Sciences, and Population Sciences Divisions all had biotechnology components that involved the establishment of laboratory infrastructure and technology as well as research and professional training. To promote interdisciplinary thinking, the Foundation created its International Program to Support Science-Based Development.

Established in 1986, Science-Based Development operated on the "premise that scientific advance and technical innovation can serve the cause of international equity by helping to reduce the incidence of poverty, disease, malnutrition, unwanted pregnancies and illiteracy in developing countries, and thereby advance the well-being of their peoples." It sought to distribute scientific knowledge and technology more equitably across the world.

The Foundation also refocused much of its international funding on neglected regions of the world that did not receive significant attention or support from aid agencies, especially sub-Saharan Africa, which had critical needs in science and technology. The Reflections on Development program selected young scholars from sub-Saharan Africa and Southeast Asia to work on development topics of their own choosing, free from their various obligations of teaching, government, or international agency service work.

Science-Based Development continued the interdisciplinary approach that the Rockefeller Foundation explored in the 1970s. Acknowledging that agricultural science alone could not end world hunger, the Foundation had made agriculture just one of many tools to promote food security. These new programs went one step further, making food security one of many goals in a more holistic paradigm of development that also included health and population control. The expansion of this approach capitalized on the resources that became available when in-country programs ended. Acting through third parties and partnerships, the Foundation promoted scientific research and technology in the laboratory and disbursed it to those "neglected" regions that needed it most.

Working on development internationally freed the Foundation from many of the frustrations of working with national governments. It also allowed the Foundation to distance itself from the U.S. government, which promoted development in Third World countries as a tool of foreign policy. Because the Foundation had already reduced its in-country programs, the end of the Cold War in the 1980s did not greatly affect the structure or goals of its work.

Peter Goldmark Jr., who replaced Richard Lyman as president of the Foundation in 1988, oversaw this transition. Creative and energetic, Goldmark was the son of a remarkably successful inventor. Harvard-educated, he had served as New York Mayor John Lindsay's chief of staff. He went on to head the Massachusetts Department of Human Services and then serve as executive director of the Port Authority of New York and New Jersey. At the time he was recruited to lead the Rockefeller Foundation, he was a senior executive with the Times Mirror Company.

Goldmark's tenure as president of the Rockefeller Foundation coincided with both the fall of the Berlin Wall and the Tiananmen Square protests in 1989, as well as the collapse of the U.S.S.R. in 1991. It was a time, Goldmark reported, when the "fields of human affairs were seen to swing from East-West to North-South."

Goldmark retained the same organizational structure of Science-Based Development that encompassed Agricultural, Health, and Population Sciences. He added a new health initiative and expanded field-based programs in

The International Rice Research Institute (IRRI) continued to focus on plant breeding in 1980 at Los Baños in the Philippines, in an effort to create high-yielding crop varieties. After 1983 the Foundation pumped millions of dollars into genetic engineering, including rice biotechnology. This work led to significant scientific breakthroughs by the late 1980s. (Ashwin Gatha/Kay Reese & Associates. Rockefeller Archive Center.)

Africa. He also took into account global environmental concerns, insisting that environmental issues related to development had to be "structured as part of our overall framework." In 1989 the Foundation launched its Global Environmental Program as a component of Science-Based Development.

This increasing focus on environmental issues within the Foundation and around the world became important to agricultural science. In addition to seeking to increase the quantity and quality of food produced in the developing world, the Foundation sought to promote "sustainable, environmentally positive agriculture."

Fortunately, improvements in the Foundation's financial situation gave it the ability to tackle this modest programmatic expansion, as its assets increased every year from 1984 to 1989, doubling in just five years.

Agricultural Sciences Evaluations & Shifts

With increased resources and an awareness that other institutions' support for agriculture was declining, the Rockefeller Foundation reprioritized its agricultural initiatives. The transition had begun in 1982 with Richard Lyman's effort to review each of the Foundation's major programs, aided by three consultants: Bryant Kearl, vice chancellor for academic affairs at the University of Wisconsin; Robert McNamara, former

U.S. Secretary of Defense and president of the World Bank; and Perry Adkisson, deputy chancellor for Agriculture at Texas A&M University. The report produced by this team proposed that the Rockefeller Foundation's agriculture program should be restructured around three core areas: 1) strengthening food and agricultural systems in African nations; 2) supporting biological research and developing new agricultural technologies; and 3) promoting institutional cooperation to address critical agricultural issues.

To accomplish these goals, the Foundation underwent a major strategic and organizational transition beginning in 1983. Since the early years of the Foundation's history, field operations, first in health and later in agriculture, had been a major component of the Foundation's work. These were expensive endeavors for which the Foundation hired highly skilled professionals and sent them around the world to work directly with public officials, research scientists, farmers, and communities in developing nations. Under its new strategy, the Foundation concluded that dollar-for-dollar it could be far more effective as a grant-maker and catalyst.

In agriculture, the timing of this transition was propitious. By 1983 many governments and international agencies had adopted crop-specific work previously initiated by Rockefeller Foundation field staff. By handing off more work to others, the Foundation could focus its staff in a few areas without having older projects disintegrate. This streamlining now outweighed the "traditional philosophy of seizing opportunities wherever they arise." Having already ceased its in-country programs, the Foundation also looked to reduce involvement in the international agricultural research institutes it had helped to start. The Consultative Group on International Agricultural Research (CGIAR) proved an effective vehicle for this transition. By the early 1980s CGIAR was receiving support from over 30 governments, international agencies, developmental organizations, and foundations.

As the Rockefeller Foundation implemented the new strategy, it provided one last terminal core support grant to each of the five research centers' operating programs concerned with agricultural technology and policy in Africa. The Foundation continued to fund CGIAR projects after 1985, but only as they aligned with the interests of the Agricultural Sciences Division and at a level that would allow the Foundation to retain its CGIAR membership. At this time the Foundation also made its final appropriations to several other research centers, including the Chinese Academy of Agricultural Sciences and the International Agricultural Development Service (IADS), which had merged with other entities to form the Winrock International Institute for Agricultural Development. With the decks cleared by the mid-1980s, the Foundation had the resources to focus on new undertakings.

The Foundation had created its biotechnology program in 1983 as a modest effort to apply genetic engineering to agricultural sciences, but in many ways the Foundation had already been a pioneer in the field. Although humans have manipulated biological processes to generate food, medicines, and other products for centuries, modern biotechnology is rooted in the field of molecular biology. Emerging from breakthroughs in physics and chemistry in the early decades of the twentieth century, molecular biology allowed researchers to begin to explain biological processes at the molecular level. Rockefeller Foundation funding had helped to support those early breakthroughs. When Warren Weaver became head of the Natural Sciences Division, he concluded that new discoveries could potentially revolutionize the field of biology. In 1932, with support from the Foundation's trustees, he launched a program in "experimental biology." The Foundation's grants over the next two decades helped give birth to a new field that Weaver dubbed "molecular biology" and played a pivotal role in developing new knowledge that paved the way for the discovery of the double-helix structure of DNA in 1953.

Although the Foundation withdrew from this arena in the 1950s, after it was well-established and receiving significant research funding from governments in the developed world, the Agricultural Sciences Division remained interested in the breakthroughs in genetics and cell physiology that offered promising new paths for developing hardier, more productive, and more nutritional food crops. Indeed, by the mid-1970s scientists working in the field of molecular biology had progressed so far that it was increasingly possible to envision the ability to engineer life forms to meet human needs.

Some people in the general public found this prospect of bioengineering deeply troubling. Haunting images, ranging from Mary Shelley's *Frankenstein* to the profoundly disturbing eugenics experiments of the 1930s and 40s, raised strong moral issues. Others feared that new organisms created through biotechnology would disturb existing ecosystems. For every concern, however, biotechnology offered tremendous benefits to humanity—new foods that would help people live longer and healthier lives; new medicines that would inhibit disease pathogens at the molecular level; and new products that were more environmentally sustainable. Nevertheless, leading scientists came together to try to address the concerns during a conference at Asilomar, California, in 1975. They set standards for work with "recombinant DNA" to ensure public safety and to meet high moral standards. Though this conference could hardly allay public concerns, it set

the stage for professional standards that helped accelerate the development of the field.

Though the Foundation was not a "stranger to the fields of molecular genetics and cellular biology," it had not explored the intersection of biotechnology and agricultural science before 1983. That year, it sent two scientists, Judith Lyman and Gary Toenniessen, to kick off the Foundation's explorations by visiting university and commercial laboratories across the United States and by attending scientific congresses and international meetings. Seeing great potential for future work in this arena, the Foundation wanted to understand its successes and impediments. The survey, according to President Richard Lyman, was intended "to foreshadow a strategy for future work."

Toenniessen would play a pivotal role in the development of the Foundation's biotechnology program. He had joined the Rockefeller Foundation in 1971 after earning a Ph.D. in microbiology from the University of North Carolina at Chapel Hill. He rose through the ranks, serving as assistant director of Natural and Environmental Sciences; assistant, associate, and deputy director for Agricultural Sciences; and director of Food Security. Toenniessen was a steady administrator and innovative scientist. The recommendations that he and Judith Lyman offered based on their survey helped inspire the Foundation to act.

In 1984 the Rockefeller Foundation announced a major, long-term commitment to plant genetic engineering. Over a ten- to fifteen-year period, the Foundation said, it would invest in targeted research leading from basic technology development to its application in breeding. It began by funding research on the application of cellular and molecular biology to food production in the developing world, with an initial emphasis on cereals. It sought "vertical integration" of conventional breeding with new genetic-engineering techniques, believing that these "powerful tools" should flow to developing countries through their international centers and national agencies.

Rice became a high priority for the Foundation's biotechnology program, including not only the research in genetic engineering but also the promotion of new breeding techniques. In many parts of the developing world, rice accounted for a major percentage of what people ate. Prior to the Foundation's involvement, however, scientists were not focused on the ways in which rice might be bioengineered to better meet the nutritional needs of people in the developing world.

The biotechnology program targeted sophisticated research projects as well as the practical application of new findings to national research programs and small-scale farms in the developing world. Other cereal crops besides rice, as well as the root crop cassava, became top priorities. Consistent

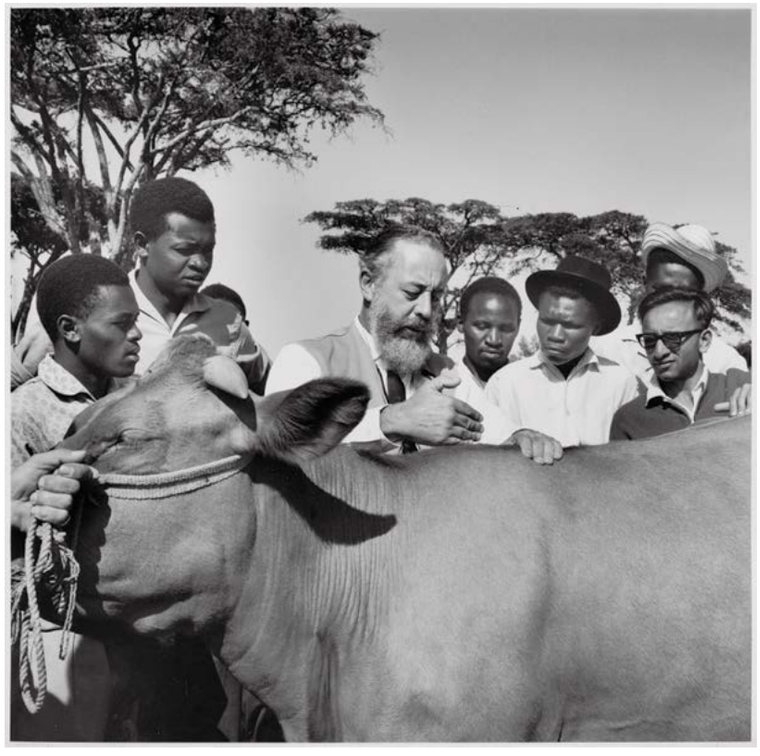
with past practice, the Foundation promoted interdisciplinary study as well, encouraging social scientists and other scholars to "anticipate the socioeconomic and environmental impacts that may be associated with successful application of genetic engineering in international agriculture."

The Foundation invested a substantial amount of money in this work. The trustees authorized almost $7 million in grants in the first two years of the cereal genetic engineering program. By 1987 they had given over $10 million (about $20 million in 2012 dollars) to the International Program on Rice Biotechnology (IPRB) alone. Much of the funding went toward already advanced laboratories, some in developed countries, with the intention that their work would be applied in the developing world. A biotechnology fellowship program aided agricultural scientists from the developing world interested in exploring biotechnology at home or in western laboratories, where they could be trained before returning to their home countries. The program expanded into China and India in 1987, taking advantage of their research establishments, scientists, and "mature rice genetic improvement programs." The Foundation stationed former IRRI scientist John O'Toole in India first, then in Thailand, to lead the rice biotechnology program in Asia.

Gary H. Toenniessen joined the Rockefeller Foundation in 1971. He worked on environmental problems associated with the Green Revolution and was an early advocate for biotechnology funding by the Rockefeller Foundation. (Rockefeller Archive Center.)

These early investments in biotechnology led to significant scientific innovations by the late 1980s. Researchers funded by the Rockefeller Foundation developed new methods for regenerating whole rice plants from protoplasts, considered a "major breakthrough in genetic engineering of cereal plants." They also introduced desirable traits such as insect resistance and cold tolerance. In 1991, scientists working at Cornell University with Foundation support developed a detailed molecular genetic map of rice, which they disseminated to rice breeders around the world to facilitate the creation of improved rice varieties. In 1995, a Foundation-funded team of scientists cloned a gene for resistance against bacterial blight, which yielded high resistance in susceptible varieties.

Meanwhile, consistent with its historic practice, the Foundation continued to promote dialogue and knowledge transfer between global networks of agricultural scientists. It helped to organize an association of scientists working in biotechnology. A mid-term review of the Foundation's International



New agriculture initiatives in Africa built on programs launched in the 1960s. In Njoro, Kenya, for example, the Foundation supported Egerton College, where the school's principal, Professor M.A. Barrett, used a prize-winning Guernsey cow to illustrate a point for students in 1963. (Marc & Evelyne Bernheim. Rockefeller Archive Center.)

Program on Rice Biotechnology highlighted partnerships with more than 350 scientists all over the world in the early 1990s, concluding that "new varieties of rice should feed 100 million more people than believed possible, and 150 million additional people within 20 years."

Peter Beyer and Ingo Potrykus, who had participated in the brainstorming session in New York regarding rice and Vitamin A, represented the leading edge of this process of innovation. They announced a major breakthrough in 1999, after years of work. With funding from the Rockefeller Foundation, they had introduced two daffodil genes and one bacterial gene into rice. In combination, these three genes were able to produce the enzymes—in four steps, in the right order—necessary for converting the precursors in rice to beta-carotene. This new "golden rice," dubbed for its remarkable color, seemed to provide a potential solution to the problem of Vitamin A deficiency.

Gary Toenniessen and others at the Rockefeller Foundation were delighted. The work was pioneering in several ways. In biotechnology, genes were usually introduced to synthesize particular proteins. But this new approach represented the first case of what scientists called "pathway engineering," designed to alter the kinetics and product of a metabolic process. Toenniessen also noted that the innovation was aimed directly at the consumer of rice—not the farmer—by improving the nutritional value of the food crop.

Unfortunately, continuing concerns about the development, regulation, and safety of genetically modified products raised significant barriers to the production of golden rice. To resolve these issues, the researchers, with the Foundation's consent and encouragement, entered into a partnership with Zeneca, a large pharmaceutical and agribusiness. The agreement allowed for the creation of public-sector breeding programs to make golden rice seeds available to resource-poor farmers in developing countries at no additional cost. Zeneca (today Syngenta) also agreed to provide resources to the Humanitarian Project, founded by the inventors, to continue their research. As of 2012, however, regulators, concerned about the safety of genetically modified organisms, were still considering whether to approve golden rice for production, frustrating many people who hoped to see this remarkable innovation enable millions of the world's poorest children to enjoy better health and a higher quality of life.

Neglected Regions: Sub-Saharan Africa & Beyond

Increasing the consumption of Vitamin A and other vital nutrients was a particular priority in sub-Saharan Africa as part of a much larger effort to increase the quantity and quality of food available there. Africa became a high priority for the Rockefeller Foundation in the 1980s, because it was the region facing the most acute food shortages.

Prior to the mid-1980s, the Foundation provided limited support for strengthening food and agricultural systems in Africa by developing research and professional infrastructure through a number of disparate programs. The Foundation provided money to CGIAR for international research institutes located in or relevant to Africa. The West Africa Rice Development Association (WARDA) received grants for research and development activities, and a senior Rockefeller Foundation staff member served as interim director when WARDA experienced management difficulties in 1985.

The Foundation also worked on a limited basis in Africa by cultivating professional development helpful to the region, with a focus on science.

These programs included agriculture as well as demography and human health. One such project, related to food security, placed African social scientists in postdoctoral fellowship programs with international research centers. The goal of supporting these ten annual fellowships was to help produce a "future generation of African social scientists versed in multidisciplinary research and sensitive to the human and social complexities inherent in the agricultural transformation process." In addition, the Foundation explored the possibility of expanding its assistance for scientific training to the pre-doctoral level for young Africans, enhancing its effectiveness and relevance in a region with relatively few scholars trained to the doctorate level.

When the Foundation restructured its Agricultural Sciences Division in the mid-1980s, the new plan retained the professional development component, but with a new focus. The postdoctoral fellowship program now targeted scholars studying "critical issues affecting international agriculture." These issues included, for example, the "application of technology" by "strengthening the often fragile linkages between research centers and country efforts." While the Foundation was reducing its field staff, it expanded the fellowship program in 1985, incorporating regional conferences and seminars into its funding to "allow the fellows to share their experiences." The Foundation also developed a program component called Enhancing International Agricultural Research Collaboration in the mid-1980s, which focused on "facilitating better communication and cooperation between the various international agricultural centers and national agricultural research systems." It sought to refine the centers' ability to respond to national systems, and to train the latter to better convey their priorities and choose the best form of assistance.

By the late 1980s the Agricultural Sciences Division began to develop a more cohesive strategy toward Africa. The new initiative, Improving Family Food Production Systems in Africa, took shape in 1985 under the leadership of Robert Herdt. Herdt had come into the orbit of the Rockefeller Foundation while he was still a graduate student at the University of Minnesota in the 1960s, working on a project at the Indian Agricultural Research Institute. For ten years he served as an economist at IRRI and then moved to the World Bank, where he was a scientific advisor to CGIAR. In 1987 he joined the staff of the Rockefeller Foundation as program director in charge of agriculture.

The program developed by Herdt and his staff adopted as its major strategic focus the strengthening of selected national agricultural research systems in order to improve the food-production strategies of farming families in sub-Saharan Africa. To this end, it supported both individuals and institutions with an emphasis on biological and socioeconomic research on such crops as roots and tubers, which, it said, were the "nutritional mainstay of much of the population."

Nigeria was among many countries that benefited from Rockefeller Foundation agriculture funding. Animal scientist Dr. A.N.A. Modebe (left) helped a member of his dairy microbiology class examine milk samples for bacteria at the University College of Ibadan in 1963. (Marc & Evelyne Bernheim. Rockefeller Archive Center.)

One major project funded by the new initiative was a cooperative effort by two CGIAR laboratories to focus on cassava, a shrubby plant grown for its edible root and widely cultivated by the "very poor in sub-Saharan Africa." The Rockefeller Foundation appropriated over $2 million in 1987 for researchers in nine African countries spread across the continent to examine a wide range of issues, including the growing, processing, consumption, and marketing of cassava. It also supported African agricultural graduate students to work on the cassava project as part of their doctoral research, and funded a social science research unit at the International Centre of Insect Physiology and Ecology in Nairobi, Kenya. This unit aimed to evaluate "farmers' needs, wants, and the appropriateness of new technology for pest control."

In the last years of the 1980s, the new president of the Foundation, Peter Goldmark, built on this work in Africa, creating more developed infrastructure for its operation. The Foundation added new personnel, hiring economist John Lynam to run its East Africa programs, including the cassava research project. It recruited Malcolm Blackie, former dean of agriculture at the University of Zimbabwe, to lead the Foundation's southern Africa programs. It also supported local professional development. In 1989, for example, the Foundation cooperatively funded Zimbabwe's Agriculture Faculty to develop a graduate program to train the country's future research and extension staff, and to form ties with the small farm community.

Expanded funding was also directed toward diversifying crop work. In 1988 the Foundation supported a program at Washington University in St. Louis, Missouri, to apply biotechnology techniques for tomato and tobacco plants to improving cassava. This project became the starting point for supporting a modest international research network for biotechnology research on cassava, which eventually became a cornerstone of the Foundation's Africa work.

Maize research in 1989 at the Mbabawa Research Station in Malawi was supported by the Rockefeller Foundation. The country's most important food crop, maize was planted on three-quarters of the land owned by small farmers. (Wendy Stone. Rockefeller Archive Center.)

In addition to backing research on cassava, the Foundation provided grants for work with other crops. A cooperative project in Uganda, for example, sought to increase banana productivity with funding to Makerere University and the Ministry of Agriculture for experiments and on-farm trials. Another project supported maize research to adapt high-yielding varieties of the crop to the needs of small farmers in Malawi. Yet another venture involved Texas A&M's genetic mapping of sorghum as well as training of scientists to work with sorghum in semi-arid Africa.

Additional Africa funding went to addressing soil fertility, water management, and livestock. After 1989 the Foundation's new Global Environmental Program encouraged these resource studies. It gave one such grant to a study of African continuous cropping systems. Another grant funded the evaluation of the use of ecological systems—including worms, insects, and microorganisms—to enhance soil productivity and sustainability.

During Peter Goldmark's tenure as president, the Foundation increased funding for agriculture work in other parts of the world as well, although on a limited basis and usually aimed at other neglected regions. In 1988 the Foundation supported scientists at the Mexican Polytechnic Institute's Center for Research and Advanced Studies in their efforts to improve maize using molecular genetic maps. The Foundation backed a similar program for using advanced biotechnology techniques to create better rice plant varieties in a range of Asian countries, including China, India, Malaysia, Thailand, Indonesia, and the Philippines.

Efforts outside of Africa focused on expanding the topical scope of agriculture work as well. In the late 1980s the Foundation helped the World Wildlife Fund establish a program of small grants to specialists in developing countries for studies aimed at tropical forest preservation. The Foundation also searched for alternative, and more comprehensive, ways of measuring the impact of technological change. To this end, it provided grants for detailed assessments of new agriculture technologies in terms of their impact on various factors—including labor, nutrition, income, prices, and the environment—through evaluating rice in China, India, the Philippines, Indonesia, Nepal, Bangladesh, and Thailand. The Foundation intended these findings to inform an evaluation of the effectiveness of their agricultural science work the world over.

Finally, the Foundation invested in education in the industrial world to support a better understanding of issues affecting international development. It supported the University of London's Wye College, for example, in creating a distance-learning masters degree program "stressing economics

Dr. Keith Gough (front), a visiting researcher from Australia's national science agency, participated in the cassava improvement program with Professor Roger N. Beachy (rear) at Washington University in St. Louis, Missouri, in 1988. (Andrew Lipman. Rockefeller Archive Center.)

and management for professionals working throughout the Third World on agricultural development projects." The projects included small farms and associated households; agricultural processing and marketing; and government planning and policy. Likewise, the Foundation provided a grant to a Cornell University project for identifying essential books and journals valuable for developing-country researchers and policymakers in the agricultural sciences. The Essential Electronic Agricultural Library (TEEAL) that resulted was made available in poor countries at no or minimal cost, first in a CD format and later online. Yet another Foundation-supported project involved agricultural scientists from both industrial and developing countries, who produced methods by which developing countries could determine aid priorities for agricultural biotechnology. Like the rest of the Foundation's expanded work in the late 1980s, this project retained its applicability to agricultural development in neglected regions of the world.

Innovation Consistent With Tradition

Biotechnology represented an important innovation in the Rockefeller Foundation's historic efforts to apply science to the goal of increasing food security. It also represented an important new tool for addressing a matrix of development concerns, including health, population, and environmental sciences. Although this work aimed to be universally useful, the Foundation by the late 1980s and 1990s increasingly believed that its mission—"to promote the well-being of humanity throughout the world"—should be focused on poor and marginalized people. While investors in the private sector funded the development of biotechnology to provide products and services for affluent communities in industrialized nations, the Rockefeller Foundation intended to ensure that biotechnology would deliver benefits to developing nations as well.

One region, above all others, seemed to demand the attention of the Foundation and of other non-governmental organizations (NGOs) as well as private foundations in what some called "the third sector." By the late 1990s it was clear that sub-Saharan Africa had not benefited from the Green Revolution or the technological innovations of biotechnology as much as other parts of the world. As the Foundation contemplated its future, Africa loomed large on the horizon.

Exploring the Ramifications of Biotechnology

As a pioneer in plant biotechnology research, the Rockefeller Foundation recognizes that biosafety regulations, intellectual property rights, and public acceptance of genetically modified organisms have emerged as major impediments to the adoption of new crop varieties that have the potential to improve agricultural production and human nutrition. With grant funding, the Foundation launched a series of initiatives designed to better understand these constraints and to foster constructive dialogues seeking to find common ground among those with varying viewpoints concerning these issues.

From 2000 to 2002 the Foundation funded a study by the Meridian Institute, which "issue mapped" current questions related to biotechnology across the globe. The Foundation then sponsored a series of conversations and training programs that helped developing countries strengthen their capacity to implement more effective programs dealing with biosafety, intellectual property management, and public awareness.

Through Meridian the Foundation helped launch a Food Security and AgBiotech news service that provides free updates and information from a broad spectrum of sources to all concerned parties. The Foundation helped create and funded the operations of the Public Intellectual Property Resource for Agriculture to facilitate collaborative intellectual property management among public-sector agricultural research institutions. The Foundation also gave grants to the International Rice Research Institute to enable it to help selected Asian countries, with large populations vulnerable to Vitamin A deficiency, to conduct the field test and biosafety assessments required for regulatory approval of Golden Rice.

A GREEN REVOLUTION FOR AFRICA

The "selective exclusion from the benefits of agricultural science has been especially pronounced in sub-Saharan Africa," the Rockefeller Foundation said in its 2004 annual report. It was a frank admission. "For decades," the report continued, "funders of international development programs have been frustrated by the difficulty of bringing the benefits of higher crop yields to many of the worlds poorest communities and farmers."

The Foundation cited a "tangle of reasons" for the continued exclusion, including "complex weather conditions, limited government capacity, scant infrastructure, and markets for both inputs and crops that remain concentrated in cities and coastal areas." Finding a solution would be a long story that is still unfolding today.

The Rockefeller Foundation had worked in different capacities and various locations in Africa throughout the second half of the twentieth century, with initiatives focused largely on areas such as public health and university development. In the 1980s it began to imbue its Africa work with more emphasis on agriculture. Despite the increased attention, farming and food supply problems in the region persisted. Many within the Foundation began to believe that the Green Revolution, which sparked such dramatic changes in key areas in Latin America and Asia, had bypassed Africa. As the work of the 1990s developed, the Foundation increasingly looked for ways to cultivate a Green Revolution for Africa.

"An America that has been complacent and satisfied in the eighties," Rockefeller Foundation President Peter Goldmark wrote in 1991, "now becomes uneasy and troubled." Like many others, Goldmark was disturbed by the new global tensions that emerged after the Cold War. "When the freeze of the Cold War lifted," he wrote, "there emerged a much more violent and uncertain world than we had hoped to find."

At the same time, the Foundation enjoyed increasing financial prosperity. Its endowment doubled from about one billion to two billion dollars in the 1980s, and reached three billion dollars in the mid-1990s. Goldmark used the additional endowment to expand the Foundation's programming, arguing that the new

The International Rice Research Institute formed part of the rice biotechnology network supported by the Rockefeller Foundation in the late 1980s and early 1990s. The Foundation's funding in 1987 helped Dr. Lesley Sitch, the institute's associate cytogeneticist, transfer useful genes from wild rice into domesticated varieties. (Rockefeller Archive Center.)

decade required something "quite different" from what he called "the romantic interventionism of the 1960s" or the "minimalist doctrine of the 1980s."

It was in this context of both prosperity and tectonic shifts after the Cold War that Goldmark served the majority of his tenure as president. He continued to build on the established operating structure of the Foundation to expand its abilities without scattering the focus of its work. The Foundation increased its funding for the International Program to Support Science-Based Development, which encompassed Agricultural, Health, and Population Sciences, as well as Global Environment. It also added an African Initiatives program to address the needs of the continent more directly.

Biotechnology continued to be a pillar of the Foundation's work, with a focus on supporting research in the rice biotechnology network that included Cornell and Purdue Universities, CIAT in Colombia, and IRRI in the Philippines. In the eight years leading up to 1992, the Foundation appropriated more than $40 million for rice research. The Foundation thus stimulated a major achievement early in the decade with the development of rice varieties demonstrating durable, long-term resistance to blast fungus, a widespread and damaging disease-producing organism. Complementing the focus on rice, the Foundation also continued its historic funding of maize research for higher yields.

By 1993 the Foundation defined its core strategy for Agricultural Sciences in terms of improving the yield of a handful of staple crops. It aimed to "increase food production in selected developing countries" with a "20% increase in rice productivity and 50% increase in maize productivity by 2005." In Africa, the Foundation concentrated on Kenya, Malawi, Uganda, and Zimbabwe as the agricultural regions from which improved productivity could be spread to the rest of the sub-Saharan continent.

The Foundation also funded research and networking on a smaller scale for other food crops important to the developing world, including sorghum and millet, both staple crops in parts of Asia and Africa. A genetic map of a legume genus created by a Foundation-funded scientist helped researchers working with cowpeas and mung beans, major tropical legumes. And the Foundation continued to champion cassava, which was "once regarded as a backstop crop to tide the rural poor over in 'hungry season,'" but had recently "emerged as a nutritional and commercial mainstay in sub-Saharan Africa." Like the work with maize, cassava research aimed to help both Africa and the rest of the developing world.

Rockefeller Foundation-funded researchers reached a watershed moment in 1996 with the discovery that all eight types of cereals, providing 70 percent of the food consumed by humans, share many nearly identical chromosome segments with rice. This discovery allowed much of the knowledge developed by the International Program on Rice Biotechnology to be utilized for genetic research and engineering on all cereals.

In addition to crop research, the Rockefeller Foundation funded a number of subsidiary areas relevant to agriculture. It supported an ongoing cooperative project to help developing countries obtain genetic-engineering technologies and products, with attention to ethical, social, cultural, and scientific concerns. It articulated one goal of funding biotechnology research networks to accelerate the transfer of knowledge between scientists working in the developed and developing countries. The Foundation also funded various studies of the impact of the Green Revolution in different regions, including a report on the history of Indonesian rice that covered the period between 1970 and 1990.

Many of the subsidiary projects concentrated on Africa. The Foundation placed a priority on research and technology that addressed problems of soil-nutrient depletion and declining yield caused by pests and diseases. The Tropical Soil Biology and Fertility Programme (TSBF) in Kenya, for example, included field research at sites in Kenya, Zambia, and Zimbabwe that addressed the biological processes in tropical soil to improve crop yields. The Foundation also supported the Forum on Agricultural Resource Husbandry, which worked to strengthen graduate education in Kenya, Malawi, Uganda, and Zimbabwe. The forum awarded competitive grants for master's degree students to study soil- and crop-management field research with an eye on policy and farmers, and functioned as a research network linking more than a dozen institutions in eastern and southern Africa. In Malawi, a program started in the late 1980s sought to increase maize production among small farmers by looking at soil, agro-forestry practices, weeding, and pest and disease damage measurement. The Foundation supported similar ongoing work in Kenya, Uganda, and Zimbabwe. It also funded efforts to apply the advances in rice research that had been made in Asia to the work being done in Africa, by crossing Asian and African strains to create new high-yield varieties well-suited to African conditions in their resistance to drought, weeds, and pathogens.

As the nutritional and crop yield crisis in Africa deepened in the 1990s, the Foundation became aware that it needed a more focused approach. Many African nations neared a crisis point. Food, health, and basic needs were out of reach for many people. This was especially striking in the field of agriculture. Despite substantial policy reforms, most of sub-Saharan Africa had seen only limited improvement in agricultural productivity, and few of the indirect growth effects that had accompanied agricultural improvement in other developing regions.

These shortcomings shook the faith of some in the development community that agriculture could be a vehicle for progress in Africa. The predicament fueled a "resurgence of 'agro-pessimism,'" and led some scholars, such as Luc Christiaensen and Lionel Demery, to describe this era as one that "led many to question agriculture's potential to reduce poverty." Most sub-Saharan African countries were different than Asia in key ways, including the condition and under-development of their infrastructure, irrigation, human capital, and access to credit. The global economic context was also different. Compared to the experience of the 1960s, African nations in the 1990s faced a much more competitive external trading environment. At the close of the 1990s, under the leadership of a new president, the Foundation began to grapple with addressing these issues in the context of its work in African agriculture.

New Century, New Horizons

Gordon Conway succeeded Peter Goldmark as president of the Rockefeller Foundation in 1998. An agricultural ecologist by training, Conway had focused his academic work extensively on sustainable agricultural development. Before coming to the Foundation he had conducted research in Malaysia, at Imperial College of London, and in various locations in Asia and the Middle East on behalf of the Ford Foundation, World Bank, and USAID. He was known for pioneering Integrated Pest Management in the 1960s and for articulating the concept of sustainable agriculture in the 1970s. At the time he was selected to become president of the Rockefeller Foundation, he was serving as vice-chancellor at the University of Sussex.

In many ways, the trustees' decision to recruit Conway reflected a profound exercise in institutional humility. Conway had co-written an account of agricultural development that was critical of many of the working methods the Foundation had employed for more than four decades. His book, *Unwelcome Harvest: Agriculture & Pollution*, published in 1991, took industrialized farming to task for the waste and pollution created by synthetic pesticides and fertilizers as well as silage, livestock slurry, and other farm processes. These pollutants, Conway argued, not only negatively affected the global environment and human health, they were also unsustainable and were impeding the goal of higher agricultural productivity in the long run. Almost a decade before his presidency, Conway had concluded that agricultural development should cultivate a system of global farming that both polluted less and was more efficient and productive.

Conway was a vocal proponent of these ideas from within the agricultural aid community. In 1995 he presented a report to CGIAR titled "Sustainable Agriculture for a Food Secure World," which advocated a new Green Revolution—one in which natural resources management and knowledge of local farming communities were just as important as productivity. A few years later he published an elaborated version of this argument in *The Doubly Green Revolution: Food For All in the 21st Century*. This book continued to stress sustainability and the effects of agriculture on human health and the global environment. It also branched out to address farmers' economic concerns and the unequal distribution of the benefits of agricultural science to the rural poor. Whereas the first Green Revolution started with the science and technology of creating high-yielding food crops and then tried to reach farmers, Conway argued that the new, "doubly" Green Revolution "has to reverse the chain of logic" by seeking research priorities based on rural demands. "Its goal," Conway wrote, "is the creation of food security and sustainable livelihoods for the poor."

Sir Gordon Conway was president of the Rockefeller Foundation from 1998 to 2004. Conway advocated for a "doubly green revolution" that took into account the needs of small farmers as well as global environmental concerns. (The Rockefeller Foundation.)

It was fitting that publication of this book in the U.S. coincided with Conway assuming the Foundation's presidency. The book aimed to be prescriptive, neither losing its accessibility nor oversimplifying complex matters to be dealt with through public policy and private-sector investment. It took a pragmatic view of the international context in which agricultural development operated, but remained hopeful, ending with a rallying cry to address the world's need for food. "Now is not the time to sit back and congratulate ourselves on what has been achieved over the past thirty years," Conway concluded. "It is the next thirty years that will be the true test of whether we can harness the power of science and technology . . . for those millions of poor and hungry who deserve and have a right to enough to eat."

Like Goldmark before him, Conway acknowledged that the geopolitical shifts of the 1990s were a two-sided coin. He argued that the end of the Cold War had not brought about an increase in global stability. While "conflict between East and West has declined," he wrote, there existed a "fast-growing divide between the world of the peoples, countries and regions who 'belong' and those who are excluded." This new reality made food

Created in 1998, the Food Security team of the Rockefeller Foundation worked with farmers, scientists, and governments to increase food availability. (Jonas Bendiksen. The Rockefeller Foundation.)

security all the more important. Addressing hunger worked to offset the polarized state of affairs and calm global unrest.

Upon assuming his post, Conway emphasized the legacy of the Foundation's attention to local needs and local responsibility in its international work. He affirmed his commitment to the early Rockefeller Foundation framework of ensuring that a community receiving grants from the Foundation would have "its own will and its own resources to meet the need." He also called the Foundation's attention to issues of globalization, arguing that the distinction between international and national grantmaking should be dropped to "seek a more integrated global approach." That approach would include partnerships with key social actors drawn from governments, the private sector, and non-governmental organizations.

As the Rockefeller Foundation's policies evolved during Conway's tenure, they reflected a continuing commitment to agricultural science, but with new concerns for the unintended consequences of technology. During Conway's first year as president, the Foundation adjusted its course and defined a new organizational structure. It began making grants under four core program

themes: Food Security, Creativity and Culture, Working Communities, and Health Equity. "Cross themes" were meant to institutionalize an interdisciplinary and integrated approach. These themes and cross themes aimed to help the world's poor in an integrated and interdisciplinary fashion, grounded in focused regional activities in Africa, Asia, Latin America, and the West Coast of the United States.

The Foundation defined the goal of its new Food Security work: to "help achieve food security for all through the generation of agricultural policies, institutions and innovations that can provide sustainable livelihoods for the rural poor in regions of developing countries bypassed by the Green Revolution." This reorientation was significant in that it explicitly subsumed agricultural science under food production, and acknowledged the shortcomings of past work.

The Foundation gave grants under the auspices of Food Security in a few well-defined categories. The first was "Enabling Farmer Participation," which was based on the premise that farmers must be engaged to not only articulate their own needs, but to design and implement innovations. Grantmaking focused on involving farmers in "setting priorities for and conducting plant breeding, developing seed production and distribution systems, and improving agronomic practices." The second category was "Applying Science and Technology," based on the idea that cooperation between local scientists and farmers with scientists in the fields of biotechnology, plant breeding, agroecology, and policy could overcome barriers to food security. Grantmaking targeted projects that would accelerate the "discovery, development and application of new genetic and agroecological strategies" to promote yield stability, resilient crops, and human nutrition, and to prevent environmental degradation.

The third grant category within Food Security was "Strengthening Policies and Institutions." This program emphasized professional development and institution building that could strengthen local organizations to influence key policy, institutional, and technological levers in the interest of food security. Grantmaking aimed to foster national support for smallholder agriculture and to strengthen institutions that integrated scientific and participatory approaches to innovation. In all three categories, grants were global in scope, but focused especially on sub-Saharan Africa and Southeast Asia. The Rockefeller Foundation gave grants to institutions, but scientists from these regions who were nominated by grantee institutions also received research grants and postdoctoral fellowships.

Other initiatives besides Food Security focused on agricultural issues. Under Global Inclusion, for example, the Foundation gave grants to promote "Global Dialogue on Plant Biotechnology." These grants aimed to help

communities and nations address concerns about plant biotechnology and shape policies to cultivate a more stable policy environment for research. They were offered particularly to "developing-country stakeholders." The Foundation also developed an Africa Regional Program in 2000, which focused much of its support on Makerere University in Uganda. It supported building human and institutional capacity in agriculture, health, finance, education, planning, and public administration.

The Foundation worked with other philanthropies at this time to support higher education across sub-Saharan Africa. Its "Partnerships for Africa's Renewal" component began exploratory work in 2000, based on the premise that efforts in food, health, culture, and work required "broader contextual and developmental issues that shape the contribution of the capacity that is being built."

In the effort to deepen its engagement in Africa, two of the regional offices opened by the Rockefeller Foundation during this period were located there. The Nairobi office, led by Cheikh Mbacke, and the Harare office, led by Akin Adesina (who was appointed Nigeria's Minister of Agriculture in 2010), employed seven full-time program officers in 2000. Other agricultural initiatives in Africa in the first years of the twenty-first century included the Agricultural Productivity and Food Security Task Force in Zimbabwe, the Maize Productivity Task Force in Malawi, and the Sustainable Community Oriented Development Programme in Kenya. The Foundation also funded the National Agricultural Research Organization of Uganda to release new maize varieties with improved disease resistance and more efficient nitrogen utilization. The organization developed these new varieties specifically so that farmers could save seed from their harvest for the next planting.

The Foundation contributed some funding to projects in Asia and Latin America, recognizing that, despite successes in these regions, the Green Revolution had bypassed certain sectors of society. "Large numbers of rural poor people," it stated in 2000, "remain in poverty," and many are "chronically undernourished." In Africa, however, the Foundation worked to create a more holistic, systemic development initiative, aiming to "build the capacity of African institutions and strengthen their commitment to serving smallholder farmers." It also began to make good on Conway's intention to promote local input and responsibility, and to cultivate agricultural prosperity by working with the natural environment rather than just petrochemical fertilizers and pesticides.

All of these initiatives helped to revitalize the Rockefeller Foundation's global perspective at a time when the world's leaders struggled to cope with new tensions. The September 11, 2001, attack on the World Trade Center ignited war in the Middle East and raised new concerns regarding global terrorism. Growing economic instability raised further concerns regarding increases in income inequality. All of these issues would confront the Foundation and a new president after Gordon Conway stepped down in 2004.

Alliance for a Green Revolution in Africa

Judith Rodin, a prominent research psychologist and academic, came to the Rockefeller Foundation from the University of Pennsylvania, where she was the first woman to head an Ivy League institution. Rodin had served on the faculty at Yale, was dean of the Graduate School of Arts and Sciences, and served as provost before she left to lead Penn in 1994. Over the course of her career, she had been involved in various science and development issues, participated in influential global forums, and written or co-written many articles and books, including *Public Discourse in America* (2003).

Like Rockefeller Foundation presidents before her, Rodin began her tenure with an organizational review of the Foundation and its programs. She emphasized the importance of globalization and its effects on the poor and vulnerable. Near the end of her first year as president she declared that "today more than ever, exclusion *is* poverty, and vice versa."

A pioneer in her field, Dr. Judith Rodin, the first woman to lead an Ivy League institution, became president of the Rockefeller Foundation in 2005. The founding of the Alliance for a Green Revolution in Africa was one of the earliest initiatives of her presidency, carried out together with the Gates Foundation (The Rockefeller Foundation).

Rodin called on the Foundation, along with its partners and grantees, to find new ways for "poor people and communities to better participate in the global web of information, creativity, care and commerce." Under her leadership, the Foundation began to focus on "Smart Globalization" that supports a "world in which globalization's benefits are more widely shared and social, economic, health, and environmental challenges are more easily weathered."

Organizational changes that followed the review process in 2006 reflected this new focus. The Foundation noted that, throughout its history, "what is remembered is how we have been able to improve lives." To this end, in 2007 Rodin reorganized the Foundation's work into new "issue areas" focusing on: "Basic Survival Safeguards," "Global Health," "Climate & Environment," "Urbanization," and "Social & Economic Security." Agriculture was included under the first of these programs as part of an effort to secure "food, water, housing, and infrastructure" the world over.

These new initiatives retained a close focus on Africa, where agriculture continued to experience a crisis lasting into the twenty-first century. A 2007 World Bank study focusing on Ethiopia, Kenya, Madagascar, and Tanzania concluded that "enhancing agricultural productivity is a critical starting point in designing effective poverty reduction strategy, especially in low-income countries." Though it placed little faith in the ability of agriculture alone to lift African countries out of poverty, empirical evidence seemed to indicate that indirect growth effects would make funding agriculture worthwhile. And the Rockefeller Foundation continued to believe that agriculture and food security were critical to Africa's future.

In the first years of the 21st century, the Foundation both funded and invested in a network of small businesses to develop, package, and distribute seeds, fertilizers and other materials for small farmers in Africa and to create outlets for larger harvests, hoping that market forces would help develop distribution networks for seeds and soil nutrients. Likewise, the Foundation supported cereal banks to help farmers in a given community work together to store and sell their produce to get a better return. In keeping with the value it placed on local input and sustainable development, the Foundation funded an expansion of "resident expertise" in agricultural sciences, on both the individual and institutional levels. "Only Africans," it stated, "can ultimately solve Africa's problems." In 2005 the Foundation also gave a grant to the new African Centre for Crop Improvement at South Africa's University of KwaZulu-Natal, which granted doctorates and conducted original research relevant to African environments across the continent. That grant also supported various international research studies

on soil productivity, improved crop varieties, and public goods and markets for poor farmers.

Although many of these initiatives helped build institutional capacity within African agricultural economies, the Foundation increasingly saw the need for a bolder and more integrated approach. In 2006 it opened a new era when it joined with the Bill and Melinda Gates Foundation to launch the Alliance for a Green Revolution in Africa (AGRA). "It is time," the Rockefeller Foundation asserted in its annual report, "for a second Green Revolution, aimed squarely at Africa. It is Africa's turn."

AGRA built on the lessons learned during almost a century of working on agricultural development and rural poverty. The new initiative aimed to tackle the African agriculture problem by implementing more widespread use of high-yielding crop varieties. "If better seeds could reach the farmer," the Foundation stated, "along with techniques for using them effectively, the inefficiency and risk of food shortages could be reduced or eliminated."

Additional work would focus on productive seed combinations, added soil nutrients from improved fertilizers, and involvement of farmers in breeding, testing, and selecting seeds suitable to Africa's various regions. The Rockefeller Foundation articulated the goal for this work in terms of increased yield and its effect on human prosperity and health, stating in 2006 that the aim was to "develop 400 new crop varieties and to eliminate hunger and poverty for tens of millions of people within ten years."

AGRA also built on the Rockefeller Foundation's more recent initiatives. Its six-year-old effort to improve crop varieties had established a "credible, promising beachhead" in parts of the continent, from which it was "breaking out," with Gates Foundation collaboration, in 2006. This previous work took on the more modest aim of reducing the hardships of subsistence farming and addressing the increasing chronic risks of shortages and starvation. AGRA, however, required a "more expansive vision." The Foundation stated that a "successful revolution in African agriculture would depend on the growth of stronger market systems, better infrastructure, and the technology to make the various transactions efficient."

As the Rockefeller Foundation committed to this more ambitious goal, new partners came to the table. In the seven years leading up to 2006, the Foundation had spent nearly $150 million on Green Revolution work in Africa. AGRA received that much in its first grant appropriation, with $100 million coming from the Gates Foundation and the remaining $50 million from the Rockefeller Foundation, to be distributed over five years. Key elements of this first grant supported the Program for Africa's Seed Systems (PASS), which funded research to develop improved crop varieties; training

The Alliance for a Green Revolution in Africa focuses on agricultural problems and solutions that are uniquely African. An emphasis on biodiversity includes the promotion of root crops, such as those grown on this farm in Malawi in 2006. (Jonas Bendiksen. The Rockefeller Foundation.)

of a new generation of African crop scientists; distribution of improved seeds to farmers; development of a network of African agro-dealers; and the monitoring, evaluating, and managing of these PASS projects. In its first years, AGRA funded nearly 30 organizations in eight African countries for training African crop scientists at African universities to work within their communities. In addition to providing funds, the Rockefeller Foundation seconded two experienced program officers to AGRA—Joe DeVries to lead the work on seeds and Akin Adesina to lead the work on building markets.

AGRA also worked to improve access for small farmers to affordable fertilizers and irrigation. It focused in 2007, for example, on soil health and fertility, which included both petrochemical and organic fertilizer distribution and education. "Africa's soils," AGRA states, "are significantly depleted," and thus warrant "application of fertilizers combined with soil fertility management" to replenish soils and promote food security at a lower chemical level than many developed countries.

The Alliance acknowledged that conditions in Africa were different from those in Asia and Latin America, requiring a different approach for the new Green Revolution. AGRA valued the lessons learned from the earlier Green Revolution, but recognized that new models needed to be developed for Africa. As the Alliance pointed out, given the poor soil quality in Africa, a key objective was "to make sure that the African experience is more environmentally sensitive." AGRA likewise aimed to "conserve and promote the diversity of African crops, cropping systems and livestock for future generations." It also took into account that "most of the smallholder farmers are women and therefore their access to land, appropriate technologies, and affordable finance is critical."

As the Alliance developed, the Gates and Rockefeller Foundation partnership provided critical funding that allowed AGRA to expand its work. In 2007, former United Nations Secretary General Kofi Annan became the first chair of the Alliance. By 2010, AGRA worked in 13 countries, pursuing a "system-wide approach" to stimulate gains in the quantity and quality of food crops in sub-Saharan Africa. Its Market Access Program resulted in greatly increased income and decreased food insecurity for farming families.

Strategically, the Alliance concentrated investment in the "breadbasket region" of four main countries: Ghana, Mali, Mozambique, and Tanzania. It also supported work in South Africa, Malawi, Zambia, Uganda, Kenya, Ethiopia, Rwanda, Nigeria, Niger, and Burkina Faso. Reflecting the historic pattern of the most successful Rockefeller Foundation initiatives, AGRA's core funding expanded to include resources provided by governments as well as other agencies and international institutions. AGRA was an independent organization by 2012, with its own board and governance structure whose "approach and leadership are uniquely African." By 2020 AGRA aims to cut food insecurity in half in 20 African countries, while doubling the incomes of 20 million small farmers and putting 15 countries on track to attain and sustain a Green Revolution.

Looking Forward

The worldwide economic crisis that began in 2008 had a profound impact on development efforts. As Judith Rodin said in her "president's letter" for the 2008 annual report, "people around the world found their communities in crisis" as "financial distress became financial disaster." Among other effects, "food security eroded and riots erupted." Yet, as Rodin observed, "this time of turbulence and tumult was also infused with reason

for optimism and hope," as philanthropists responded to efforts to promote the "well-being" of people across the globe in a time of crisis. The Foundation itself was founded during an economic recession, she pointed out, and has survived and done good works through 18 subsequent economic contractions.

Climate change has presented new challenges to agricultural science in recent years. "Food security," the Foundation stated in 2008, "slips further from reach as climate-sensitive agricultural ecosystems deteriorate." Climate change affects soil fertility in rural villages, traditional habitats for hunting and grazing, and access to clean water for drinking, fishing, and irrigation. The Foundation has taken very seriously the scientific predictions about the outcomes of these effects. According to its 2008 annual report, a Stanford University researcher supported by the Foundation suggests that climate change could depress maize production in southern Africa up to 30 percent in the next two decades. A scientist from Yale estimates that African smallholders relying on rain-fed land could suffer a financial loss of $28 per hectare each year.

Yet, as with the economic downturn, the Foundation sees in this new set of dangers new challenges. It seeks to help smallholder farmers at an ever-larger scale, primarily in Africa, by equipping them with its standard tool belt of agricultural technologies and practices, allowing them to sow resilient seeds, gain access to affordable fertilizers, better irrigate land, move product to market, and earn fair prices. Additionally, the Foundation aims to "achieve food security and spur economic growth over the long run" by "concurrently preparing for the effects of changing local and regional climates." While it remains committed to AGRA, the Foundation also searches for the "next generation of agricultural innovations," particularly "those that can strengthen smallholders' resilience to climate change."

Expanding its scope, the Rockefeller Foundation has funded efforts to "bridge disciplines of climate and agricultural science in African universities and think tanks," helping farmers prepare for and cope with imminent environmental changes. It has also invested in a way to safeguard the accomplishments of the Green Revolution through innovative weather insurance products designed to be affordable for African farmers. Technology in other areas has likewise been a key tool, with the Foundation supporting the World Food Programme's Climate and Disaster Risk Solutions team as it developed Africa RiskView, a software tool that allows scientists to "predict and assess the impact of severe droughts on food security throughout the continent." Ideally, Africa RiskView will allow preemptive response to climate-related food crises, including famine. Likewise, African Risk Capacity, a sovereign insurance

New strategies for agricultural development include marketing strategies that ensure fair prices for small-holder farmers in sub-Saharan Africa. (Jonas Bendiksen. The Rockefeller Foundation.)

program, provides African countries with immediate relief funding when a RiskView-documented drought threatens or causes famine.

All of these new avenues of funding highlight the Foundation's vision for the future. Throughout the 1990s and the first decade of the twenty-first century, it has sought to understand agricultural needs across the world and recalibrate its work accordingly. It has gone from concentrating on other regions to focusing immense funding on Africa, and from a highly specialized focus on biotechnology to a broader strategy that sees biotechnology as part of a range of helpful initiatives. More than ever, the Foundation is focused on innovation. As technology rapidly advances, and new threats of economic distress and climate change loom, this expansive and cutting-edge outlook serves the Foundation as a compass in its efforts at agricultural development and food security for all.

Elvin Stakman (center, with pipe) helped shape the Rockefeller Foundation's agricultural policy for several decades. He was a mentor to many agricultural scientists, and he helped convince policymakers that a revolution in agricultural production was possible. (Rockefeller Archive Center.)

An Epochal Contribution, A New Century Ahead

Near the end of his life, famed plant pathologist Elvin Stakman, who had been part of the Rockefeller Foundation's original survey team in Mexico, recalled a journey he took with Mexican agricultural scientist Benjamín Ortega Cantero. Ortega had studied with Stakman at the University of Minnesota during World War II, with the help of fellowships provided by the Rockefeller Foundation and the Mexican Ministry of Agriculture. After returning to Mexico he went to work for the Office of Special Studies. In 1952 he was appointed director of the Ministry's Northern Agricultural Zone, with an office in Torreón in the state of Coahuila.

On this particular day, Stakman and Ortega were in a pickup truck racing over dirt roads to inspect wheat fields. As they bounced along, the two men were "trying to develop a philosophy of the operations [of the Rockefeller Foundation] in Mexico." Suddenly, Ortega slammed on the brakes and, according to Stakman, glared at two farmworkers who were resting in the shade of some trees. Through the open window, he chastised the workers for not sticking to their fieldwork. But the men were unabashed. One explained that indeed they were working, and they would work harder after a little rest, but they had retreated to the shade for a moment to "philosophize" on the future of agriculture in Mexico.

As he told this story in 1967, Stakman was well aware of the irony. "That's just exactly what Benjamín Ortega and I had

been doing," he said. Indeed, as the truck pulled away, Ortega had turned to him and confessed, "Maybe we set them a bad example."

Stakman's interviewer asked about critics of the Rockefeller Foundation who suggested that American technology and resources had been wasted in Latin America because the efforts ran counter to the culture of the people. Stakman's answer focused on an abiding tension in academia between ideas that are theoretical, or embedded in the high culture of learning, and knowledge that is utilitarian or technological—in other words, applicable to immediate human problems. He acknowledged that the tension between these two ways of thinking lay at the heart of the work to which he had devoted his life.

"In all of the agricultural sciences," he said, "when you're trying to do something practical, very often you're utilizing standardized methods and you're not necessarily inventive, and you're not necessarily using the imagination—that is, scientific imagination. You're not projecting into the future. You're not determining policies—not determining truths. You're not really aiming to discover new truths. What you're doing is to use knowledge and develop skills to apply it."

But as Stakman had discovered over the course of a long career, the process of shaping any regional, national, or global philosophy of agriculture required other ways of thinking and engaging. From farmers to consumers, scientists to bureaucrats, philanthropists to entrepreneurs, the process of systemic innovation was far more complex than the search for technological solutions to narrow practical problems.

Since the Rockefeller Foundation was established in 1913, its leaders have looked to science and technology to increase agricultural yields. This science had, according to Stakman, "made an epochal contribution" to human welfare. Engineering these contributions required massive investment in research and in people. With his competitive intellect and inner drive, Stakman had been part of the first generation of agriculturalists who linked farming to public health through the new discoveries of nutrition. His talented students at Minnesota—including George Harrar, Norman Borlaug, and men like Benjamín Ortega Cantero (who would become undersecretary of agriculture in Mexico in the 1970s)—were his "gold nuggets." He had trained and mentored them as scientists under the aegis of the Rockefeller Foundation, later drawing on them for his philanthropic pursuits and building a network of innovators in the process. His work, in combination with the work of others in the Rockefeller Foundation, had laid the groundwork for a revolution in food production.

Over the course of a century, the Foundation has worked across divides of race, socioeconomics, language, and nationality. The tension between technology and culture permeated all of the Foundation's agricultural initiatives, from the American South to sub-Saharan Africa. Over the course of those years, the Foundation learned that the effort to implement new agricultural technologies required as much sensitivity to the farmers in the field as it did knowledge of hybrid seeds or biotechnology.

The Foundation worked with a variety of actors to bridge the divide, starting with outside agents like Booker T.

Washington and Seaman Knapp. After World War II the Foundation built its strategy around highly trained staff, assigned to the far corners of the world to live and work among farmers of different cultures who lacked formal training in science, but who knew their farms better than any professional. Finally, beginning in the 1970s, the Foundation came to rely on a new kind of agent who acted through the third-sector network of multilateral agencies, non-governmental organizations, and private foundations investing in international development.

This tension between technology and culture continues to characterize the Foundation's work in agriculture and food security. Those who served as cultural bridges in the past played a dynamic and important role in this story, because they were forced to confront the reality, again and again, that while science and technology offer enormous benefits to humanity, their effectiveness is bounded by the institutions and communities within which they are applied. The history of agricultural development has thus been a story of cross-cultural encounters framed by efforts to apply new solutions to old problems.

To its credit, when a gap developed between good intentions with bold expectations and failure in the field or limited success in the laboratory, the Rockefeller Foundation has adapted by modifying its approaches, listening to criticism, and submitting itself to vigorous self-evaluation. The most dynamic adaptation the Foundation made over the century was the willingness to revise its definition of agricultural prosperity. In the early years of its work, in the United States and Europe, the purpose of farm improvement programs was to better the socioeconomic status

of farmers by raising their yields through enhancing cultivation and fighting pests. Farmers who could increase their incomes would be more capable of supporting public services like education and public health. In funding an integrated set of social programs in rural China, however, the Rockefeller Foundation first acknowledged that farm productivity had to be connected to nutrition and public health—that the quantity and quality of production were both important. In the 1960s and 1970s, the Foundation's priorities shifted again as scientists focused on improving production, growing food, and expanding harvests to keep pace with the rapid rise of human populations in the emerging nations of the world, in what must have felt like a never-ending race against famine. Today, the Foundation's agricultural initiatives embrace two additional and interrelated values. Grants and programs seek to increase the quantity and quality of food while protecting and sustaining the environment and the community within which it is produced. In addition, these initiatives work to promote resilience so that the environment and the community are better able to respond to challenges and crises.

Though the targets of agriculture work have changed vastly over time, the Foundation has consistently reached out to the poor and marginalized rural communities around the world. Within the United States it has worked with the rural poor. In Europe it focused efforts on Northern and Eastern areas devastated by World War I. In China, Mexico, Colombia, Chile, and India, the Foundation worked with poor farmers and promoted agricultural science as a profession. Since the

1990s more emphasis has been placed on sub-Saharan Africa precisely because it has remained marginalized in an expanding global economy.

Exploitation and exclusion formed part of the story of agriculture and poverty in the postcolonial world of the twentieth century. It took many years for the Rockefeller Foundation to learn how to work in politically charged environments. The Foundation was often a victim of powerful historical forces beyond its control. Foundation officers in China were only partially aware of the ways in which social improvement programs were incorporated into the struggle between Communists and Nationalists. And yet the willingness to take risks and embrace new initiatives also led to stunning successes like Mexico.

The Foundation tried to remain neutral during the most political and violent century in history. It was almost impossible. It was a problem inherent in philanthropy. The Foundation constantly searched for a way to work outside the constraints of U.S. foreign policy and separate from national self-interest, but without challenging those interests. As a result, the Foundation has learned to work closely with a wide variety of partners, ranging from governments and NGOs to the private sector.

From the beginning, agriculture programs have been integral to the Foundation's efforts to improve quality of life for millions of people. Over the long run, the Foundation has worked to increase food security, improve health systems, and expand access to quality education and training as ways to develop individuals, communities, and nations. Attention to the local and the desire to build cross-cultural relationships have made agriculture

initiatives difficult at times, but also dynamic and responsive within the Foundation's history.

Since that first carryall ride down to Mexico so many years ago, agriculture has assumed a celebrated place of importance within the Rockefeller Foundation, informing its identity around the world. Today, as in 1913, the struggle to balance technology and culture to promote the well-being of humanity lies at the heart of the process of putting food on the table in households around the world. As the Rockefeller Foundation enters its second century, the lessons learned from these efforts to incorporate ways of life into scientific methods of cultivation and husbandry continue to inform the work of new generations of farmers, scientists, philanthropists, and policymakers in fields, laboratories, conference rooms, and legislative chambers throughout the world.

Food & Prosperity has been a group endeavor from start to finish, and many people deserve great thanks for their contributions.

The book is part of the Rockefeller Foundation's Centennial initiative. At the Rockefeller Foundation, President Judith Rodin inspired the project concept. Gary Toenniessen's support and willingness to review multiple drafts was invaluable. His expertise in microbiology and agricultural science, combined with four decades of work and leadership at the Rockefeller Foundation, helped develop and frame many of the ideas in this book. Bob Bykofsky and Elizabeth Pena in Records Management facilitated research of recent materials. The Foundation's Centennial team, including Michael Myers, Carolyn Bancroft, and Charlanne Burke, provided support and input, including reviewing drafts and providing essential feedback. Kathy Gomez collected photographs highlighting the Foundation's recent work. In the General Counsel's office, Shari Patrick and Erica Guyer provided legal guidance. Many people at the Foundation read manuscript drafts, including Heather Grady and Neill Coleman. Their work is greatly appreciated. Teneo Strategy kept us on track for the duration of the project. Many thanks to Michael Coakley, Andy Maas, and Max Dworin for their tireless work.

None of this would be possible without the staff at the Rockefeller Archive Center. Jack Meyers, RAC president, and James Allen Smith, its vice president, welcomed our team and provided continuous institutional support. Barb Shubinski and Teresa Iacobelli, the RAC's Rockefeller Foundation Centennial Research Fellows, generously coordinated with us, sharing ideas and research. The reference team applied their considerable skill to our efforts. Thanks to all the archivists, and especially Michele Hiltzik, assistant director and head of reference, and Tom Rosenbaum, as well as to Nancy Adgent, Mary Ann Quinn, and Monica Blank who provided valuable support at critical junctures.

Many worked to turn the manuscript into a beautiful book. The Pentagram team, including Michael Gericke, Matt McInerney, and Olya Domoradova, skillfully designed the series, according each individual book its own identity. Ernie Grafe provided diligent content and copyediting. Mindy Johnston and Leigh Armstrong handled photo rights management.

The Vantage Point team contributed immeasurably. Lois Facer managed photographs, helped with research, and provided administrative support. Claire Wilkens also helped select photographs. Sam Hurst facilitated writing and content development, helping to add punch and verve to key passages. Eric Abrahamson masterfully edited the manuscript, contributing historical integrity and journalistic clarity. He also served as sounding board and project manager, cultivating thematic elements and keeping everything coordinated and on track. Thanks also to my family and friends for their irreplaceable support.

All of the hands that helped sculpt this book shaped and improved it for the better. Any errors or omissions that remain are entirely my own.

Amanda Carroll Waterhouse

About This Book

John D. Rockefeller recognized that agricultural productivity is key to increasing overall wealth and health in the poorest of rural communities. Embracing the promise of science, the Rockefeller Foundation focused on the discovery of new technologies to enhance food production. But technology was never enough. New techniques and tools had to be adapted to local cultures and communities. This engaging book explores lessons learned from the Foundation's efforts to improve this most basic arena of human endeavor.

The Rockefeller Foundation Centennial Series

Published in sequence throughout the Rockefeller Foundation's centennial year in 2013, the six books in this series provide important case studies for people around the world who are working "to promote the well-being of humankind." Three books highlight lessons learned in the fields of agriculture, health and philanthropy. Three others explore the Foundation's work in Africa, Thailand and the United States. As a package, the books offer readers unique insights into the evolution of modern philanthropy.

About the Rockefeller Foundation

The Rockefeller Foundation is committed to achieving more equitable growth by expanding opportunity for more people in more places worldwide, and building resilience by helping them prepare for, withstand, and emerge stronger from acute shocks and chronic stresses. Throughout its history, the Foundation has supported the ingenuity of innovative thinkers and actors by providing the resources, networks, convening power, and technologies to move innovation from idea to impact. From funding an unknown scholar named Albert Einstein to accelerating the impact investing industry, the Foundation has a long tradition of enhancing the impact of individuals, institutions and organizations working to change the world. In today's dynamic and interconnected world the Rockefeller Foundation has a unique ability to address the challenges facing humankind through a 100-year legacy of innovation, intervention, and the influence to shape agendas and inform decision making.

Rockefeller Foundation

Innovation for the Next 100 Years