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# Charles Valentine Riley Memorial Lecture Series

## Agriculture: The Fuel for Sustainable Economic Development

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### *Proceedings of the 2008 AIARD Capitol Hill Forum*



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## **Cover**

Drawings by Charles Valentine Riley from his sketchbook of art studies held in the Special Collections at the U.S. Department of Agriculture, National Agricultural Library. These drawings are originally in color. To view them in color, see the cover of the online version of this volume at <http://hdl.handle.net/10113/19449>

***Top left:*** Plate 47. Neo-romantic Rosenburg Castle, built by Goldfuss in 1831; Drachenfels and Godesburg are in the background, undated.

***Top right:*** Plate 60. Rhine banks at dusk, undated.

***Lower left:*** Plate 61. Town of Ahrweiler, 1860.

***Lower right:*** Plate 32. The Monument on the Drachenfels, 1959.

**Charles Valentine Riley Memorial Lecture Series**

**The 2008 Charles Valentine Riley Memorial Lecture**

**and**

**Proceedings of the 2008 AIARD Capitol Hill Forum**

**Agriculture: The Fuel for Sustainable  
Economic Development**

Edited by Reed Hertford, Stephanie Curs, Richard Ridgway, Len Carey, Susan McCarthy,  
Maria Pisa, Tim Aylsworth, with additional copyediting by Melissa Smith and Helen White.

**Presented February 28, 2008  
Washington, DC**

## Abstract

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The Riley Memorial Lecture Series was established by the Riley Memorial Foundation in 2005 to acknowledge and honor the legacy of Professor Charles Valentine Riley, a prominent 19th-century agriculturist who possessed a vision for enhancing the success of agriculture through new scientific knowledge and linkages in the United States and beyond. This volume includes the 2008 Charles Valentine Riley Lecture and proceedings of the 2008 AIARD Capitol Hill Forum, held in conjunction with the Lecture on February 28, Washington, D.C.

Keywords: Agricultural development, developing countries, economic development, global agriculture, global development, global economy, global trade, poverty reduction, sustainable agriculture, sustainable economy.

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February 2009

## Acknowledgments

The Riley Memorial Lecture was established in 2005 by the Riley Memorial Foundation to honor the legacy of Charles Valentine Riley, prominent 19th-century agriculturalist. We are indebted today to the many contributions made by Riley in the field of agriculture.

The organizing sponsors share Riley's vision that the success of agriculture is greatly enhanced through new scientific knowledge and linkages in the United States and beyond. These values were fully expressed through the thoughtful comments and presentations given by the program speakers: Director General Joachim von Braun, International Food Policy Research Institute; Robert Townsend, World Bank; Mark Keenum, Under Secretary, United States Department of Agriculture; and Janet Poley, President, American Distance Education Consortium.

We are grateful to the Association for International Agriculture and Rural Development (AIARD) for opening their annual Capitol Hill Forum as a venue for the second Riley Memorial Lecture. We wish to further acknowledge the many contributions made by the AIARD membership, who helped to promote the Forum to their diverse communities; as well as the tangible contributions in hosting the website and the efforts of Joy Odom in managing the registration process.

We acknowledge the unselfish personal contributions of the organizing team who spent many hours in the planning and implementation of the program. The team included the following: for AIARD, President Robert Haggerty and Reed Hertford; Richard Ridgway, Riley Memorial Foundation; for Texas A&M University, Borlaug Institute, Stephanie Curs and Tim Aylsworth; for the U.S. Department of Agriculture, National Agricultural Library, Maria Pisa, Susan McCarthy, and Len Carey. And special thanks go to Melissa Smith, Texas A&M University, for designing this proceedings volume.

We are greatly appreciative of the direct financial support of the Riley Memorial Foundation; the U.S. Department of Agriculture, National Agricultural Library; Texas A&M University's Borlaug Institute; and the Association for International Agriculture and Rural Development. Additional support was provided by AgriFuture, LLC; Bread for the World; Catholic Relief Services; CNFA, Inc.; Congressional Hunger Center; Consultative Group on International Agricultural Research; DAI, Inc.; German Marshall Fund; Land O'Lakes International Development; National Association of State Universities and Land-Grant Colleges; and the World Cocoa Foundation.

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*“Agriculture is a powerful engine of economic growth and development worldwide.”*

T.W. Schultz (1963) winner of the 1979 Nobel Prize in Economics

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## Foreword

More than 200 members of the Washington, D. C. metropolitan area public policy community attended the 2008 AIARD (Association for International Agriculture and Rural Development) Capitol Hill Forum and Riley Memorial Lecture at the Rayburn House Office Building on February 28, 2008. To facilitate the participation of busy people, the 2-hour event, including lunch, provided four formal presentations and question/answer sessions. The goal of the AIARD forums is to help the public policy community better understand and fully appreciate the central role of agriculture in world development. This increased awareness can help close the gap between the needs of poor people in rural areas around the world who depend on agriculture and the public policy investments made in agriculture and rural development by multilateral organizations and our own and foreign governments.

AIARD partnered this year with three other institutions to enrich this event with their distinguished expertise in international agriculture and rural development: the Borlaug Institute of Texas A&M University, the Riley Memorial Foundation, and the U.S. Department of Agriculture, National Agricultural Library. One representative from each institution served on the Forum Executive Group (FXG), which led the planning and implementation of the event.

At the outset, the FXG encountered a major consensus that the emphasis of the program for the event be on the fundamentals of agriculture as the

fuel for sustainable economic development. Though more than 50 people were nominated as speakers, two nominees stood out to the group. Dr. Joachim von Braun, this year's keynote speaker and Riley Memorial Lecturer, was strongly recommended because of his distinguished experience and solid research. Dr. Rob Townsend, senior economist with the World Bank and a prime candidate for the Forum because of his fine contributions to the World Development Report, shared views from the report that focused on agriculture for the first time in many years.

We are especially proud of two additional lectures found in these proceedings. Janet Poley's presentation highlights information as an ingredient for accelerated agricultural development and sustainable economic growth. She discusses information as a "critical input" and points out that today's focus is on information access driven by the Internet, and that every developing country of the world seeks that access. Finally, Mark E. Keenum, Under Secretary, Farm and Foreign Agricultural Services, U.S. Department of Agriculture, provides a rich commentary on the Department's programs targeted at economic development for poor nations. Though not as well known to most of us as those of the U.S. Agency for International Development, these programs have their own merit because of the substantial win-win benefits they generate to the United States and to developing nations.

**Robert (Bob) J. Haggerty, President**  
Association for International Agriculture  
and Rural Development



Capitol Hill Forum panelists, left to right: Riley Memorial Lecturer Dr. Joachim von Braun, Dr. Mark Keenum, Dr. Janet Poley, Dr. Gale Buchanan, Dr. Robert Townsend, Moderator Dr. Mike McWhorter, at the 2008 Capitol Hill Forum and Charles Valentine Riley Memorial Lecture, on February 28, 2008, in the Rayburn House Office Building, Capitol Hill, Washington, D.C. Photo by Len Carey.

# Contents

**Welcoming Remarks** ..... 1  
Gale A. Buchanan

**The 2008 Charles Valentine Riley Memorial Lecture**

**Agriculture for Sustainable Economic Development:  
A Global R&D Initiative to Avoid a Deep and Complex Crisis** ..... 3  
Joachim von Braun

**Agriculture for Development: A Perspective from the 2008 World Development Report** ..... 15  
Robert Townsend

**Information Matters: From Delivery to Access** ..... 25  
Janet K. Poley

**Benefits to the United States of Sustainable Economic Progress in Developing Countries** ..... 35  
Mark Keenum

**Speaker Biographies** ..... 39

**Capitol Hill Forum Participants** ..... 41

**Charles Valentine Riley Biographical Notes** ..... 47

**Charles Valentine Riley Collection at the U.S. Department of Agriculture,  
National Agricultural Library** ..... 49



# Welcoming Remarks

**Gale A. Buchanan**

**United States Department of Agriculture Under Secretary  
for Research, Education and Economics**

It is a special pleasure to welcome you, on behalf of the Department of Agriculture, to this forum today honoring one of USDA's foremost entomologists and public figures, Charles Valentine Riley. The Department is honored to support this program through the National Agricultural Library and to have such distinguished lecturers here today.

These forums help underscore the important role agriculture plays in improving the lives of people everywhere. This year's topic, *Agriculture: The Fuel for Sustainable Economic Development*, promises to be a fitting tribute to the legacy and vision of Charles Valentine Riley.

Riley clearly understood that scientific knowledge is the most powerful tool we can use to improve agriculture and uplift humanity. He no doubt recognized that agriculture is the foundation industry of nations that undergirds all other economic sectors.

Science plays a key role in improving agriculture and empowering both people and nations to rise above the poverty which is the source of so much misery and conflict in the world today. How-

ever, agriculture must also be sustainable if it is to become the strong and lasting foundation which helps build prosperity and improves lives.

President Ronald Reagan once noted that despite its powerful military and impressive arsenal of nuclear weapons, the former Soviet Union was "a country which employs one-fifth of its population in agriculture [that] is unable to feed its own people."

Far too many nations today are unable to feed their people and lack the economic resources to buy food. Over half of the world's 6 billion people live lives of significant deprivation. Yet it is widely recognized that agriculture can play a key role in helping nations end the vicious cycle of poverty.

The Department of Agriculture has a long history of supporting international efforts to reduce hunger and poverty around the world through food programs and through scientific research and exchange. We believe that scientific agriculture offers the best hope for eliminating poverty around the world and that agriculture is indeed the "fuel for sustainable development."



# The 2008 Charles Valentine Riley<sup>1</sup> Memorial Lecture

## Agriculture for Sustainable Economic Development: A Global R&D Initiative to Avoid a Deep and Complex Crisis

Joachim von Braun<sup>2</sup>

### Abstract

World agriculture has entered a new, unsustainable, and politically risky period. Agriculture, and the natural resources it depends on, has been over-exploited ecologically, has suffered from underinvestment, has recently been exposed to ill-designed bioenergy programs, and has been politically sidelined for too long. It is now at a critical point. Appropriate responses to the food and agriculture price and productivity crises are lacking. *A global initiative for accelerated agricultural productivity is necessary now; such an initiative makes economic sense, is pro-poor and sustainable, and serves security.* The initiative needs political leadership and coordination. There is no effective governance architecture at the global level and national levels to address the matter. Industrialized economies, including the United States, should substantially accelerate their investment in international agricultural research and development (R&D) in cooperation with new players.

### The Issues at Stake

World agriculture has entered a new, unsustainable, and politically risky period. Agriculture, and the natural resources it depends on, has been over-exploited ecologically, has suffered from underinvestment, has recently been exposed to ill-designed bioenergy programs, and has been politically sidelined for too long.

World agriculture depends mostly on small farms. More than 400 million small farms in the developing world hardly appear on the radar screens of economic policymakers, though the households connected to these farms are home to

the majority of the world's hungry and poor people. Pressures on food availability are particularly affecting those who can afford it the least—the poor and food insecure.

Agriculture is being re-identified as an essential element of economic growth in developing countries where food security also relates to broader security concerns, but this recognition has been too slow in coming. What is required now is a new vision for a transforming, productive, and economically sustainable agricultural sector in the developing world.

When it comes to climate change, agriculture is part of the problem and part of the solution because it adds to greenhouse gases and offers opportunities for carbon mitigation. Emerging climate change impacts in developing countries, such as water scarcity and policies for biomass and CO<sub>2</sub>, further complicate the food supply and price situation.

Globalization of retail industries and high-value commodity diversification strengthen the geographical and cross-sectoral linkages in the food system. Though such global economic integration could help the poor, there will be not only winners but also losers.

---

<sup>1</sup>Charles Valentine Riley was born in London on September 19, 1843 and moved to the United States at the age of 17. In 1868, he was appointed to the office of entomologist of the State of Missouri, where he studied the plague of grasshoppers that invaded many western states between 1873 and 1877. In 1878, he was appointed as an entomologist with the U.S. Department of Agriculture. He was one of the first to practice biological insect control, introducing a beetle that was the natural enemy to a scale that was damaging the California citrus industry. Riley is known as the “father of biological control.” He was among the first to notice that American grapes (*Vitis labrusca*) were resistant to grape *Phylloxera*, and his work helped save the French wine industry. Riley received the French Grand Gold Medal for his efforts and was named a Chevalier of the Legion of Honor in 1884. Riley authored more than 2,400 publications. He died September 14, 1895, the result of a bicycle accident. For more information, see “Charles Valentine Riley Biographical Notes” on page 47 of this volume.

<sup>2</sup>Joachim von Braun is Director General, International Food Policy Research Institute.

How can agricultural growth be accelerated and translated into pro-poor and sustainable development in light of the new challenges and pressures? This paper will discuss some recent key changes in the world food system: rapidly globalizing agricultural markets, the integration of the agribusiness chain, increased trade, changing trade policies, high food prices, closer agriculture–energy sector linkages, sustainability threats, and security synergies.

Charles Riley’s vision for agricultural advancement through new scientific knowledge is today more relevant than ever. The key message here is that a new strategic policy portfolio of science, trade, and rural services is needed at the national and international levels to ensure sustainable growth and to reduce the political risks.

### **Globalization of the Agrifood System**

Agriculture growth is today very much driven by the demand side—toward consumers who are getting richer and the retail industries that cater to them. The regional and intercontinental integration of the agrifood system is both a consequence of and a factor in the larger process of globalization. The 6.5 billion global consumers are served by a variety of suppliers that include food retailers standing next to the road in Africa as well as modern supermarkets. Supermarkets are supplied by the food processing and trading industries, which in turn are supplied by the farm sector, which receives its inputs from companies producing fertilizers, agrochemicals, seeds, and other inputs (figure 1). In this system, international corpora-

tions have been increasing their power and leverage. Between 2004 and 2006, the sales of the top 10 food retailers soared by more than 40 percent, while the sales of the top food processors and agricultural input companies grew by 13 and 10 percent, respectively (von Braun 2007). The sustainability of agriculture can no longer be defined by fields or farms or ecologies. Today, agriculture sustainability spans the globe, the whole value chain of food- and agriculture-related inputs and outputs, and includes outcomes such as nutrition, health, and safety.

What and how is the small farmer doing in this time of change? On the one hand, globalization of the agrifood system and consumption of high-value agricultural produce could offer huge opportunities to small agricultural producers in developing countries. On the other hand, many farmers are faced with high barriers to market entry due to geographic distance to national market centers and the safety and quality standards of food processors and retailers. Contract farming and cooperation schemes are ways to overcome this dilemma. The disparity of scale between small farmers and the rest of the agrifood business chain is increasing due to further fragmentation of agricultural holdings in many countries. In India, for example, the fragmentation of landholdings has continued to increase since 1991 (Birthal et al. 2007).

### **The New Global Power Structure of Agriculture**

Developing countries and middle-income economies are playing an increasingly important role in the global agrifood system. Higher incomes and urbanization are raising food spending in developing countries. In the past 20 years, the United States’ and Western Europe’s share of world agricultural production has decreased by 9 and 19 percent, respectively, while the share of Brazil, China, and India has substantially increased (figure 2). The share of agriculture in the economy has fallen in all of the sample countries; its share in the United States and Western Europe is currently at

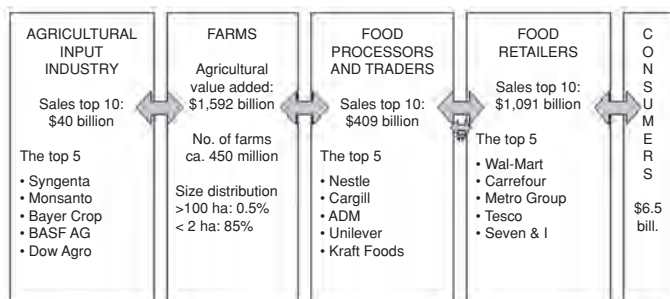


Figure 1. The global agrifood business chain, 2006. (Source: von Braun 2007.)

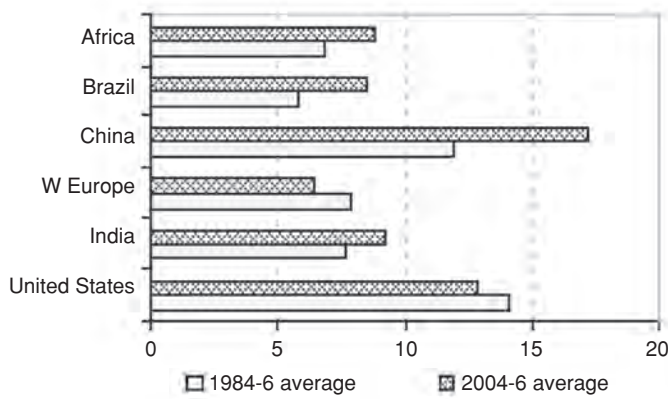


Figure 2. Agricultural production by country and region, percent of total. W. Europe includes Belgium, France, Germany, Liechtenstein, Luxembourg, the Netherlands, and Switzerland. (Source: FAO 2008a.)

a mere 1 and 2 percent of Gross Domestic Product (GDP), respectively (World Bank 2007a). In contrast, the agricultural sector in Africa currently contributes 20 to 40 percent of overall GDP and employs 60 percent of the labor force (World Bank 2007a, Beintema and Stads 2004).

The integration of the agrifood system becomes most evident in global agricultural trade. Between 1985 and 2005, world trade in agricultural products increased more than threefold (FAO 2008a). Trade is also an area that provides evidence for new developments in the global power system of agriculture. The share of world agricultural exports of one of the major producers—the United States—has declined by 33 percent since 1983–1985 (FAO 2008a). In some of the largest developing countries—China, India, and Brazil—the share has remained almost constant despite rising production due to increased domestic demand. A more open trade regime in agriculture would have far-reaching positive effects, but the negotiations through the Doha Round are currently stalled. Developed countries continue to be a major import market for agricultural commodities and their trade and domestic protection policies have major implications for developing countries.

Agriculture policy is today increasingly made outside of the domain of agriculture, and often as an offshoot of energy or infrastructure policy.

While the U.S. farm bill includes some biofuel support programs, for example, most government support for biodiesel production is outlined in the energy bill and entails large subsidies. Developing countries are unable to provide agricultural support on such a scale, and especially not in new markets such as for biofuels and for CO<sub>2</sub> sequestration.

The global power system of agriculture now consists of a conglomerate of different players. The playing field includes new actors, such as energy and retail market players, and traditional ones, such as the input industries and food processors. However, global agriculture issues currently have only a limited decisionmaking architecture relating to public goods such as water, climate, and food safety. What is missing is a recognized governance platform that addresses the growth opportunities and sustainability threats on a global scale. The current state of multiple agricultural agendas is risky and leads to serious lack of attention to the management of and investment in agriculture-related global public policy issues. This lack of a coordinated global response is visible in the field of agriculture-energy policies, climate change mitigation and adaptation policies for agriculture, food aid policies, and agriculture-health and food safety policies. It also is evident in the lack of a coordinated response to rising world food prices.

### ***Rising Food Prices***

Surging food and oil prices have turned the attention of policymakers and the public to the world food equation and food–energy price linkages. Between 2000 and 2008, the prices of wheat and petroleum in dollar terms increased more than threefold, while the prices of corn and rice more than doubled (figure 3). When adjusted for inflation or reported in Euros, the price increases are smaller, but also drastic.

The major drivers of increases in cereal prices have been the high demand for food (and feed) due to income growth (and less so due to population growth), high demand for biofuels, and slow production responses to that rising demand. Between 2000 and 2006, cereal supply increased by a mere

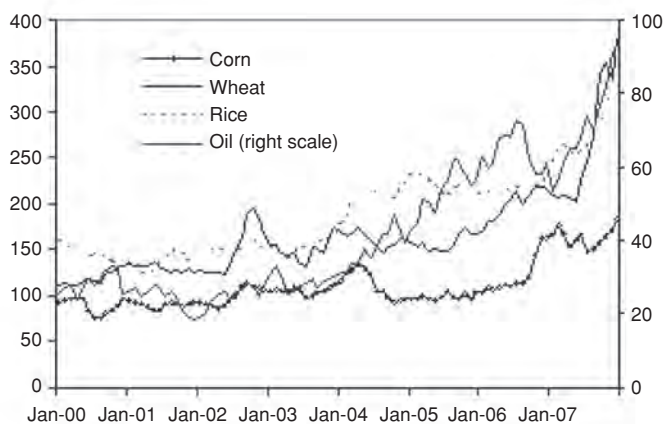


Figure 3. Commodity prices (US\$/ton), January 2000–January 2008 (Sources: Data from FAO 2008b and IMF 2008.)

8 percent and stocks declined to low levels (von Braun 2007).

This inelastic response of cereal supply is characteristic of aggregate agriculture supply as well. Studies over the past several decades suggest that typically a price increase of 10 percent results in only a 1-percent increase in aggregate agriculture production, and that response takes time. Today, the supply response takes even more time because it needs to come from higher yields (and not from area expansion) and from increased productivity in the livestock sector. These responses need prior investments in R&D services and input supply systems. Farms have become smaller in most of the developing world over the past few decades. This trend leads to further challenges since the supply response in small-farm agriculture is impaired by constrained access to capital and innovation and a lack of organization among small farmers. Furthermore, the higher but more unstable prices observed today trigger smaller production responses, while improved rural infrastructure triggers higher responsiveness. Still, underinvestment in rural roads, electricity, and communications infrastructure impairs supply response in developing countries.

A rise in cereal prices has uneven impacts across countries and population groups. Households that are net buyers of food, which represent the large majority of the world’s poor, are negatively impacted (von Braun 2007). It is largely

the poor who respond to food prices with reduced consumption and changed patterns of demand, leading to calorie and nutrition deficiencies. Since food accounts for a large share of their total expenditures, the impact on the poor can be dramatic. Faced with higher prices, the poor switch to foods with lower nutritional value and to foods lacking important micronutrients.

On the demand side, the growth in the consumption of cereals has been particularly high in industrial countries. Since 2000, cereal use for food and feed has increased by 4 and 7 percent, respectively, while cereal use for industrial purposes increased by more than 25 percent (FAO 2003 and 2007). In the United States in 2007–2008, corn for ethanol production is projected to account for more than 30 percent of domestic use in the country (USDA 2008). As calls for energy security remain strong, this high cereal demand trend is likely to continue and spread globally.

On top of these demand and supply changes come production shocks (such as Australia’s drought) and reduced grain stocks, which make the markets more and more nervous the smaller the stocks become. Such nervousness invites speculative capital, and the trade restrictions triggered by high prices in many countries further narrow the global market and result in “starving your neighbor” policies. These are unsustainable policies that also undermine political security.

### ***Expanding Biofuel Production***

The expansion of new sources of biofuels such as ethanol and biodiesel has a strong effect on agricultural prices, since biofuel production largely draws on natural vegetation. Second-generation technology is still a long way away. Incorporating new developments in supply and demand, as well as actual biofuel investment plans, IFPRI’s International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT)<sup>3</sup> projects that the prices of maize and oilseeds will increase by

<sup>3</sup>The IMPACT Model is managed by IFPRI’s Environment and Production Technology Division under the leadership of Mark Rosegrant.

26 and 18 percent, respectively, by 2020. A more drastic expansion scenario doubling the production levels assumed in the first scenario projects even more dramatic increases in the price of maize and oil seeds—by 72 and 44 percent (von Braun 2007).

In addition, biofuels have indisputably created new linkages, trade-offs, and competition between the agricultural and energy sectors. The concentration of demand in developed countries also implies potential for biofuel exports from the rest of the world. Removing trade barriers will facilitate the establishment and expansion of biofuel production in countries with a comparative advantage. On the other hand, distorting subsidy regimes for biofuels and agricultural products used as biofuel feedstock will undermine the comparative advantage of developing countries.

Many countries have already established ambitious biofuel expansion plans and blending targets, yet biofuel production remains uncompetitive in many places of the world. Recent increases in the prices of cereals and oil seeds signal that, as increased biofuel demand began to stimulate agricultural prices, the competitiveness of biofuels began to decline because the feedstock price is critical for the competitiveness of biofuels. Maize ethanol, of which the United States is currently the largest producer, has been controversial because, until recently, it had a negative energy balance—the amount of energy used to produce it was greater than the output of energy of the final product—and its impacts on greenhouse gas mitigation is limited, too. Recent research frequently finds a negative effect of biofuels on greenhouse gas emissions (Searchinger et al. 2008 and Fargione et al. 2008).

Whether expanded biofuel production is an environmentally sustainable source of energy depends on the choice of feedstock, cultivation practices, technologies employed, and the security, trade, and environmental policies that are adopted. Factoring in environmental and economic aspects, embarking on large-scale biofuel production with current technologies does not make sense at this time. For many developing countries, it would be

more rational to wait for the emergence of second- and third-generation technologies, and “leap-frog” onto these technologies later. This will be an important area for sharing innovations between industrialized countries and developing countries in the future that could serve global sustainability. As the majority of patents in biofuels are held by the private sector, this is a promising area for public–private partnerships.

## **The Threats to Agricultural Sustainability and Resources**

Agricultural production has experienced impressive growth in many developing countries, but is this growth sustainable? In sub-Saharan Africa, agriculture has been reaching almost 6-percent growth in recent years (IMF 2007). Yet, when it is driven by area expansion, this growth can undermine natural resources, forests, and water systems. In the main domains of natural resources that are key to agriculture, new threats have become more visible in recent years, and outlooks raise concerns.

### **Water**

Climate change, population growth, irrigation, and industrial expansion increase competition for water. About 1.4 billion people now live in river basins where water use surpasses recharge rates. In many countries, developed water sources are almost fully utilized, and new sources are becoming increasingly expensive to develop (UNDP 2006). Irrigation provides productivity gains and greater food security, yet it also exerts substantial pressures on limited water resources. In developing countries, irrigated agriculture is the largest user of water resources, accounting for more than 80 percent of water use (FAO 2008c). However, this does not mean that irrigation in the developing world is widely or equally spread. Sub-Saharan Africa, for example, is highly dependent on rainfed agriculture and accounts for less than 5 percent of global irrigation (UNDP 2006). The potential for agricultural

expansion needs to be evaluated against existing water resources and the constraints to their expansion. For agricultural growth to be sustainable, efficiency and equity of water use in agricultural production needs to be increased.

## **Soils**

Overgrazing, deforestation, and inappropriate agricultural practices have been some of the major forces behind soil degradation. Inappropriate agricultural practices are often associated with insufficient use of mineral fertilizers, rather than overuse. Farmers apply about 9 kg/ha of fertilizer in Africa, compared with 142 kg/ha in Southeast Asia. Soil degradation affects one-fourth of the world's agricultural land and the pace of degradation has increased in the past 50 years. Soil quality is a major variable influencing agricultural yields, and erosion has already had significant impacts on the productivity of about 16 percent of the agricultural land in developing countries (Scherr 1999). The goal of simultaneously protecting the environment, assuring the sustainability of global soil resources, and increasing agricultural production should build on increased agricultural productivity and improved agricultural practices.

## **Biodiversity**

Biodiversity conservation is severely impacted by the conversion of forests and wild lands to farmland and pastures. Maintaining the genetic richness of crops and varieties is of key importance to farm productivity. Crop genetic improvements have increased resistance to pests, diseases, and climatic shocks. Biotechnology can enhance these positive effects. As a result, yields have increased, but at the same time, crop genetic diversity is eroding as traditional varieties are being widely replaced by genetically uniform and stable modern varieties. Plants that have been guarded and bred by generations of farmers are in danger of being lost and many have recently been placed into storage in the new permafrost genebank in Spitzbergen, Norway.

## **Climate Change and Climate Risks**

As climate change increases climate vulnerability, temperature, and the risk of droughts and floods, agricultural productivity losses are imminent and the sustainability of agriculture is at risk. World agricultural GDP is projected to decrease by 16 percent by 2020 due to global warming. The impact on developing countries will be much more severe than on developed countries. Output in developing countries is projected to decline by 20 percent, while output in industrial countries is projected to decline by 6 percent (Cline 2007). In a group of more than 40 developing countries, mainly in sub-Saharan Africa, cereal yields are expected to decline with mean losses of about 15 percent by 2080 (Fischer et al. 2005). As a consequence of climate change, low-income countries with limited adaptive capacities will be faced with significant threats to food security.

## **Underutilized Opportunity: The Agricultural Growth and Poverty-Reduction Link**

The vision of the future of agriculture in the developing world should not focus on conserving small farms, but on a measured and appropriate transformation toward viable farm units and clusters of part-time and specialized farms. Subsistence agriculture is not a viable option for getting out of poverty (von Braun and Kennedy 1994). Increasing rural-urban migration is affecting labor availability for agricultural activities and the flows of goods and money between rural and urban areas. Projections show that urban transformation will continue to occur at an increasingly rapid pace; 61 percent of the world's population is projected to live in urban areas by 2030 (Cohen 2006). Droughts, land scarcity, and low wages in rural areas, compared with better job opportunities and lower or different risks in urban areas, are increasing labor-related migration out of rural areas (von Braun 2005). However, three-quarters of the poor remain in rural areas, and rural poverty is projected to be higher

than urban poverty for decades to come (Ravalion et al. 2007). A massive transformation is in the making: global farm employment is estimated to decrease by about 300 million people by 2020, while employment in services and industry—both in urban and rural areas—is expected to grow by 400 million people.<sup>1</sup> Further development of labor-market institutions is needed to enable the participation of rural areas in the national economy.

Improving the livelihoods of people at the bottom of the income scale and including them in the growth process has proven difficult, especially in environments with high inequality and discrimination. The number of undernourished in the developing world actually increased from 823 million in 1990 to 830 million in 2004 (FAO 2006). A look beneath the dollar-a-day poverty line reveals that about 160 million people in the world continue to live in ultra poverty, on less than 50 cents a day (Ahmed et al. 2007). In a worrying trend, the most severe deprivation has increasingly been concentrated in sub-Saharan Africa, which has experienced a significant increase in the number of the ultra poor since 1990 and is currently home to three-quarters of the world's ultra poor people (Ahmed et al. 2007). These poorest are particularly hard hit by the high and volatile food prices.

## **The Underrated Agriculture and Security Risks**

Sustainability of agriculture is today not only a matter of appropriate management and utilization of natural resources and ecosystems, but also a matter of sustainability of states and political systems. For example, energy security objectives led to subsidized expansion of biofuel production, driving up food prices around the world. The poorest suffer silently for a while, but the middle class typically has the ability to organize, protest, and lobby early on. Although domestic causes such as neglect of agriculture and the rural economy may play an important role, the people's disenchantment is frequently diverted by political leaderships to external causes. The trivial energy security gain brought about by

biofuel production here may be largely overwhelmed by broader losses in political security emerging from frustration and aggression. Increased engagement of the United States in international agriculture capacity strengthening could correct the problem.<sup>2</sup>

Making the world more peaceful is directly linked to making the world more food secure and affluent. It has long been recognized that social conflict increases food insecurity, but it also needs to be pointed out that food insecurity can be a key source of conflict. Some of the trigger conditions of violence can be directly related to change in the prices of staple foods or cash crops. Unchanneled frustration that is insufficiently organized or repressed can lead to conflict (Messer and Cohen 2008). Rising prices of tortillas in Mexico City and bread in Uzbekistan have led to riots. The new food situation poses a threat to the basic dignity of large populations of people. Cutting food aid at the same time when it is needed more would add to the security problem.

## **A Global R&D and Technology Offensive for Agriculture**

The world is facing an agricultural crisis. This crisis is more complex than the ones of the 1960s or the 1880s because it is the result of a dangerous mix of economic, environmental, and political factors that have come together in a much more crowded and much better-informed world. Relative deprivation matters more today.

Technology has been a critical component in preventing Malthusian predictions of population growth outpacing agricultural production, instigating the Green Revolution in Asia in the 1960s

<sup>1</sup>Estimates based on ILO economically active populations projections and own estimates of sector shares.

<sup>2</sup>Robert Gates, U.S. Secretary of Defense, stated at the World Food Prize Symposium in Des Moines, Iowa, in 2006: "It could be argued that our inability to continue our investment in human capital on a scale that we did in the 1960s and 1970s is a factor that has contributed at least in some measure to instability in many places today and hostility to the United States . . . The United States was the key influence in developing the Indian agricultural university system, the key contributor to the African agricultural universities, and to Asian and Latin American agricultural universities as well. But such U.S. programs are now a pale shadow of what they once were. Science has disappeared. Human capital development has disappeared. And the investments for long-term institution building have nearly disappeared."

and 1970s in which the centers of the Consultative Group on International Agricultural Research (CGIAR) played key roles. However, agriculture and technological innovation for agricultural productivity have not moved high enough on the agenda. According to the latest World Development Report, which focused on agriculture for development, agriculture R&D investments in developing countries have an average rate of return of 43 percent (World Bank 2007b). Yet, underinvestment in agriculture and agricultural R&D has prevailed for too long. The persistence of poverty in the rural areas of low- and middle-income countries, of high food prices undermining livelihoods, and of deficiencies in the sustainability of agriculture requires large-scale global action. That response must have at its core R&D and technology, and the countries with strong science systems, especially the United States, Europe, China, India, and others can lead in supporting such an initiative.

Technological breakthroughs, and their adoption on a large scale, have had high positive social payoffs. In the area of agricultural production, technological advancements and improvements in information and communication technologies (ICTs) have increased productivity, reduced transaction costs, opened new markets, and provided additional positive network externalities (Torero and von Braun 2006). The quick spread of ICTs has been impressive, but low-income countries still lag behind. And whereas leapfrogging worked for the cell phone, that technology had unusual properties that do not apply to most other technology domains. Agricultural technology is not an easy candidate for leapfrogging. It needs persistence, patience, and commitment, as was so well demonstrated by Charles Riley. Agriculture biotechnology is no exception. It currently spreads relatively fast, but still slowly measured by leapfrogging standards. In 2007, about 11 million farmers in 12 developing countries were growing biotech crops (Clive 2007), but these farmers represent a small fraction of the ones working on the 400 million farms in developing countries. Dissemination of technology in agriculture requires much more upfront investment in effective technology utiliza-

tion, including rural education, infrastructure, and extension services.

Since the mid-1990s, expenditures on R&D have increased at very low rates in developed countries. In the United States, Japan, and the European Union, spending increased by less than 3 percent a year in real terms (OECD 2007). In contrast, spending in China grew by 18 percent per year since 2000 (OECD 2007). Surpassing Japan, China currently ranks second in the world in gross domestic expenditure on R&D. The United States, still at number one, invested more than \$343 billion in R&D, almost two-and-a-half times more than China.

The Agricultural Science and Technology Indicators (ASTI) initiative of the International Food Policy Research Institute (IFPRI) provides information on expenditures on agricultural science and technology in particular. Between 1981 and 2000, global public agricultural R&D increased from 15.2 to 23 billion international dollars, with slowed growth in the 1990s (figure 4). Therefore, developing countries on the whole are currently undertaking most of the world's public agricultural R&D (66 percent), but this is largely due to China and India. The two countries are the largest investors, with spending growth in the 1990s averaging 6.4 and

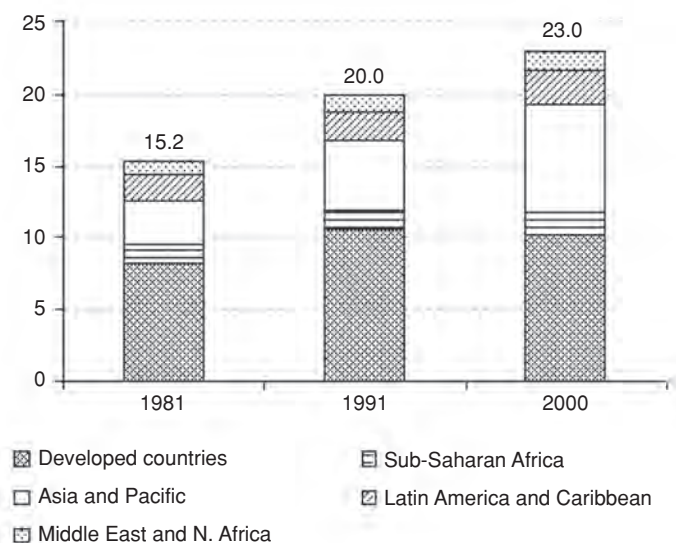


Figure 4. Public agricultural R&D, in billion of 2000 international dollars (Source: Pardey et al. 2006.)

5 percent, respectively, while R&D expenditures in developed countries at large stagnated and even slightly decreased (Pardey et al. 2006). Despite exceptions like China, Brazil, and India, most developing countries are still underinvesting in agricultural R&D and are dependent on developed countries for science and technology spillovers. In 2000, 80 developing nations accounted for only 6 percent of global R&D spending. In comparison, each one of more than 35 public universities in the United States spent more than this amount in 2004. In recent years, stagnation of agricultural R&D spending in the United States has continued. Agricultural research spending has decreased from 2.7 billion, or 12.4 percent of total discretionary spending in 2005, to 2.5 billion, or 10.4 percent of total discretionary spending in 2007 (OMB 2008 and OMB 2006). In contrast, spending in India from fiscal year 2004/5 to 2006/7 increased by 29 percent adjusted for inflation (India Ministry of Finance 2008, Reserve Bank of India 2008).

As developed countries are switching from crop production to more multifunctional agriculture, they are increasingly investing in research that is not directly related to productivity enhancement and transformation of subsistence farming. Food safety concerns and rising demand for high-value commodities and processed foods redirect funds to organic farming and enhancing specific attributes of food. As a result of the reduced applicability of new technologies, the spillover pathways to developing countries for productivity enhancement are reduced. Also, more expensive and advanced R&D needs to be undertaken for local adaptation and additional development. Some developing countries have become “technological orphans” as their traditional private- and public-sector benefactors cut their support (Pardey et al. 2006).

A critical element of sustainable agriculture is the increase in crop and livestock productivity. Yields per unit of land are only one such indication, and their trends do not look encouraging. Sub-Saharan Africa is lagging far behind the cereal yield growth and its gap with the yields in other regions has increased (figure 5). Total factor productivity tends to be at about 1 to 1.2 percent per

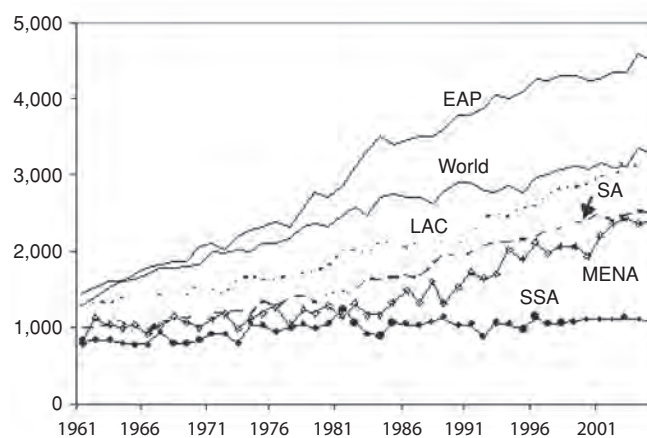


Figure 5. Growth of cereal yields by region in kg per hectare, 1961–2005 (Source: World Bank 2007a. EAP—East Asia and the Pacific, LAC—Latin America and the Caribbean, SA—South Asia, SSA—sub-Saharan Africa, MENA—Middle East and North Africa.)

annum at current research expenditures; for China it is closer to 2 percent. On a global scale, these productivity gains are simply too low to deal with the demand growth in sustainable ways.

The global environment for innovation is also changing. Under the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), for example, patent rights for agricultural inventions are being introduced. Strengthening intellectual property rights would, on the one hand, increase the incentives for investing in R&D, but would, on the other hand, make technologies that had been freely available much harder to access and use. At the same time, the need for more global research is increasing due to factors such as climate change, continuing population growth, and concerns about food quality and safety.

The CGIAR, which supports the work of 15 agricultural research centers and works with research institutions in the developing world to improve local research capacity, has a key role to play in addressing the global problem of underinvestment in agricultural research. To sustainably increase R&D, effective public–private partnerships that increase efficiency of use of the resources already available and political commitment at the national level are needed.

## **Serving Sustainability: Toward a Global R&D Initiative**

### ***Global Political Attention at the Highest Levels***

Agriculture needs to move to the highest place on the political agenda. No longer can the global community afford to ignore ecological overexploitation, massive underinvestment in agriculture, and the consequences of ill-designed bioenergy programs. The world is now facing a new and historically different agricultural crisis resulting from a dangerous mix of economic, environmental, and political factors.

### ***Specific Policy Action to Protect the Poorest From Excessively High Food Prices***

Agriculture today is strongly driven by the demand side. The demand for high-value foods has increased dramatically as large numbers of people in the developing world have gotten richer. While this is very good news for net sellers, most of the world's poor are net buyers of food, and because food accounts for a large share of their total expenditures, the impact is dramatic. The poorest are being left behind. They are feeling the effects of higher food prices due to the policy actions and consumption power of their now wealthier global neighbors, and are responding to the higher prices by reducing consumption and altering patterns of demand, which is leading to nutrition deficiencies.

### ***Major Investments in Services and Input Supply Systems, as Well as Expanded Access to Financing and Innovation for Small Farmers***

Productivity response and overall supply response are lagging because today much of that response needs to come in the form of increased yields and productivity gains along the whole

food chain, not just on the farm. These responses need prior investments in services and input supply systems. At the same time, farms have become smaller in most of the developing world over past decades, and small-farm agriculture is impaired by constrained access to financing and innovation and by a lack of organization among small farmers.

### ***An Urgent Global R&D Initiative for Accelerated Agricultural Productivity***

Central to the sustainability of world agriculture is a global R&D initiative for accelerated agriculture productivity; such an initiative makes economic sense, is pro-poor and sustainable, and serves security. The R&D initiative needs political leadership and coordination. Industrialized economies, including the United States, should substantially accelerate their investment in international agricultural research and development.

### ***Enhanced Collaboration of Old and New Key Global Agricultural Players***

In order to effectively implement such a global R&D initiative for accelerated agriculture productivity, a new agriculture, food, and nutrition governance architecture is needed to provide the appropriate political response to the global price and productivity crisis. A coordinated global response is needed in the form of agriculture-energy policies, climate change mitigation and adaptation policies for agriculture, food aid policies, and agriculture-health and food-safety policies. Agricultural power has become more spread around the world, with the result that there is no governance architecture that can generate appropriate political responses to the food and agriculture price and productivity crisis at the global and national levels. Under such a new global architecture, new partnerships among old and new players such as the United States, Europe, China, India, Brazil, UN agencies, the CGIAR, and foundations, and the private sector must be facilitated.

## References

- Ahmed, A., R. Hill, L. Smith, D. Wiesmann, and T. Frankenburger. 2007. *The world's most deprived: Characteristics and causes of extreme poverty and hunger*. 2020 Discussion Paper 43. Washington, D.C.: International Food Policy Research Institute.
- Beintema, N. M., and G. Stads. 2004. *Investing in sub-Saharan African agricultural research*. 2020 Africa Conference Brief 8. Washington, D.C.: International Food Policy Research Institute.
- Birthal P. S., P. K. Joshi, D. Roy, and A. Throat. 2007. *Diversification in Indian agriculture towards high-value crops: The role of smallholders*. Discussion Paper 00727. Washington, D.C.: International Food Policy Research Institute.
- Cline, W. R. 2007. *Global warming and agriculture: Impact estimates by country*. Washington, D.C.: Center for Global Development and Peterson Institute for International Economics.
- Clive J. 2007. Global status of commercialized biotech/GM crops: 2007. ISAAA Brief 37. Ithaca, NY: International Service for the Acquisition of Agri-Biotech Applications.
- Cohen, B. 2006. Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability. *Technology in Society* 28: 63–80.
- FAO (Food and Agriculture Organization of the United Nations). 2003. Food Outlook No.5 – November 2003. Rome.
- \_\_\_\_\_. 2006. *The State of Food Insecurity in the World* 2006. Rome.
- \_\_\_\_\_. 2007. Food Outlook– November 2007. Rome.
- \_\_\_\_\_. 2008a. FAOSTAT database. Available at [www.faostat.fao.org/default.aspx](http://www.faostat.fao.org/default.aspx).
- \_\_\_\_\_. 2008b. International Commodity Prices Database. Available at [www.fao.org/es/esc/prices/PricesServlet.jsp?lang=en](http://www.fao.org/es/esc/prices/PricesServlet.jsp?lang=en).
- \_\_\_\_\_. 2008c. AQUASTAT database. Available at <http://www.fao.org/nr/water/aquastat/main/index.stm>.
- Fargione, J., J. Hill, D. Tilman, S. Polasky, P. Hawthorne. 2008. *Land clearing and the biofuel carbon debt*. Science Express Report.
- Fischer, G., M. Shah, F. Tubiello, and H. van Velhuizen. 2005. Socio-economic and climate change impacts on agriculture: An integrated assessment, 1990-2080. *Philosophical Transactions of Royal Society B* 360: 2067-83.
- IMF (International Monetary Fund). 2008. International Financial Statistics Database. Washington, D.C. Available at [www.imfstatistics.org/imf/](http://www.imfstatistics.org/imf/).
- IMF (International Monetary Fund). 2007. World Economic Outlook Database. Washington, D.C. Available at [www.imf.org/external/pubs/ft/weo/2007/02/weodata/index.aspx](http://www.imf.org/external/pubs/ft/weo/2007/02/weodata/index.aspx).
- India Ministry of Finance. 2008. *Union Budget 2008-2009*. Available at <http://indiabudget.nic.in/>.
- Messer, E. and M. Cohen. 2008. Conflict, food insecurity, and globalization. Chapter in J. von Braun, J. and E. Díaz-Bonilla. 2008. *Globalization of food and agriculture and the poor*. Forthcoming.
- OECD (Organisation for Economic Co-operation and Development). 2007. *Main science and technology indicators (MSTI): 2007/2 edition*. Paris.
- OMB (Office of Management and Budget). 2008. Budget of the United States Government: Fiscal Year 2009. Available at <http://www.whitehouse.gov/omb/budget/fy2009/>.
- \_\_\_\_\_. 2006. Budget of the United States Government: Fiscal Year 2006. Available at <http://www.whitehouse.gov/omb/budget/fy2006/>.
- Pardey, P. G., J. M. Alston, and R. R. Piggott, eds. 2006. *Agricultural R&D in the developing world: Too little, too late*. Washington, D.C.: International Food Policy Research Institute.
- Searchinger, T., R. Heimlich, R. A. Houghton, F. Dong, A. Elobeid, J. Fabiosa, S. Tokgoz, D. Hayes, and T.-H. Yu. 2008. *Use of U.S. croplands for biofuels increases greenhouse gases through emissions from land use change*. Science Express Report.
- Ravallion, M., S. Chen, and P. Sangraula. 2007. *New evidence on the urbanization of global poverty*. Washington, D.C.: World Bank.
- Reserve Bank of India. 2008. RBI Bulletin. Available at [http://www.rbi.org.in/scripts/BS\\_ViewBulletin.aspx](http://www.rbi.org.in/scripts/BS_ViewBulletin.aspx).

Scherr, S. 1999. *Soil degradation: a threat to developing-country food security by 2020?*. 2020 Vision Discussion Paper 27. Washington, D.C.: International Food Policy Research Institute.

Torero, M. and J. von Braun, Eds. 2006. *Information and communication technologies for development and poverty reduction: The potential of telecommunications*. Baltimore: The Johns Hopkins University Press for the International Food Policy Research Institute.

UNDP (United Nations Development Programme). 2006. *Human development report 2006: Beyond scarcity: Power, poverty and the global water crisis*. New York.

USDA (United States Department of Agriculture). 2008. World Agricultural Supply and

Demand Estimates No. 455. Available at <http://www.usda.gov/oce/commodity/wasde/index.htm>.

Von Braun, J. and E. Kennedy, Eds. 1994. *Agricultural commercialization, economic development, and nutrition*. Baltimore: The Johns Hopkins University Press for the International Food Policy Research Institute.

Von Braun, J. 2005. Agricultural economics and distributional effects. *Agricultural Economics* 32 (s1), 1–20. Malden, Mass.: Blackwell for IAAE

\_\_\_\_\_. 2007. *The world food situation: New driving forces and required actions*. Washington, D.C.: International Food Policy Research Institute.

World Bank. 2007a. *World development indicators 2007*. Washington, D.C.

\_\_\_\_\_. 2007b. *World Development Report 2008: Agriculture for Development*. Washington, D.C.

# Agriculture for Development: A Perspective From the 2008 World Development Report<sup>1</sup>

Robert Townsend<sup>2</sup>

## Abstract

Agriculture remains a fundamental instrument for global sustainable development and poverty reduction. Three of every four poor people in developing countries live in rural areas and most depend on agriculture for their livelihoods. Yet past policies heavily taxed agriculture with low reinvestment in the sector, particularly in sub-Saharan Africa. Global trade policies have also had an adverse consequence coupled with a declining share of official development assistance for agriculture. Realizing the potential of agriculture for development will require that it be given much more prominence in government and development partner priorities.

The priorities for agriculture differ across three broad categories of countries. In the agriculture-based countries, mainly in sub-Saharan Africa, using agriculture as the basis for economic growth requires a productivity revolution in smallholder farming. In transforming countries, which include most of South and East Asia and the Middle East and North Africa, rapidly rising rural-urban income disparities and continuing extreme rural poverty are major sources of social and political tensions. Addressing these income disparities requires a comprehensive approach—shifting to high-value agriculture, decentralizing nonfarm economic activity to rural areas, and providing assistance to help move people out of agriculture. In urbanized countries, which include most of Latin America and much of Europe and Central Asia, agriculture can help reduce the remaining rural poverty if smallholders become direct suppliers in modern food markets, good jobs are created in agriculture and agroindustry, and markets for environmental services are introduced. The 2008 World Development Report highlights policies,

institutions, and investments that can address these priorities within the current global context.

## Overview

In the 21st century, agriculture continues to be a fundamental instrument for sustainable development and poverty reduction. Three of every four poor people in developing countries live in rural areas—2.1 billion living on less than \$2 a day and 880 million on less than \$1 a day—and most depend on agriculture for their livelihoods. Given where they are and what they do best, promoting agriculture is imperative for meeting the Millennium Development Goal of halving poverty and hunger by 2015 and continuing to reduce poverty and hunger for several decades thereafter. Agriculture alone will not be enough to massively reduce poverty, but it has proven to be uniquely powerful for that task. With the last World Development Report on agriculture completed 25 years ago, it is time to place agriculture afresh at the center of the development agenda, taking account of the vastly different context of opportunities and challenges that has emerged (World Bank 1982).

Agriculture operates in three distinct worlds—one agriculture based, one transforming, and one urbanized. And in each the agriculture-for-development agenda differs in pursuing sustainable growth and reducing poverty.

In the agriculture-based countries, which include most of sub-Saharan Africa, agriculture and its associated industries are essential to growth and to reducing mass poverty and food insecurity. Using agriculture as the basis for economic growth in the

<sup>1</sup>This paper is extracted from *World Development Report 2008 on Agriculture for Development*.

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agriculture-based countries requires a productivity revolution in smallholder farming. Given sub-Saharan Africa's unique agriculture and institutions, that revolution will have to be different from the Asian green revolution. How to implement it after many years of limited success remains a difficult challenge. But conditions have changed, and there are many local successes and new opportunities on which to build.

In transforming countries, which include most of South and East Asia and the Middle East and North Africa, rapidly rising rural-urban income disparities and continuing extreme rural poverty are major sources of social and political tensions. The problem cannot be sustainably addressed through agricultural protection that raises the price of food (because a large number of poor people are net food buyers) or through subsidies. Addressing income disparities in transforming countries requires a comprehensive approach that pursues multiple pathways out of poverty—shifting to high-value agriculture, decentralizing nonfarm economic activity to rural areas, and providing assistance to help move people out of agriculture. Doing this calls for innovative policy initiatives and strong political commitment, but it can benefit 600 million of the world's rural poor.

In urbanized countries, which include most of Latin America and much of Europe and Central Asia, agriculture can help reduce the remaining rural poverty if smallholders become direct suppliers in modern food markets, good jobs are created in agriculture and agroindustry, and markets for environmental services are introduced.

With rising resource scarcity and mounting externalities, agricultural development and environmental protection have become closely intertwined. Agriculture's large environmental footprint can be reduced, farming systems made less vulnerable to climate change, and agriculture harnessed to deliver more environmental services. The solution is not to slow agricultural development: it is to seek more sustainable production systems. The first step in this is to get the incentives right by strengthening property rights and removing subsidies that encourage the degradation

of natural resources. Also imperative is adapting to climate change, which will hit poor farmers the hardest—and hit them unfairly because they have contributed little to its causes.

Agriculture thus offers great promise for growth, poverty reduction, and environmental services, but realizing this promise also requires the visible hand of the state—providing core public goods, improving the investment climate, regulating natural resource management, and securing desirable social outcomes. To pursue agriculture-for-development agendas, local, national, and global governance for agriculture need to be improved. The state will need greater capacity to coordinate across sectors and to form partnerships with private and civil society actors. Global actors need to deliver on a complex agenda of interrelated agreements and international public goods. Civil society empowerment, particularly of producer organizations, is essential to improving governance at all levels.

## What Can Agriculture Do for Development?

Agriculture has features that make it a unique instrument for development. Agriculture can work in concert with other sectors to produce faster growth, reduce poverty, and sustain the environment. In the *World Development Report*, agriculture consists of crops, livestock, agroforestry, and aquaculture. It does not include forestry and commercial capture fisheries because they require vastly different analyses. But interactions between agriculture and forestry are considered in the discussions of deforestation, climate change, and environmental services.

Agriculture contributes to development in many ways. Agriculture contributes to development as an economic activity, as a livelihood, and as a provider of environmental services, making the sector a unique instrument for development.

- **As an economic activity.** Agriculture can be a source of growth for the national economy, a provider of investment opportunities for

the private sector, and a prime driver of agriculture-related industries and the rural nonfarm economy. Two-thirds of the world's agricultural value added is created in developing countries. In agriculture-based countries, agriculture generates on average 29 percent of the gross domestic product (GDP) and employs 65 percent of the labor force. The industries and services linked to agriculture in value chains often account for more than 30 percent of GDP in transforming and urbanized countries. Agricultural production is important for food security because it is a source of income for the majority of the rural poor. It is particularly critical in a dozen countries of sub-Saharan Africa, with a combined population of about 200 million and with highly variable domestic production, limited tradability of food staples, and foreign exchange constraints in meeting their food needs through imports. These countries are exposed to recurrent food emergencies and the uncertainties of food aid. For them, increasing and stabilizing domestic production is essential for food security.

- ***As a livelihood.*** Agriculture is a source of livelihoods for an estimated 86 percent of rural people. It provides jobs for 1.3 billion smallholders and landless workers, “farm-financed social welfare” when there are urban shocks, and a foundation for viable rural communities. Of the developing world's 5.5 billion people, 3 billion live in rural areas, nearly half of all humanity. Of these rural inhabitants, an estimated 2.5 billion are in households involved in agriculture, and 1.5 billion are in smallholder households. The recent decline in the \$1-a-day poverty rate in developing countries—from 28 percent in 1993 to 22 percent in 2002—has been mainly the result of falling rural poverty (from 37 percent to 29 percent) while the urban poverty rate remained nearly constant (at 13 percent). More than 80 percent of the decline in rural poverty is attributable to better conditions in rural areas rather than to out-migration of

the poor. So, contrary to common perceptions, migration to cities has not been the main instrument for rural (and world) poverty reduction. But the large decline in the number of rural poor (from 1,036 million in 1993 to 883 million in 2003) has been confined to East Asia and the Pacific. In South Asia and sub-Saharan Africa, the number of rural poor has continued to rise and will likely exceed the number of urban poor until 2040. In these regions, a high priority is to mobilize agriculture for poverty reduction.

- ***As a provider of environmental services.*** In using (and frequently misusing) natural resources, agriculture can create good and bad environmental outcomes. It is by far the largest user of water, contributing to water scarcity. It is a major player in underground water depletion, agrochemical pollution, soil exhaustion, and global climate change, accounting for up to 30 percent of greenhouse gas emissions. But it is also a major provider of environmental services, generally unrecognized and unremunerated, sequestering carbon, managing watersheds, and preserving biodiversity. With rising resource scarcity, climate change, and concern about environmental costs, business as usual in the way agriculture uses natural resources is not an option. Making the farming systems of the rural poor less vulnerable to climate change is imperative. Managing the connections among agriculture, natural resource conservation, and the environment must be an integral part of using agriculture for development.

Agriculture's contributions differ in the three rural worlds. The way agriculture works for development varies across countries depending on how they rely on agriculture as a source of growth and an instrument for poverty reduction. The contribution of agriculture to growth and poverty reduction can be seen by categorizing countries according to the share of agriculture in aggregate growth over the past 15 years, and the current share of total pov-

erty in rural areas, using the \$2-a-day poverty line (figure 1). This perspective produces three types of countries—three distinct rural worlds:

- **Agriculture-based countries.** Agriculture is a major source of growth, accounting for 32 percent of GDP growth on average, mainly because agriculture is a large share of GDP, and most of the poor are in rural areas (70 percent). This group of countries has 417 million rural inhabitants, mainly in sub-Saharan countries. Eighty-two percent of the rural sub-Saharan population lives in agriculture-based countries.
- **Transforming countries.** Agriculture is no longer a major source of economic growth, contributing on average only 7 percent to GDP growth, but poverty remains overwhelmingly rural (82 percent of all poor). This group, typified by China, India, Indonesia, Morocco, and Romania, has more than 2.2 billion rural inhabitants. Ninety-eight percent of the rural population in South Asia, 96 percent in East Asia and the Pacific, and 92 percent in the Middle East and North Africa are in transforming countries.
- **Urbanized countries.** Agriculture contributes directly even less to economic growth, 5 percent on average, and poverty is mostly urban. Even so, rural areas still have 45 percent of the poor, and agribusiness and the food industry and services account for as much as one third of GDP. Included in this group of 255 million rural inhabitants are most countries in Latin America and the Caribbean and many in Europe and Central Asia. Eighty-eight percent of the rural populations in both regions are in urbanized countries.

Countries follow evolutionary paths that can move them from one country type to another. China and India moved from the agriculture-based to the transforming group over the past 20 years, while Indonesia gravitated toward the urbanized (figure 1). In addition, countries have sharp sub-national geographical disparities. For example, many transforming and urbanized countries have

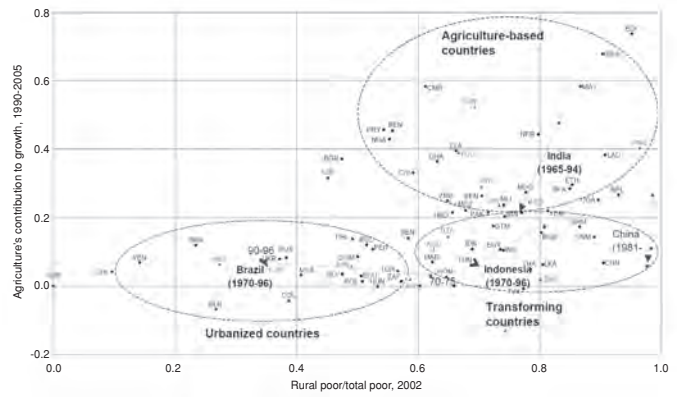


Figure 1. Agriculture’s contribution to growth and the rural share in poverty distinguish three types of countries: agriculture based, transforming, and urbanized.

agriculture-based regions, such as Bihar in India and Chiapas in Mexico.

Agriculture has special powers in reducing poverty. Agricultural growth has special powers in reducing poverty across all country types. Cross-country estimates show that GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture (figure 2).

For China, aggregate growth originating in agriculture is estimated to have been 3.5 times more effective in reducing poverty than growth outside agriculture—and for Latin America, 2.7 times more. Rapid agricultural growth—in India

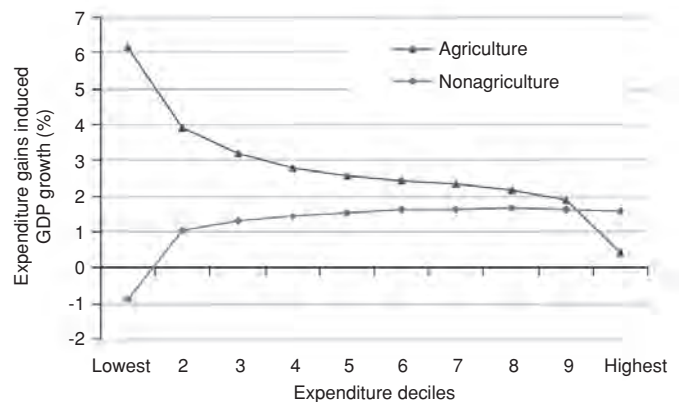


Figure 2. GDP growth originating in agriculture benefits substantially more the poorest half of the population.

following technological innovations (the diffusion of high-yielding varieties and in China following institutional innovations (the household responsibility system and market liberalization)—was accompanied by major declines in rural poverty. More recently, in Ghana, rural households accounted for a large share of a steep decline in poverty induced in part by agricultural growth.

Agriculture can be the lead sector for overall growth in the agriculture-based countries. Agriculture has a well-established record as an instrument for poverty reduction. But can it also be the leading sector of a growth strategy for the agriculture-based countries? Besides the sheer size of the sector, two arguments, applied to the agriculture-based countries of Sub-Saharan Africa, support the view that it can. The first is that in many of these countries, food remains imperfectly tradable because of high transaction costs and the prevalence of staple foods that are only lightly traded, such as roots and tubers and local cereals. So, many of these countries must largely feed themselves. Agricultural productivity determines the price of food, which in turn determines wage costs and competitiveness of the tradable sectors. Productivity of food staples is thus key to growth. The second is that comparative advantage in the tradable subsectors will still lie in primary activities (agriculture and mining) and agroprocessing for many years, because of resource endowments and the difficult investment climate for manufactures. Most economies depend on a diverse portfolio of unprocessed and processed primary-based exports (including tourism) to generate foreign exchange. Growth in both the nontradable and tradable sectors of agriculture also induces strong growth in other sectors of the economy through multiplier effects.

That is why, for many years to come, the growth strategy for most agriculture-based economies has to be anchored on getting agriculture moving. Success stories of agriculture as the basis for growth at the beginning of the development process abound. Agricultural growth was the precursor to the industrial revolutions that spread across the temperate world from England in the

mid-18th century to Japan in the late 19th century. More recently, rapid agricultural growth in China, India, and Vietnam was the precursor to the rise of industry. Just as for poverty, the special powers of agriculture as the basis for early growth are well established.

Yet agriculture has been vastly underused for development. Parallel to these successes are numerous failures to use agriculture for development. Many agriculture-based countries still display anemic per capita agricultural growth and little structural transformation (a declining share of agriculture in GDP and a rising share of industry and services as GDP per capita rises). The same applies to vast areas within countries of all types. Rapid population growth, declining farm size, falling soil fertility, and missed opportunities for income diversification and migration create distress as the powers of agriculture for development remain fallow. Policies that excessively tax agriculture and underinvest in agriculture are to blame, reflecting a political economy in which urban interests have the upper hand. Compared with successful transforming countries when they still had a high share of agriculture in GDP, the agriculture-based countries have very low public spending in agriculture as a share of their agricultural GDP (4 percent in the agriculture-based countries in 2004 compared with 10 percent in 1980 in the transforming countries, figure 3). The pressures of recurrent food crises also tilt public budgets and donor priorities toward direct provision of food rather than investments in growth and achieving food security through rising incomes. Where women are the majority of smallholder farmers, failure to release their full potential in agriculture is a contributing factor to low growth and food insecurity. Underuse of agriculture for development is not confined to the agriculture-based countries. In transforming countries with rapid growth in nonagricultural sectors, the reallocation of labor out of agriculture is typically lagging, leaving large numbers of poor people in rural areas and widening the rural-urban income gap. The farm population demands subsidies and protection. But weak fiscal capacity to sustain transfers large enough to reduce the income gap and

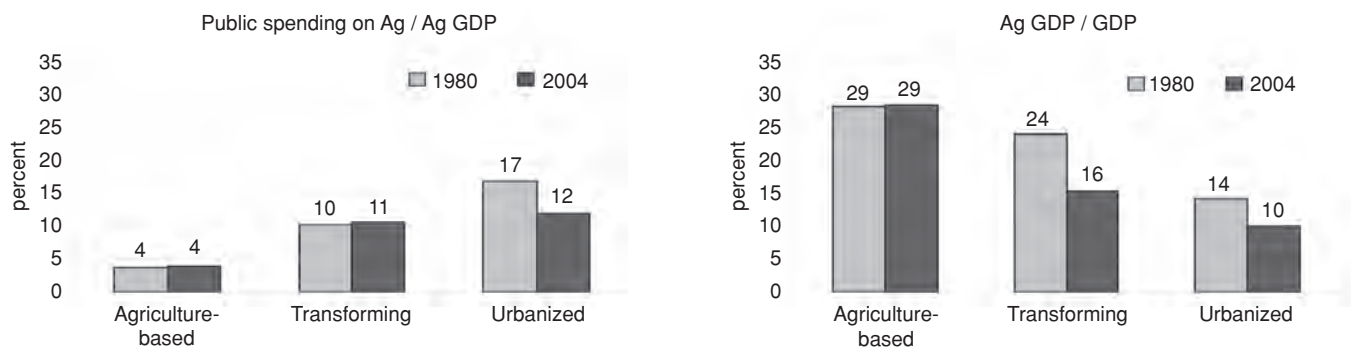


Figure 3. Public spending on agriculture is lowest in the agriculture-based countries, while their share of agriculture in GDP is highest.

continuing urban demands for low food prices create a policy dilemma (Hayami 2005). The opportunity cost of subsidies (which are three times public investments in agriculture in India) is reduced public goods for growth and social services in rural areas. Raising incomes in agriculture and the rural nonfarm economy must be part of the solution.

New opportunities are emerging. The world of agriculture has changed dramatically since the 1982 *World Development Report* on agriculture. Dynamic new markets, far-reaching technological and institutional innovations, and new roles for the state, the private sector, and civil society all characterize the new context for agriculture. The emerging new agriculture is led by private entrepreneurs in extensive value chains linking producers to consumers and including many entrepreneurial smallholders supported by their organizations. The agriculture of staple crops and traditional export commodities also finds new markets as it becomes more differentiated to meet changing consumer demands and new uses (for example, biofuels) and benefits from regional market integration. However, agriculture faces large uncertainties that are difficult to predict and call for caution in managing the global food supply.

An emerging vision of agriculture for development redefines the roles of producers, the private sector, and the state. Production is mainly by smallholders, who often remain the most efficient producers, in particular when supported by their organizations. But when these organizations can-

not capture economies of scale in production and marketing, labor-intensive commercial farming can be a better form of production, and efficient and fair labor markets are the key instrument to reducing rural poverty. The private sector drives the organization of value chains that bring the market to smallholders and commercial farms. The state—through enhanced capacity and new forms of governance—corrects market failures, regulates competition, and engages strategically in public-private partnerships to promote competitiveness in the agribusiness sector and support the greater inclusion of smallholders and rural workers. In this emerging vision, agriculture assumes a prominent role in the development agenda.

## Defining an Agriculture-for-Development Agenda

Pursuing an agriculture-for-development agenda for a country implies defining what to do and how to do it. What to do requires a policy framework anchored on the behavior of agents/producers and their organizations, the private sector in value chains, and the state.

### ***Agriculture-based Countries: Achieving Growth and Food Security***

Sub-Saharan countries account for over 80 percent of the rural population in the agriculture-based countries. For them, with both limited tradability

of food and comparative advantage in primary subsectors, agricultural productivity gains must be the basis for national economic growth and the instrument for mass poverty reduction and food security. This poses a huge challenge to governments and the international community, but there is little alternative to success in this undertaking, and there are new opportunities that provide a basis for optimism.

As macroeconomic conditions and commodity prices improved in sub-Saharan Africa starting in the mid-1990s, agricultural growth accelerated from 2.3 percent per year in the 1980s to 3.8 percent between 2001 and 2005. Rural poverty started to decline where growth occurred—but rapid population growth is absorbing much of the gain, reducing per capita agricultural growth to 1.5 percent. Faster growth and poverty reduction are now achievable, but they will require commitments, skills, and resources.

Diverse local conditions in sub-Saharan Africa produce a wide range of farming systems and reliance on many types of food staples, implying a path to productivity growth that differs considerably from that in Asia (Staatz and Dembele). Although diversity complicates the development of new technologies, it offers a broad range of opportunities for innovation. Dependence on the timing and amount of rainfall increases vulnerability to weather shocks and limits the ability to use known yield-enhancing technologies. But the untapped potential for storing water and using it more efficiently is enormous. Small and landlocked countries acting alone cannot achieve economies of scale in product markets and in research and training, which makes regional integration important. Low population density that increases the cost of providing infrastructure services and loss of human resources because of HIV/AIDS impose additional constraints.

The agenda for sub-Saharan Africa is to enhance growth by improving smallholder competitiveness in medium- and higher-potential areas, where returns on investment are highest, while simultaneously ensuring livelihoods and food security of subsistence farmers. Getting agriculture

moving requires improving access to markets and developing modern market chains. It requires a smallholder-based productivity revolution centered on food staples but also including traditional and nontraditional exports. Long-term investments in soil and water management are needed to enhance the resilience of farming systems, especially for people in subsistence farming in remote and risky environments. And it requires capitalizing on agricultural growth to activate the rural nonfarm economy in producing nontradable goods and services. The agenda must recognize the often-dominant role of women as farmers, agroprocessors, and traders in local markets.

The sub-Saharan context implies four distinct features of an agriculture-for-development agenda. First, a multisectoral approach must capture the synergies between technologies (seeds, fertilizer, livestock breeds), sustainable water and soil management, institutional services (extension, insurance, financial services), and human capital development (education, health)—all linked with market development. Second, agricultural development actions must be decentralized to tailor them to local conditions. These include community-driven approaches with women, who account for the majority of farmers in the region, playing a leading role. Third, the agendas must be coordinated across countries to provide an expanded market and achieve economies of scale in such services as R&D. Fourth, the agendas must give priority to conservation of natural resources and adaptation to climate change to sustain growth.

This agenda will require macroeconomic stability, policies to improve producer incentives and trade, and sharply increased public investment—especially in infrastructure, roads, and communications to improve market access, and in R&D to address Africa's distinct crops and agroecologies, as proposed by the New Partnership for Africa's Development. The recent surge in growth of sub-Saharan agriculture has been induced by improved price incentives from macro and sectoral reforms and higher commodity prices. As the easy gains from price reforms have been captured in many countries, future growth will have to rely more on

increased productivity. The increased willingness of governments, the private sector, and donors to invest in sub-Saharan agriculture opens a window of opportunity that should not be missed.

### ***Transforming Countries: Reducing Rural Urban Income Disparities and Rural Poverty***

In transforming countries, with 600 million rural poor and 2.2 billion rural inhabitants, nonagricultural sectors have been the fastest growing in the world. The main focus of agriculture for development is to narrow rural-urban income disparities and reduce rural poverty while avoiding the subsidy and protection traps, challenges poorly addressed thus far. With growing political attention to widening income disparities, there are strong pressures to better use the powers of agriculture for development (Vyas 2007).

In these countries, agriculture is almost exclusively in the hands of smallholders. Continuing demographic pressures imply rapidly declining farm sizes, becoming so minute that they can compromise survival if off-farm income opportunities are not available. Competition over access to water is acute, with rising urban demands and deteriorating quality from runoffs. As nonfarm incomes rise, pressures to address rural-urban income disparities through subsidies would compete for fiscal expenditures, at a high opportunity cost for public goods and rural basic needs. On the other hand, addressing those disparities through import protection would elevate food costs for the large masses of poor consumers who are net food buyers.

Because of demographic pressures and land constraints, the agenda for transforming countries must jointly mobilize all pathways out of poverty: farming, employment in agriculture and the rural nonfarm economy, and migration. Prospects are good for promoting rural incomes and avoiding the subsidy-protection trap, if the political will can be mustered. Rapidly expanding markets for high-value products—especially horticulture, poultry, fish, and dairy—offer an opportunity to diversify farming systems and develop a competitive and labor-

intensive smallholder sector. Export markets for nontraditional products are also accessible because transforming countries have a comparative advantage in labor- and management-intensive activities. Many countries have high levels of poverty in less-favored regions that require better infrastructure and technologies adapted to these regions.

To confront rural unemployment, a complementary policy objective is promoting a dynamic rural nonfarm sector in secondary towns, linked to both agriculture and the urban economy. China has brought industry to rural towns, diversifying rural incomes, an approach that could be emulated in other transforming countries. In all transforming countries, the transfer of labor to the dynamic sectors of the economy must be accelerated by massive investments in skills for this generation and the next. The momentous changes this restructuring implies must be ensured by effective safety-net programs to allow households to assume risks in moving to their best options. Successfully meeting the disparity problem in transforming countries can make a huge dent in world poverty.

### ***Urbanized Countries: Linking Smallholders to Modern Food Markets and Providing Good Jobs***

The broad goal is to capitalize on rapid expansion of modern domestic food markets and booming agricultural subsectors to sharply reduce the remaining rural poverty, still stubbornly high. The urbanized countries, with 32 million rural poor—representing 39 percent of all their poor—are experiencing the supermarket revolution in food retailing. For smallholders, being competitive in supplying supermarkets is a major challenge that requires meeting strict standards and achieving scale in delivery, for which effective producer organizations are essential (Reardon and Berdegue 2006). Exceptionally high land inequality in Latin America also constrains smallholder participation.

Increasing the access of smallholders to assets, particularly land, and increasing their voice in unequal societies can enhance the size and competi-

tiveness of the smallholder sector. Beyond farming, territorial approaches are being pursued to promote local employment through interlinked farming and rural agroindustry, and these experiences need to be better understood for wider application. Agricultural growth is especially important to improve well-being in geographic pockets of poverty with good agricultural potential. For regions without such potential, the transition out of agriculture and the provision of environmental services offer better prospects. But support to the agricultural component of the livelihoods of subsistence farmers will remain an imperative for many years.

### ***The Global Agricultural Agenda***

The agriculture-for-development agenda cannot be realized without more and better international commitments. And the overarching global tasks of the 21st century—ending hunger and poverty, sustaining the environment, providing security, and managing global health—will not be accomplished without agriculture. The global agricultural agenda has a multiplicity of dimensions: establishing fair rules for international trade, agreeing on product standards and intellectual property rights, providing new technologies for the benefit of the poor, avoiding such negative externalities as livestock diseases, conserving the world's biodiversity, and mitigating and adapting to climate change. With their narrow sectoral focus, the global institutions created for agriculture in the twentieth century, despite their many achievements, are inadequately prepared to address today's interrelated and multi-sectoral agendas. Institutional reforms and innovations are needed to facilitate greater coordination across international agencies and with the new actors in the global arena, including civil society, the business sector, and philanthropy.

Implementing the global agenda requires a mix of institutional arrangements. Specialized institutions, such as the Consultative Group on International Agricultural Research, the Food and Agriculture Organization of the United Nations, and the International Fund for Agricultural Development,

can provide long-term support and commitment by improving their efficiency and cross-agency coordination. Cross-sectoral, issue-specific networks can react quickly to emergencies, such as controlling avian influenza, and seize emerging opportunities, such as biofortification through nutrient-enhanced crops. In other cases, mainstreaming global priorities, such as adaptation to climate change, into increased donor aid to agriculture may work best. Delivering on the international agenda is a matter not only of self-interest, which extends broadly in a global world, but also of equity and justice between the developed and developing worlds and between present and future generations.

### **Moving Forward**

If the world is committed to reducing poverty and achieving sustainable growth, the powers of agriculture for development must be unleashed. But there are no magic bullets. Using agriculture for development is a complex process. It requires broad consultations at the country level to customize agendas and define implementation strategies. It also requires having agriculture work in concert with other sectors and with actors at local, national, and global levels. It requires building the capacity of smallholders and their organizations, private agribusiness, and the state. It requires institutions to help agriculture serve development and technologies for sustainable natural resource use. And it requires mobilizing political support, skills, and resources.

There is growing recognition among governments and donors that agriculture must be a prominent part of the development agenda, whether for delivering growth in the agriculture-based countries or for reducing rural poverty and addressing the environmental agenda everywhere. Today's improved opportunities and greater willingness to invest in agriculture provide optimism that agriculture-for-development agendas can move forward. The window of opportunity that this offers should not be missed because success will provide high payoffs toward the Millennium Development Goals and beyond.

## References

- Hayami, Y. 2005. *An emerging agriculture problem in high-performing Asian economies*. Paper presented at the 5th Conference of the Asian Society of Agricultural Economists (Presidential Address). Zahedan, Iran.
- Pardey, P., N. Beintema, S. Dehmer, and S. Wood. 2006. *Agricultural research: A growing global divide?* Washington D.C.: International Food Policy Research Institute (IFPRI), *Food Policy Report 17*.
- Reardon, T. and J. Berdegue. 2006. *The retail-led transformation of agrifood systems and its implications for development policies*. Background paper for the WDR 2008.
- Staatz, J. and N. N. Dembele. 2007. *Agriculture for development in sub-Saharan Africa*. Background paper for the WDR 2008.
- Vyas, V. S. Processed, 2007. *Marginalized sections of Indian agriculture: The forgotten millions*. Institute for Development Studies. Jaipur.
- World Bank. 1982. *World development report 1982: Agriculture and economic development*. Washington.D.C.: Oxford University Press for the World Bank.
- \_\_\_\_\_. 2007. *World development report 2008: Agriculture for development*. Washington, D.C.

# Information Matters: From Delivery to Access

Janet K. Poley<sup>1</sup>

## Abstract

Developing country progress, promoted by sustainable agricultural growth and expansion, requires integration of quality information into learning, discovery, and utilization systems. Information is not in and of itself knowledge or power! It can be a critical input to creating positive change.

Historically, agricultural extension and distance education programs were located within government ministries to deliver government information to communities. In today's developed world, a tremendous shift has occurred moving away from information delivery toward an access model driven by the Internet.

For information to matter, it must engage, empower, and build partnerships and relationships between and among people, communities, and institutions. "Expert" knowledge external to communities has always been difficult to package and deliver in a way that creates action and positive sustainable change. *Interaction* with target populations through needs assessment, asset mapping, appreciative inquiry, and other methods greatly increases the potential for change in technologies and practice. It also builds sustainable social capital, i.e. strong relationships and networks that can be used in the future.

The emerging Internet-based access model should not entirely replace the delivery and interaction models but can rapidly and powerfully supplement and eventually replace historical practice. When Information and Communication Technology Centers (ICTs) are inviting places and are staffed with knowledgeable and caring translators and facilitators, they become an arm of extension. Documented cases from the developed world and Asia, Africa, and Latin America suggest that combining university-based extension with this type of ICT might literally change the world.

Developing countries want information access and the choice to create their own knowledge

repositories and learning communities. For information to matter, it must be part of an affordable, interactive, and accessible system for learning and collaboration.

## Introduction: Information Matters

In "Managing for the Future: The 1990s and Beyond," Peter Drucker predicted that all organizations would reorganize around information—that the world was headed toward a future where information and just-in-time access to it would be the most important factor in innovation and survival (Drucker 1992). Drucker also stated in 1986 that the dynamics of technology were switching to an organic model organized around information and access to it, rather than around mechanical energy and fossil fuels (Drucker 1986).

In "Sustainable Society and Sustainable Development: Limits and Possibilities," Hazel Henderson notes that sustainability has become a buzzword and everybody has a sustainability index. She suggests that the planet is moving toward cooperation and rejecting competition because we're learning that cooperation and trust are necessary to global sustainability. She says we have only three basic resources at our disposal for this transition—information, matter, and energy—and of these, information is primary, since the quality of information drives our use of matter and energy.

In 1995, the World Bank acknowledged that 60 percent of the "Wealth of Nations" was comprised of human capital and 20 percent was ecological capital. Financial and built capital represented only 20 percent. Today, many sustainable-development-oriented professionals would argue that investment in human capital, health, and education is the best bet for making a difference. Information matters (Henderson 2005).

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## **Information, Communication, and Technology: Education and Marketing**

The dictionary defines information as “useful facts as contrasted with raw data” and offers related words such as to inform, to report, to advertise, to educate, and to reeducate. The author assumes information and education to be related concepts and will discuss the importance of access to both. Recently, the term “knowledge management” is used to describe work in this general area. From an access perspective, it is the user or learner at the center of the model and, to a large extent, views about information and information work depend on the individual and his or her context. The wealthiest and most highly educated people have the greatest access to the most information through the largest number of sources and channels for less money. Currently, U.S. information access is very individualistic, and this type of access to information may or may not contribute to the knowledge of a broader community, increasing that community’s wealth and sustainability. People access information to solve individual problems, but U.S. information-seekers, given their “personal computing” nature, use it less extensively in collaborative ways to build intellectual and social capitals.

However, in the context of developing countries, less information may be available to individuals and what is available may also be shared more widely within the community. A recent study of Chinese villages shows why it may be important to study both the individual and the community gains with respect to information access and sustainability (Soriano 2007).

### **History of Information Importance in Agriculture**

The U.S. Department of Agriculture and the land-grant universities have a long and well-documented history of leadership in communication, information education research, and technology. The Smith-Lever Act of 1914 established the

Extension Service and made it responsible for moving research information out of university ivory towers to the people. Various accounts exist of why and how the agricultural extension service began, but all agree that historically, it had significant impact.

Drucker calls the most important event of the 20th century the exponential growth in farm production and farm productivity worldwide (except for the former Soviet Union). He states this was largely brought about by agricultural extension agents and Julius Rosenwald, the CEO of Sears and Roebuck. Drucker states that farmers didn’t dramatically change their spots but Extension, originally financed by Rosenwald, put new agricultural knowledge within farmers’ reach.

Rosenwald did not do this solely as philanthropy, but primarily to create purchasing power among his potential customers—the American farmers. Extension agents assisted by 4-H youth became the agricultural knowledge and information conduits: they created access. And within a few short years, “ignorant, reactionary, tradition-steeped peasants” became the “farm technologists of the scientific revolution on the farm” (Drucker 1986).

International agricultural activities increased among universities in the 1950s and 1960s. Economic growth and scientific values constituted key themes as a solution to underdevelopment. Beginning in the 1960s, the first United Nations’ Development Decade, economic growth goals were established for developing countries at the macro level and channeled (delivered) down to local communities. The focus was on technology transfer of innovation from the North to the South. Participatory local development was thought of as slow, and if only people received the right information, they would discard their traditional ways. The 1960s saw many U.S. agricultural scientists engaged in programs in Latin America, Asia, and Africa. Since the technology transfer model was applied in highly variable ways, results were “highly variable.” Perhaps one of the most positive outcomes for the United States was the human capacity development of a large number of young agricultural Ph.D.s who served in U.S. university programs in other coun-

tries and returned better prepared as scientists and educators. In an experiential sense, many young professors gained their international experience in the 1950s and 1960s followed by a period of significant productivity in the 1970s and 1980s to the benefit of U.S. universities.

## **Studying Information's Role in Development—1970s**

Development communication grew up as a field during this time and was led by Everett Rogers. The Diffusion of Innovation theory came from his studies in India, Nigeria, and Columbia. Rogers' work started from the study of the "diffusion" notion of mass media messages and better understanding of how opinion leaders were able to persuade people to change ideas and practices locally. In 1969, Rogers defined development as a "type of social change in which new ideas are introduced into a social system to produce higher incomes and levels of living through more modern production methods and improved organization" (Melkote 2006). Diffusion theory proved to be inadequate, giving way to social marketing principles and methods where determination of messages and strategies are scientifically determined. Rogers' work had important historical linkages to the Bohlen and Beal development of the awareness, interest, trial, evaluation, and adoption model spread throughout the Extension system (Bohlen and Beal 1955). Other important perspectives come from Gibson and Donnelly (Gibson et al.) (Source → encoding → Channel → decoding → Receiver with a feedback loop; 1973); social marketing approaches; and mass media delivery of agricultural information via print and broadcast. Substantial human capacity was built within the U.S. land-grant system, and the leaders of today's primary agricultural communication and education initiatives were products of this period.

In the 1980s, greater attention was focused on understanding participatory processes as vehicles for social change. The U.S. Department of Agriculture's Foreign Development Division pioneered

action learning and experiential approaches to training and technical assistance with considerable success. The Training for Rural Development project in Tanzania demonstrated the power of participatory approaches to information sharing and learning from village to regional and national policymakers. Needs assessment strategies and use of early personal computers coupled with train-the-trainer programs replaced information delivery strategies such as the World Bank Training and Visit system. The author pioneered much of this work in Tanzania where Tanzanians were the principal agents of change and relationships, human networks, and cross-cultural communication and understanding were fundamental to the success achieved (Poley 1987).

## **Information and the Internet in the 1990s and Beyond**

These foundational theories and programs were expanded and continue to influence domestic and international information programs today. With the dawn of the Internet in the 1990s, the focus shifted from delivery of information via mass methods to creating anytime, anywhere access to information and education.

Access to Web-based information of all types has spread—somewhat unevenly on a global basis with African countries lagging significantly.

## **Meaning of Real Access**

Internet Technology (IT) matters less today as a focus for discussion unless you don't have IT. However, as studies increasingly show, people in rural and remote areas in all countries are Internet and informationally handicapped. It is increasingly like electricity—the only time people pay attention to it is when it isn't there or if it goes out. But IT is not like electricity in an important and fundamental way: electricity delivers power, while IT creates access to digital information. In many senses, the digitalization of information is standing the world on its head with respect to shifting

power relationships. The real questions now are no longer “can it be done technologically?” but “will users be allowed access?” and “is there *freedom of information* and *open access*?” Countries are all beginning to consider the profound implications in shifting from delivery of information to real access to information.

Real access criteria as defined by Bridges.org (2008) include the following:

1. Physical access to technology
2. Appropriateness of technology
3. Affordability of technology and technology use
4. Human capacity and training
5. Locally relevant content, applications, and services
6. Integration into daily routines
7. Socio-cultural factors
8. Trust in technology
9. Local economic environment
10. Macro-economic environment
11. Legal and regulatory framework
12. Political will and public support

## **Food Security: Information and Education Universities Are Engines for Innovation and Development**

In his July 2007 testimony to the House Committee on Foreign Affairs, Subcommittee on Africa and Global Health, Calestous Juma asked that people remember the work of Carl Linnaeus, who tried to find permanent solutions to the persistent famines in Sweden. Juma noted that...

1. Food security is inseparable from economic development: rich countries do not starve;
2. Science and innovation are an essential part of both economic development and food security; and
3. Universities in most countries are engines for innovation and development. (Juma 2007)

This paper argues that “information” broadly defined is an essential fuel for sustainable agricultural development and it will increasingly drive the

development process in predictable and unpredictable ways. As tools are available to rapidly access information rather than wait for its delivery, local people and communities will gain more power and control over their circumstances increasing the potential to create sustainable situations (Juma 2007).

## **Food and Agricultural System Changes**

The Internet now allows users to become actively engaged and interactive in information flows. As “the Net” spreads to “virtually” every square inch of the planet, profound changes will occur. As the world and its inhabitants become more visible and networked, more information will be available and more education and processing will be required to make sense of the picture. The old adage “out of sight, out of mind” will be less possible as transparency is required of all societies. Questions of accuracy and authenticity are becoming the prime information focus. Food security and sustainability are now everybody’s business and increasingly, food production marketing, processing, transportation, and consumption will become a public matter.

1. Agriculture is more vertically and horizontally integrated and is highly dependent on marketing, rural finance, technical assistance, and quality control.
2. The diet of richer and more urbanized consumers is more diverse and oriented toward quality control. A contractual agriculture has to be more transparent, i.e. more open communication and information.
3. As a result, knowledge and human capital are becoming strategic variables in agriculture and rural development. Agriculture is more globalized and requires greater information management and decision support systems at all levels.

Increasingly, it is recognized that women play a large role in the economy and always have— whether in agriculture, food processing and preparation, small business, child care, family management, and a host of other responsibilities “overlooked” as real economic activity 25 years ago.

Sustainability requires a balance of production, natural resources, environmental considerations, and social fairness with respect to income and opportunity. Eradicating hunger and improving nutrition are not simply achieved by increasing food production. Along with science, open access to information about food, its production, processing, healthful qualities, and cost will allow knowledgeable policymakers and the public to make better decisions and participate actively in policies that affect health.

## **International Organizations and Summits Create Future Agenda**

### ***World Summit on the Information Society***

The World Summit on the Information Society (WSIS) held in Tunis in November 2005 attracted a large number of participants. The priority conclusion of the conference was an assertion that all persons should have access to the global Internet for information and for opportunities of all types. In setting the agenda for the future, participants recognized the scale of the problem in bridging the digital divide and the challenge posed for many countries with competing demands for development funds. They agreed that the financing of Information and Communication Technologies (ICT) for development needs to be placed in the context of the growing importance of the role of ICTs, not only as a medium of communication, but also as a development enabler and as a tool for the achievement of the Millennium Development Goals. Access to information and knowledge as well as capacity building were identified as priority action lines (WSIS 2005).

### ***UNESCO: Education for All***

In addition to the WSIS Summit, the UNESCO-coordinated Education for All (EFA) initiative is gaining momentum. The September 2005 World Conference assessed progress toward the Millen-

nium Development Goals and re-affirmed EFA as a key element in broader development efforts with major attention to the gender gap in literacy and education. Sixty-six percent of adults without literacy skills are women. One cannot discuss access to information without noting the critical need to address ongoing obstacles blocking access for girls and women.

Also, the EFA report emphasizes the need for quality teachers able to employ a range of pedagogical strategies as a sine qua non of quality learning. Institutions of higher education must be capable of providing excellent teachers and offer in-service training that results in sustainable learning outcomes. Access to quality learning materials in appropriate languages and relevant to the environment is needed in many locations (EFA 2005).

## **UNCTAD**

Increasingly, ICT is applied to spur economic development. The February 2008 UNCTAD report states that special emphasis should be put on education and training as returns on higher education are rising. Information technology is an important enabler of innovation. UNCTAD is establishing a virtual institute as a capacity-building initiative seeking to cooperate with academic institutions so as to support teaching and research on trade, investment, and development issues. UNCTAD states that universities must play a central role in educating decision-makers, providing policy advice to governments, disseminating information, promoting dialogue, and contributing to civil society. UNCTAD sees the virtual institute as the vehicle to strengthen cooperation among universities and create access to research results related to international economic development (UNCTAD 2008).

UNCTAD intends to help universities to do the following:

- Access and customize relevant international knowledge (from UNCTAD, members of the network, etc.) and to integrate it into their regular curricula;
- Generate their own knowledge and research in trade investment and development; and

- Exchange knowledge and cooperate with other members in course development and research.

Whether it is food security, dissemination of agricultural research results, international trade, economic development, global climate change, education, or nutrition and health—sustainable approaches require access to information and sharing of experience among countries. No global magic bullets exist. Sustainable approaches are new everywhere, but many approaches can be productively adapted from one location to another.

## **OECD**

OECD has launched a campaign focused on creating access to the Internet for the “next billion users.” For this to happen, strategies must be tailored to user needs. The Internet must be increasingly accessible, affordable, and applicable. Providers must extend the reach of networks and lower the access costs. Users must find information and content they are looking for on the devices available to them (Paltridge 2008).

## **Universities and Sustainable Development**

In July 2007, Peter McPherson, president of the National Association of State Universities and Land-Grant Colleges (NASULGC), testified at a hearing before the Subcommittee on Africa and Global Health of the House Committee on Foreign Affairs that agriculture is a critical component of the lives and economics in Africa, and that agricultural development is fundamental to broad-based sustainable development on the continent. He said that agriculture has been shown to produce more equitable growth in personal income than other forms of development. He testified that “Generating and extending research, knowledge and technology, building African human capacity to conduct research and supporting the capacity of institutions to produce creative and productive people is essential to the process.” He stated that food security

and improved rural development are achieved by addressing a wide range of constraints—but “first and foremost, they depend on well-trained, visionary, indigenous people to design, implement, and support enabling environments.” Highly educated human capital is essential.

McPherson also discussed the importance of supporting higher education in emerging market countries because higher education and research institutions generate knowledge that has economic impact, particularly in agriculture (McPherson 2007).

He quoted an IFPRI report stating that the median rate of return estimates for 1800 rates of return to research in agriculture was 48 percent per year for research, 62.9 percent per year for extension studies, 37 percent for studies that combined research and extension jointly, and 44.3 percent for all studies combined (McPherson 2007).

## **Libraries: Scientists and Scholars Become Creators and Users of Digital Policy**

The mission of National Agricultural Library (NAL) is now “advancing access to global information for agriculture.” NAL currently houses one of the world’s largest and most accessible agricultural information collections. It partners with land-grant institutions in various ways including through the Agricultural Network Information Center (AgNIC), a growing movement of people and quality information resources worldwide.

Scholarship is inherently a social process and it is embedded in a structure of relationships with other scholars, with scholarly societies, and with publishers and libraries. The access era replaces print with electronic publishing, digital libraries, and computer networks, bringing with it changes in pricing, intellectual property policies, and contracts. Not only NAL but all physical libraries are transforming from “bricks” housing documents to “bricks and clicks” creating information access. Digital repositories for information of many types are being created inside and outside the library

community. For example, the Gilbert Library in Maricopa County, Arizona, is replacing the Dewey Decimal System with an organizational and numbering system similar to that used by book stores. Why? People find it easier to use.

Andy Powell of the EduServ Foundation (Powell 2008), in a recent talk in Melbourne, Australia, said that we are overly preoccupied with building digital repositories of information (they are a means, not an end) rather than working on the surfacing of scholarly information on the Web (open access is an end), and librarians are not using language intuitive to users. Institutions, not social networks of scientists and other related uses, are currently the focus of repository work. He states that we have promoted the needs of institutions over the needs of individuals and that we need to focus on building and/or using global scholarly networks based on global repository services. He concludes by saying that a “resource-oriented” approach should be used at the technical level.

## **TEEAL and AGORA**

Two initiatives were designed to “deliver” agricultural journal content over the Internet to 114 low-income countries around the world for free or at very low cost (\$1000/year). Cornell University’s Mann Library created The Essential Electronic Agricultural Library (TEEAL), and the Food and Agriculture Organization (FAO) offers Access to Global Online Research in Agriculture (AGORA). The Mann Library was also involved in the development of AGORA, and it currently helps to coordinate the program and conduct training and outreach workshops in Africa (TEEAL 2008).

TEEAL content begins with 1993 journals and AGORA with 1997 journals. Both contain full-text articles, and TEEAL is available on CD. TEEAL is not accessible via the Internet or on the Web: it can only be used on an internal network. FAO’s AGORA is intended to replace TEEAL (primarily a stop-gap system) in opening journal access in research institutions in developing countries, especially in Africa.

## **Demand for Internet Access**

While Thomas Friedman declared “The World is Flat” (Friedman 2005) and Richard Florida said no, “The world is spikey,” both are right and both are wrong, because situations vary dramatically from county to county and location to location within that county. Florida’s spikey approximation of global participation based on electricity usage augments Friedman’s observations. Also, those who regard fundamental infrastructure such as fiber optic cable as just a tool will likely miss the long-term implications of current infrastructural development in countries where excess fiber bundles are being laid as new electric systems, roads, rails, and other public works projects are preparing the country for telecommunications transformation. Fiber alone does not result in increased and affordable bandwidth and the possibilities it provides. It is necessary but not sufficient to lift African countries from long-term reliance on satellite-based Internet—a useful delivery technology, but limited at present with respect to symmetrical, two-way bandwidth delivery. In the United States, major land-grant universities are still negotiating for access to sufficient bandwidth to conduct current and future research and education programs held hostage by monopoly telecommunication companies and policies. U.S. and Latin-American universities are known to have “dark fiber”—the means to getting bandwidth—in their backyards but are not allowed to tap into it due to a variety of factors that will eventually be corrected (Science-Policy Forum 2004).

## **Case Examples—A Few Examples From Many Available**

### ***The Village Phone Ladies—Bangladesh***

The Grameen Telecom is enabling women members of the Grameen Bank’s revolving credit system to retail cellular phone service in rural areas. The project involves 950 village phones providing

telephone access to more than 65,000 people. Women use micro-credit to acquire digital GSM cellular phone and sell phone calls and services within their villages. When complete, 40,000 village phone operators will be employed, earning a combined income of \$24 million USD per annum.

This project demonstrates that people want access and will pay for access to information. The technology saved villagers the cost of trips to Dhaka, and enabled discussions of financial matters with family members including remittances (42 percent) from local men working in the Gulf States. Villagers were able to obtain accurate information about remittance transfers and foreign currency exchange rates. Calls also frequently involved transfer of information about market prices and market trends, increasing profits and reducing productive expenses (Richardson et al 2000).

### ***Mozambique— Internet Information for All***

Mozambique is one of the poorest nations in the world and has a literacy rate of 42.3 percent. The country is recovering from a civil war spanning multiple decades. With assistance from USAID and IDRC, Mozambique has developed an “Internet for All Citizens” policy—urban and rural. The rural constitutes 87 percent of the population. Internet adoption has been increasing at a more rapid rate than television, and Mozambique views computer learning as the most important application of Internet connectivity. When asked to rank what priorities Mozambiquians would give to spending income, food was most important (71 percent) but 20 percent said they would spend it on education as second priority, and 36 percent said as a third priority (Stanford CSE).

### ***Nepal and Nigeria— Local Content (OECD)***

Little Internet content is written in the language of developing countries or relevant to rural needs; however, this is changing. Local content worldwide is generally the most popular with users. In Nepal,

local school results caused an Internet traffic spike. In Nigeria, the information about the falling cost of digital cameras and computer editing equipment enabled the country to become the third largest producer of films.

### ***Internet Use Grows in Tanzania***

Internet cafes are very scarce in rural Tanzania as compared with urban areas. However, a recent study of users found the rural and urban uses to be remarkably similar. Out of 10 variables studied, only gender, age, and monthly expenditures differentiated rural and urban calling into question. Forty percent of urban women used Internet cafes compared with 25 percent of rural women. Young people, particularly students, were the largest users in rural areas, and in terms of monthly expenditures, rural users had only one-third the purchasing power of urban users.

This study confirmed the findings from many countries—Internet access is a necessary first step, and that public Internet access points are required just as much for rural people to use the Internet for their human development needs as for urban dwellers.

This study and a comparable study by Wahed et al. in Indonesia found that the purpose of Internet usage in Internet cafes changed over time. With higher education, Web access at Internet cafes is used for more serious purposes. Well-educated people in rural areas use their Internet access for instrumental purposes like information seeking and research (Bjorn and Kristiansen 2007).

### ***Lubuto Library Project***

Lubuto libraries are places where marginalized African children can read for themselves, look at books, and have books read to them. These libraries primarily serve homeless children not in formal schools. Libraries are designed in a traditional African style. The first library located in Zambia is complete, and the project plans to build 100 African libraries over the next 10 years.

Access is of the utmost importance as nonfiction books being collected for the project are to be well-presented illustrated books on nature, science, sports, crafts, technology, geography, history, and biography, especially books that describe how children live all over the world.

The Lubuto Library Project (LLP) is headquartered in Washington, D.C. and operates a regional office in Lusaka, Zambia. The LLP is a registered 501(c)(3) organization in the United States and a registered nongovernmental organization in Zambia (LLP 2008).

### ***Lessons Learned From the Tsunami***

While the December 26, 2004 event was rare in its magnitude—300,000 dead and missing and damages exceeding \$13 billion—the lessons learned apply to other types of disasters in the food and agricultural sector. FAO's U.S. Representative states that:

“ . . . the more information you can disseminate and the more transparency you can bring in, the better the implementation is. We have witnessed the crucial role played by the ICTs during the Tsunami relief work (Gustafson).”

### ***Lessons Learned Related to Information Include***

- Use sensors networks for early detection.
- Effective networks of communication must be in place so that vulnerable populations have access to warning messages. Comprehensive, interoperable, real-time detection, forecast and warning systems are critical for tsunamis and integrated into comprehensive action-oriented plans for addressing all types of hazards and vulnerabilities. International cooperation is required to address global threats (SDR 2005).

## **Conclusion**

Information and education play a significant role in sustainable agriculture and rural development. A shift from a delivery-oriented mindset to a user-centered access model with respect to information is already under way. The demand for information and education is being fueled by Internet-deployment rapid-digitalization of information and the emergence of inexpensive tools allowing users to create and share content. Expectations are rising as citizens desire open and transparent government, rapid access to research results and market information, vehicles to share information with families and customers, and access to quality education including “open educational resources” that are replacing outdated or nonexistent textbooks and journals. Opening access to quality digital public-sector information on agriculture, health, meteorology, geography, climate, economics, change models, and creative ideas will be particularly important to improved rural livelihoods, when coupled with initiatives that focus on skills development, experiential learning, education, and human resource development. Initiatives incorporating the Internet as a significant development tool should be mainstreamed and encouraged, not just in urban areas, but also particularly in rural, remote, and underserved areas. While it is ultimately the information, education, and security that result in sustainable livelihoods, the rapid creation of affordable Internet access everywhere has the power to improve and encourage sustainable communities throughout the world.

## **References**

- Bjorn, F. and S. Kristiansen. 2007. A rural-urban digital divide? Regional aspects of Internet ‘use in Tanzania.’ Proceedings of the 9<sup>th</sup> International Conference on Social Implications of Computers in Developing Countries. Sao Paulo, Brazil.
- Bohlen, J. M. and G. M. Beal. 1955. How farm people accept new ideas. *Special Report No. 15*. Agricultural Extension Service, Iowa State College.

Drucker, Peter F. 1992. *Managing for the future: The 1990's and beyond*. New York: Dutton.

\_\_\_\_\_. 1986. *The frontiers of management*. New York: Harper and Row.

Education for All (EFA) International Coordination. <http://portal.unesco.org/education>.

Friedman, T. L. 2005. *The world is flat—A brief history of the twenty-first century*. New York: Farrar, Straus, and Giroux.

Gibson, J., M. Ivancevich, and J. H. Donnelly, Jr. 1973. *Organizations, structure, processes, behavior*. Business Publications. Dallas, TX.

Global environmental change, globalization and food systems. Science–Policy Forum Proceedings. [http://iaibr1.iaii.int/SI/2004/2004GECI\\_files/IAI\\_CR\\_web.pdf](http://iaibr1.iaii.int/SI/2004/2004GECI_files/IAI_CR_web.pdf).

Henderson, H. (2005). Sustainable society and sustainable development: Limits and possibilities. *Terra Habitavel*, International Symposium, UNISINOS, San Leopoldo, Brazil. [http://www.hazelhenderson.com/recentPapers/sustainable\\_society.html](http://www.hazelhenderson.com/recentPapers/sustainable_society.html).

Juma, C. (2007). Food security, agriculture and economic growth: Opportunities for cooperation between the United States and sub-Saharan Africa. Testimony to the House Committee on Foreign Affairs Subcommittee on Africa and Global Health United States House of Representatives.

Lubuto Library Project. <http://www.lubuto.org>.

Melkote, S. R. (2006). Everett M. Rogers and his contributions to the field of communicators and social change in developing countries. *Journal of Creative Communications*. Vol. 1, No. 1. <http://crc.sagepub.com/cgi/content/abstract/1/1/111>.

McPherson, P. (2007). Hearing: Food Security in Africa. House Committee on Foreign Affairs, Subcommittee on Africa and Global Health.

Paltridge, S. Ask the economist: Internet and development – Towards a Wider World Web. [http://www.oecd.org/document/29/0,3343,es\\_2649\\_201185\\_40067741\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/29/0,3343,es_2649_201185_40067741_1_1_1_1,00.html).

Poley, J. K. (2007). *A critical assessment of the Tanzania models of development: Key communication variables in agricultural development*. Agricultural Communications Documentation Center, Document ID:C13866. Conference Proceedings

Association of U.S. University Directors of International Agricultural Programs, University of Rhode Island.

Powell, A. EduServ Foundation <http://efoundations.typepad.com/efoundations/2008/02/repositories-th.html>.

Real Access/Real Impact Criteria/Bridges.org. (2008). [http://www.bridges.org/Real\\_Access](http://www.bridges.org/Real_Access).

Richardson, D., R. Ramirez, M. Haq. Grameen Telecom's Village Phone Programme in rural Bangladesh: a multi-media case study, final report. <http://www.telecommons.com/villagephone/finalreport.pdf>.

Science and technology lessons learned from the December 26, 2004 Indian Ocean disaster: Interim report of the Subcommittee on Disaster Reduction. <http://www.sdr.gov/Tsunami%20Science%20and%20Technology%20Lessons%20Learned%202005-1130%20FINAL.pdf>.

Soriano, C. R. R. (2007). Exploring the ICT and rural poverty reduction link: Community telecenters and rural livelihoods in Wu'an, China. *The Electronic Journal on Information Systems in Developing Countries*, Vol. 32, No. 1, Pages 1–15. <http://www.ejisdc.org>.

The diffusion process. 1957. Special Report No. 18. Agricultural Extension Service, Iowa State College.

The Essential Electronic Agricultural Library (TEEAL): Cornell University. Albert R. Mann Library. <http://www.teeal.org/faq.html>.

The impact of the Internet on developing countries. <http://cse.stanford.edu/class/cs201/projects-00-01/third-world/mozambique-overview.html>.

There are going to be winners and losers. Interview with Daniel J. Gustafson, FAO representative. Digital Opportunity Channel. <http://www.digitalloppportunity.org/article/view/113220>.

UNCTAD: Information Economy Report 2007-2008. <http://www.unctad.org/Templates/webflyer.asp?docid=9479&intItemID=2068&lang=1>.

World Summit on Information Society (WSIS). <http://www.itu.int/wsis/basic/about.html>.

# Benefits to the United States of Sustainable Economic Progress in Developing Countries

Mark Keenum<sup>1</sup>

## Abstract

The United States Department of Agriculture (USDA) works to create stability and security in developing countries through food assistance, trade capacity building, development projects, and trade negotiations.

USDA uses its unique resources and expertise in agricultural development to promote market- and science-based policies, institutions, and sustainable agricultural systems. Promoting productivity-enhancing technologies that increase food security is a priority for the Department. To address immediate food security needs, USDA administers food assistance programs to help countries experiencing humanitarian crises. Over the longer term, the food aid programs help support economic development in recipient countries. Combined with trade-capacity building efforts and development assistance, recipient countries can be expected to transition from food aid recipients to commercial buyers. This becomes a chief benefit to the United States from the Department's programs. USDA also participates in global agricultural trade negotiations, which help improve world food security and further enhance development.

Through these efforts, USDA works to create stable and secure countries that become politically and economically strong U.S. customers and trading partners.

## Introduction

USDA has a long-standing history of using its unique resources and expertise in agricultural development to promote market- and science-based policies and institutions and sustainable agricultural systems. We are continuing this tradition by working to create stability and security in develop-

ing countries through food assistance, trade-capacity building, and trade negotiations.

Promoting productivity-enhancing technologies that will increase food security is a priority for the Department. To deal with immediate food security needs, USDA administers food assistance programs to help countries experiencing humanitarian crises. Over the long term, our food aid programs help support economic development in recipient countries. Combined with trade capacity building efforts, recipient countries can be expected to transition from food aid recipients to commercial buyers. USDA also participates in global agricultural trade negotiations and other initiatives designed to help improve world food security and enhance development.

## Food Assistance

The first tool I would like to discuss is food assistance. U.S. food aid programs have helped feed millions of hungry people around the world. Our oldest program, Public Law 480, grew out of U.S. efforts after World War II to feed those affected by the war's devastation. Under Title II of that law, agricultural commodities are donated by the U.S. Government to meet emergency needs. Those commodities may be provided under government-to-government agreements, or through public and private agencies, including intergovernmental organizations, such as the United Nations World Food Program and other multilateral organizations. Non-emergency assistance may be provided through private voluntary organizations (PVOs), cooperatives, and intergovernmental organizations. The U.S. Agency for International Development (USAID) has the primary responsibility to imple-

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<sup>1</sup>Mark Keenum is U.S. Department of Agriculture Under Secretary, Farm and Foreign Agricultural Services.

ment Title II, and USDA assists by handling the purchasing and shipping of many commodities.

USDA administers the Food for Progress Program, which is targeted at countries that are making strides toward democracy and private enterprise. The program supports agricultural and economic development projects that are implemented by PVOs and foreign governments. The McGovern-Dole International Food for Education and Child Nutrition program helps support education, child development, and food security for some of the world's poorest children.

In addition to these programs, we are constantly seeking the flexibility to react quickly to the changing environment. When commodity and freight costs for the USDA food aid programs increased in 2006 and 2007, we launched a Stocks-for-Food initiative to help minimize the impact of increased costs on the McGovern-Dole program. Last July, USDA authorized the exchange of uncommitted government-owned commodities for finished food products. Nearly 80 percent was used for domestic feeding programs, while 20 percent was provided to the McGovern-Dole program. To date, over \$11 million in vegetable oil and corn-soy blend has been provided to the international feeding program. Based on current market prices, we anticipate the total benefit of this initiative to reach \$120 million by the end of 2008, and approximately \$24 million of these food products would benefit participants in the McGovern-Dole program.

We believe this flexibility is essential if we are to be in a position to respond to an ever-growing number of food emergencies and crises. We need the maximum amount of flexibility to be able to rapidly and effectively address these emergency needs. As a result, we do not support measures in both the House and Senate farm bills that essentially earmark between \$450 and \$600 million of P.L. 480, Title II funds for non-emergency aid. These proposals would, in effect, cut off approximately \$88 million (House) or \$238 million (Senate) away from emergencies, which would jeopardize 3 to 8 million lives in places such as Darfur and Afghanistan.

We also continue to seek the ability to use up to 25 percent of P.L. 480, Title II funds for local purchase in time-critical, life-saving situations. This proposal is crucial to saving lives, and has a negligible impact on U.S. commodities, as purchases are made only from local suppliers and not from major U.S. competitors. Grains, cereals, and oilseeds represent the majority of food aid commodities. The United States exports 146 million metric tons of grains and oilseeds, but the United States contributes just 3 million metric tons of these products to the food aid programs. Thus, we only contribute about 2.0 percent of this total to food aid. "Up to 25 percent" translates to about one half of one percent of all U.S. grains and oilseeds exports.

Over the long term, our food aid programs help support economic development in recipient countries. Combined with USDA's trade-capacity building and technical assistance efforts, recipient countries often transition from being food aid recipients to commercial buyers. In fact, if you look at the top 10 markets for U.S. agriculture, you will see many former food aid recipients—Japan, Korea, Egypt, Indonesia, Turkey, and members of the European Union. After World War II, Japan was a U.S. food aid recipient. Today, it is our third largest export market for U.S. agricultural products and bought over \$10 billion worth of U.S. agricultural products last year.

It might be helpful to look at an example of how these programs work and how the impacts can spread so quickly within a country. In 2001, USDA provided \$8.5 million in commodities under the Food for Progress Program for the National Rural Electric Cooperative Association (NRECA) to use in the Philippines. NRECA sold the commodities and used the funds to help establish and finance the Rural Electric Finance Corporation of the Philippines (REFC). Once established, it financed a lending program. Loan projects included power distribution improvements and expansion, small power supply projects, and renewable energy systems. As a result of this highly successful project, there are 120 electric co-ops providing as many as 5 million people with electricity every day.

## Trade-Capacity Building

Our second area of focus in creating stability and security in developing countries is education and information sharing. The United States has broad, comprehensive trade-capacity building programs throughout the world. These programs help developing countries harness the power of trade and create open, predictable policies and procedures to boost economic growth and reduce poverty. Working together with USAID, we have developed a strong partnership to deliver agriculture-related technical assistance and trade-capacity building activities worldwide.

Let me take just a few moments to highlight some of our trade-capacity building efforts, especially to stabilize fragile economies. By the end of 2007, USDA had deployed 20 agricultural advisors to Iraq to provide technical assistance. Our focus is on helping the government build the capacity to deliver more effective agricultural extension, animal health, statistics, and soil and water programs and services. We are also working to improve the capacity of Iraq's Ministry of Agriculture to support growth in the private agricultural sector. Four USDA advisors are working to strengthen the Ministry's strategic planning, animal inspection and food safety programs, water and soil initiatives, and agricultural extension efforts.

In Afghanistan, USDA deployed six agricultural advisors in 2007; in 2008, that number will increase to 13. USDA provided technical assistance to help the government improve its capacity to deliver agricultural extension, animal health, biodiversity, and conservation programs and services. Our efforts to help Afghanistan have had some remarkable successes.

USDA provided technical guidance to assist Afghanistan in developing a forest management plan for the rehabilitation of degraded pistachio woodland. The USDA team designed a process for reducing soil erosion and increasing tree density. In 2006, target villages applied the new management techniques and realized a 65-percent increase in income from pistachio nuts, with 2007 also show-

ing an increase even above 2006. This successful project is being expanded to include other villages. USDA technical specialists have also provided training and consultation on improving the management of tree nurseries and on improving seed collection and storage.

Over the longer term, USDA's Cochran Fellowship Program provides U.S.-based agricultural training opportunities for senior and mid-level specialists and administrators from the public and private sectors who are interested in agricultural trade and agribusiness development, management, policy, and marketing. To date, more than 13,000 Cochran Fellows from 103 countries have benefited from this program. Cochran participants meet with U.S. agribusinesses, attend policy and food safety seminars, and receive technical training related to market development and trade-capacity building. When these Cochran participants return to their home country, they use what they have learned; many eventually become leaders and policymakers. Some notable Cochran alumni include the President of Albania, the Minister of Agriculture for Kyrgyzstan, the Minister of Agriculture for Madagascar, and the Prime Minister of Moldova.

Another educational program, the Norman E. Borlaug International Agricultural Science and Technology Fellows Program, helps developing countries strengthen sustainable agricultural practices by providing short-term, scientific training and collaborative research opportunities to visiting researchers, policymakers, and university faculty while they work with a mentor. The program targets developing countries and places participants at land-grant universities and 1890s colleges, government agencies, international research centers, and other nonprofit institutions and private companies. Since the program's inception, over 300 researchers, policymakers, and faculty members from nearly 40 countries have received short-term scientific training and research opportunities at U.S. colleges and universities. And although this is a relatively new program, we are already reaping benefits.

The benefits of trade-capacity building activities go far beyond the immediate benefits to the

recipient country: they spread to all countries. By helping countries develop transparent, science-based regulations and increasing their understanding of the U.S. regulatory system, trade-capacity building can expand future access for U.S. agricultural exports. At the same time, this assistance enables recipient countries to access other markets.

As a result of USDA's capacity building efforts, for example, Nicaragua has rewritten its poultry inspection laws and regulations to match USDA's requirements. U.S. poultry products now have access to Nicaragua, and Nicaragua can access the U.S. and other global markets. This is just one example of how countries benefit from stronger, more predictable infrastructure and regulatory systems; established frameworks for monitoring and mitigating plant and animal diseases; and compliance with international standards.

Trade-capacity building also assists international standards-setting bodies. USDA has helped African nations understand Codex Alimentarius food safety standards and build strategic coalitions both within the continent and with the United States to ensure that African food products meet international requirements. In a collaborative effort with USAID, USDA is providing science advisors in East, West, and Southern Africa to cover capacity building in plant and animal health and food safety systems. We are emphasizing harmonizing sanitary and phytosanitary regulations with international standard-setting bodies and increasing export opportunities for plant, horticultural, and animal products. Adoption of international laws and standards benefits U.S. agricultural exporters and enhances the ability of developing countries to trade. This leads to economic development and growth.

## **Trade Liberalization**

Let me conclude by briefly discussing the current status of the multilateral trade negotiations in the World Trade Organization (WTO). Trade liberalization achieved through the Doha Development Round will have an enormous reach throughout the global economy.

Two-thirds of the WTO membership is comprised of developing countries; 32 are classified as least developed countries. Agriculture accounts for about 60 percent of the labor force in developing countries and about 25 percent of the gross domestic product. Economic opportunity and political freedom are vital to fighting the destabilizing effects of poverty and, in the end, can be far more effective than all development programs from the United States and the rest of the developed world combined.

Agriculture and trade development are fundamental to trade negotiations. With a successful Doha Round, every nation stands to gain something. But, in my judgment, the developing world stands to gain the most. Global free trade would increase income in developing nations by over \$200 billion annually, 2.5 times the amount of annual development assistance. Millions of the world's poor could be pulled out of poverty by a successful round.

The United States will work toward that end and toward a successful conclusion of the Doha Round. We will continue to provide the leadership necessary to reach this objective.

## **Conclusion**

I have provided you with a brief look at USDA's programs to expand global agricultural trade through trade-capacity building, economic development, technical assistance, and trade negotiations. Through these efforts, USDA works to create a stable and secure environment for countries to become politically and economically strong trade partners and customers.

## Speaker Biographies

### Joachim von Braun

#### Director General, the International Food Policy Research Institute (IFPRI)

Last degree: Doctoral degree in Agricultural Economics from University of Gottingen, Germany. As IFPRI's Director General, Dr. von Braun guides and oversees the Institute's efforts to provide research-based sustainable solutions for ending hunger and malnutrition. Before becoming IFPRI's Director General in 2002, he worked as a division director and research fellow of the Institute for 11 years. During this same period, he also served as Director of the Center for Development Research at the University of Bonn, Germany; Head of the Department of Economics and Technological Change of the Center; and Professor at the Institute for Agricultural Policy and Applied Economics, Faculty of Agriculture, University of

Bonn, Germany. He has served on the faculty of the University of Kiel, Germany; the University of Gottingen, Germany; and worked as a visiting fellow at Institute of National Planning, Cairo, Egypt. Dr. von Braun has provided extensive short-term assistance in Egypt, Gambia, Guatemala, Rwanda, Sudan, Ethiopia, China, Bangladesh, and Russia. As a result of his research, he has published extensively, chiefly on the topics of science and technology and on policy issues relating to trade and aid, famine, health, and nutrition. He was President of the International Association of Agricultural Economists in 2000-2003, and has served numerous scientific societies and advisory councils/boards around the world.

### Robert F. Townsend

#### Senior Economist, Africa Agriculture and Rural Development Department, the International Bank for Reconstruction and Development (IBRD, the World Bank)

Last degree: Ph.D. in Agricultural Economics from the University of Pretoria, South Africa. (Dr. Townsend was born in Zimbabwe.)

As a Senior Economist at the World Bank, Dr. Townsend deals with a wide range of research and operations in the Africa Region of the World Bank concerning issues of international agricultural trade and the design and implementation of public policies for agriculture and rural development. His research has also included the matter of incentives for agricultural expansion and the productivity of the sector and its production units. Prior to embarking on his present role, he served as Senior Economist in the South Asia Sustainable Development Department of the Bank, where again he worked chiefly in research and bank operations (both the design and implementation of agricul-

tural projects) relating to trade and public policy for rural development. He has also served the Bank's Rural Development Departments for Eastern Europe and Central Asia, although the region of his concentration has been Africa. Most recently, Dr. Townsend was a principal author of the 2008 World Development Report: Agriculture for Development. Because of the vast differences in the agricultural sector among developing nations, the production of a coherent and properly organized document represented a major challenge. Dr. Townsend was specifically responsible for preparing two of the Report's chapters: one dealt with agricultural trade policies and the other with public policymaking and implementation for agricultural and rural development.

## **Janet K. Poley**

### **CEO and President, American Distance Education Consortium (ADEC)**

Last degree: Ph.D. in Adult and Continuing Education from University of Nebraska. As ADEC's President, Dr. Poley develops collaborative distance-education initiatives and conducts research and education programs relating to information technology access and applications with more than 60 land-grant university faculty and international partners. She came to her present post in 1994, following a 5-year stint as Director and Deputy Administrator for Communication, Information and Technology, U.S. Department of Agriculture (USDA), and earlier (1986–89) as Coordinator, Development Program Management Center in USDA's Office of International Cooperation and Development, where she conducted training and consultancies in developing countries.

In 1980–86, Dr. Poley was Chief of Party in Tanzania for the USAID-financed Training for Rural Development I and II Project, for which effort she received the Excalibur Award from the U.S. Congress. Before joining the USDA in 1975, she was a faculty member of the University of Nebraska/Lincoln (UNL) in agricultural communications for 9 years. (She continues today as a professor in UNL's College of Journalism and Institute of Agricultural and Natural Resources.) Dr. Poley has numerous journal articles, book chapters, and presentations to her credit, dealing chiefly with information technology and distance learning. She is currently co-authoring a book. She has also been a valued member of boards and advisory councils of numerous organizations.

## **Mark E. Keenum**

### **U.S. Department of Agriculture Under Secretary, Farm and Foreign Agricultural Service (FFAS)**

Last degree: Ph.D. in Agricultural Economics from Mississippi State University (MSU). Since first occupying his present position in 2006, Dr. Keenum has provided leadership and oversight for the USDA Farm Service Agency, Risk Management Agency, and Foreign Agricultural Service. He is responsible for the diverse interests of the U.S. food and agricultural sector abroad, involving the developing and expanding of markets for U.S. agricultural, fish, and forest products overseas. Dr. Keenum came to this post from Senator Thad Cochran's staff, serving from 1989 to 1996 as his Legislative Assistant for Agriculture and Natural Resources and, then, from 1996 to 2006, as his Chief of Staff, or his chief advisor on politi-

cal, legislative, and appropriations issues. Earlier, after completing his first two academic degrees, Dr. Keenum joined the Mississippi State University faculty in 1984 as a marketing specialist with the Mississippi Cooperative Extension Service. Following receipt of his Ph.D., he became an assistant professor/economist with the Department of Agricultural Economics at MSU. During his professional tenure at MSU, his primary research and extension accomplishments dealt with the marketing and economics of aquaculture, specialty crops, and forestry. After joining Senator Cochran's staff, he continued at MSU in the role of Agricultural Economics Adjunct Professor, with responsibility for a seminar on agricultural legislative policy.

## Capitol Hill Forum Participants

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## Charles Valentine Riley Biographical Notes

“Professor Riley,” as he was generally known, was born in Chelsea, London, England, on September 19, 1843. He attended boarding school at Dieppe, France and Bonn, Germany. Passionately fond of natural history, drawing, and painting, Riley collected and studied insects and sketched them in pencil and in color. At both Dieppe and Bonn, he won prizes in drawing and was encouraged to pursue art as a career.

At the age of 17, he came to the United States and settled on an Illinois farm about 50 miles from Chicago. Soon his attention was drawn to insect injuries to crops, and he sent accounts of his observations to *The Prairie Farmer*, a leading agricultural journal. At the age of 21, Riley moved to Chicago and worked for that publication as a reporter, artist, and editor of its entomological department. His writings attracted the attention of Benjamin D. Walsh, the Illinois State entomologist. It was through Walsh's influence as well as the recommendation of N.J. Coleman of Coleman's *Rural World* that Riley was appointed in the spring of 1868 to the newly created office of entomologist of the State of Missouri. From 1868 to 1877, in collaboration with T.W. Harris, B.D. Walsh, and Asa Fitch, Riley published nine annual reports as State Entomologist of Missouri, which unequivocally established his reputation as an eminent entomologist. Today, authorities agree that these nine reports constitute the foundation of modern entomology.

From 1873 to 1877, many Western states and territories were invaded by grasshoppers from the Northwest. In some states their destruction of crops was so serious that it caused starvation among pioneer families. Riley studied this plague and published results in his last three Missouri annual reports, and worked to bring it to the attention of Congress. In March 1877, he succeeded in securing passage of a bill creating the United States Entomological Commission, the Grasshopper Commission administered under the Director of the Geological Survey of the U.S. Department of the Interior. Riley was appointed chairman, A.S. Packard, Jr.,

secretary, and Cyrus Thomas, treasurer. All this time, Riley, with the help of Otto Lugger, Theodore Pergrande, and others, was also making brilliant contributions to the knowledge of the biology of insects. Besides studying the life cycles of the 13- and 17-year cicadas, he studied the remarkable Yucca moth and its pollination of the Yucca flower, a matter of special evolutionary interest to Charles Darwin. In addition, he conducted intensive life history studies of blister beetles and their unusual triungulin larvae, and the capriciousness of the fig.

In the spring of 1878, Townsend Glover retired as entomologist to the U.S. Department of Agriculture and Riley was appointed his successor. After a year in this position, Riley resigned owing to a disagreement with the Commissioner of Agriculture over Riley's practice of making independent political contacts. From his home, Riley then continued the work of the U.S. Entomological Commission with others. Two years later, after the inauguration of President Garfield in 1881, Riley was reappointed and remained chief of the Federal Entomological Service until June 1894, when the Service was renamed the Division of Entomology of the U.S. Department of Agriculture. In 1882, Riley gave part of his insect collection to the U.S. National Museum, now The Smithsonian Institution, at which time he was made honorary curator of insects. In 1885, he was appointed assistant curator of the Museum, thus becoming the Museum's first curator of insects, whereupon he gave the Museum his entire entomology collection consisting of 115,000 mounted insect specimens (20,000 species), an alcohol collection of 2,800 vials, and 3,000 slides of minute insects in Canada balsam.

One of Riley's greatest triumphs while Chief of the Federal Entomological Service was his initiation of efforts to collect parasites and predators of the cottony cushion scale, which was destroying the citrus industry in California. In 1888, he sent Albert Koebele to Australia to collect natural enemies of the scale. A beetle, *Vedalia cardinalis*, now *Rodolia cardinalis*, was introduced into California

and significantly reduced populations of the cottony cushion scale. This effort gave great impetus to the study of biological control for the reduction of injurious pests and established Charles Valentine Riley as the “Father of Biological Control.” For a review of the cottony cushion scale project, see Doutt 1958.

A prolific writer and artist, Riley authored over 2,400 publications. He also published two journals, the *American Entomologist* (1868-80) and *Insect Life* (1889-94). Riley received many honors during his lifetime. He was decorated by the French Government for his work on the grapevine Phylloxera. He received honorary degrees from Kansas State University and the University of Missouri. He was an honorary member of the Entomological Society of London, and founder and first president of the Entomological Society of Washington. He and Dr. L.O. Howard, Riley’s assistant in the Federal Entomological Service, were among the founders of the American Association of Economic Entomologists, which became part of Entomological Society of America in 1953.

Tragically, on September 14, 1895 Riley’s life was cut short by a fatal bicycle accident. As he was riding rapidly down a hill, the bicycle wheel struck a granite paving block dropped by a wagon. He catapulted to the pavement and fractured his skull. He was carried home on a wagon and never regained consciousness. He died at his home the same day at the age of 52, survived by his wife and six children.

In 1978, upon the death of Riley’s last surviving child, Dr. Cathryn Vedalia Riley, a modest trust was established to further Riley’s memory. This trust assisted in the founding of the Charles Valentine Riley Memorial Foundation. Thus, the singular characteristic of Riley as a “whole picture” person is reflected in the precepts and goals of the Riley Memorial Foundation. Riley’s vision, and ability to see the role of agriculture and forestry in the productive use of the landscape, as an artistry upon which all society depends, is perhaps his greatest legacy.

For more information, visit <http://www.nal.usda.gov/speccoll/findaids/riley/>

# Charles Valentine Riley Collection at the U.S. Department of Agriculture, National Agricultural Library

## Scope and Content

The initial Charles Valentine Riley Collection donated to the U.S. Department of Agriculture, National Agricultural Library included correspondence, unpublished lectures, photographs, news clippings, drawings, reprints, books, and artifacts covering the time period from 1868 to 1894. Additional donations of a medal, portrait, and sketchbook were made in 1984, 1985, and 2002, and the inclusion of these materials increased the size of the collection to 24 linear feet.

The nine series of materials focus on the history of entomology and the development of biological control of insects injurious to crops. In addition to professional papers and documents, the collection includes many personal articles such as family photographs; a wedding announcement; Riley's desk, clock, microscope, books, medals, and drawings; a portrait painted by Henry Ulke, known as "the painter of the Presidents"; and clippings about Riley's untimely death.



