

*A 2020 Vision
for Food,
Agriculture,
and the
Environment*

*The Vision,
Challenge, and
Recommended
Action*



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2020
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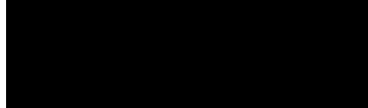
A 2020 Vision for Food, Agriculture, and the Environment

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*International Food Policy
Research Institute
1200 Seventeenth Street, N.W.
Washington, D.C. 20036-3006*

2020
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Preface

Considerable disagreement prevails on the magnitude and nature of the world's food and environmental problems. Many people complacently believe that future food needs will be met through technological breakthroughs that will happen without any special effort to increase food production, that the dangers of resource loss have been exaggerated, and that global food surpluses are a sufficient guarantee of world food security, even for low-income developing countries and people. Others counter that the limits of production are being reached, that new technologies will not be able to raise agricultural productivity and production sufficiently to meet growing needs, and that natural resources are being depleted at an alarming rate.

Concerned about the lack of a long-term vision and a consensus on what actions are needed to achieve it, the International Food Policy Research Institute (IFPRI), in collaboration with several national and international institutions, launched an initiative on A 2020 Vision for Food, Agriculture, and the Environment. The initiative has two objectives: (1) to develop and promote a vision for eradicating hunger and malnutrition while protecting the environment; and (2) to generate information and encourage debate to influence action by national governments, nongovernmental organizations (NGOs), the private sector, and international development institutions to realize the 2020 Vision.

The initiative, launched in 1993, builds on food policy research by IFPRI and others and relies on data from many sources, most notably the Food and

Agriculture Organization of the United Nations (FAO). In addition to conducting analyses and syntheses on many topics related to food, agriculture, and the environment, the initiative has brought together policymakers, analysts, and officials of governments, NGOs, and the private sector in workshops and consultations to share their knowledge on selected topics and to bring that knowledge to bear on recommendations for action. Besides topical consultations, regional workshops in Sub-Saharan Africa, South Asia, and Latin America have facilitated the development of regional strategies by select groups of policymakers, advisers, analysts, and others knowledgeable about the issues in each of these regions.

Results from the 2020 Vision initiative are disseminated in policy briefs, discussion papers, news articles, and books, and through conferences, symposia, and press briefings in several countries, including an international conference in Washington, D.C., on June 13–15, 1995. The 2020 Vision initiative offers a forum for debate through *News and Views*, a bimonthly newsletter. The written output is distributed to more than 3,300 individuals and institutions in 125 countries.

The 2020 Vision initiative is directed by a steering committee of IFPRI staff chaired by the director general and guided by an international advisory committee of distinguished individuals chaired by H. E. President Yoweri Museveni of Uganda. An expert advisory committee guides communications and public awareness activities. Discussion papers are reviewed by a committee of reviewers from outside IFPRI as well as by IFPRI

staff. The 2020 Vision initiative receives financial support from more than 20 countries, international organizations, development institutions, foundations, and private companies.

This document builds on past IFPRI research and on analyses and syntheses undertaken as part of the initiative on A 2020 Vision for Food, Agriculture, and the Environment. It is an outcome of extensive discussions within IFPRI and of extensive consultations with a large number of people in government and NGOs, international assistance agencies, academic institutions, national and international agricultural research centers, and the international advisory committee. Comments on an earlier draft were received from participants at the international conference held in Washington, D.C., in 1995.

The preparation of this document was coordinated by Per Pinstrup-Andersen, Rajul Pandya-Lorch, David Nygaard, and Barbara Rose, with substantial contributions from many others, including IFPRI staff members. The responsibility for the content of this document rests solely with IFPRI.

The action program recommended in this document is aimed primarily at developing-country governments and international assistance agencies because these institutions strongly influence the political, social, and economic framework within which civil society, including NGOs and the private sector, will play a critical role in realizing the 2020 Vision.

Per Pinstrup-Andersen
Director General

Overview

Although hunger, malnutrition, and environmental degradation are rampant in the developing world, and although the world population will grow by an unprecedented 90 million people a year in the next quarter century, many people have developed a dangerous sense of complacency about the current and future food, agriculture, and environment situation. Troubled by this complacency and a corresponding lack of foresight, IFPRI launched an initiative on A 2020 Vision for Food, Agriculture, and the Environment in order to develop and promote a vision and an action plan for eradicating hunger and malnutrition while protecting the environment.

IFPRI's 2020 Vision is "a world where every person has access to sufficient food to sustain a healthy and productive life, where malnutrition is absent, and where food originates from efficient, effective, and low-cost food systems that are compatible with sustainable use of natural resources."

Nine key challenges must be overcome for the 2020 Vision to be realized:

- **Food security and nutrition.** Today, 800 million people are food insecure, while 185 million preschool children are seriously underweight for their age. 2020 Vision research projects that, with business as usual, the number of malnourished children is likely to decline only slightly to 156 million by 2020.
- **Poverty and economic growth.** Over 1.1 billion people live on incomes of a dollar a day or less per person. The gap between the rich and the poor is widening.
- **Human resource development.** One-third of primary school enrollees drop out by Grade 4, 1 billion people lack access to health services, 1.3 billion people consume unsafe water, and almost 2 billion do not have access to adequate sanitation systems.
- **Food demand and diet changes.** 2020 Vision research projects per capita demand for foodgrains to increase by less than 3 percent, for livestock products by 17 percent, and for roots and tubers by 1 percent.
- **Population growth and movements.** In the next 25 years, about 90 million people are likely to be added to the world's population every year, the developing world's urban population is expected to more than double, and involuntary displacements of people are likely to increase.
- **Food supply.** Increased food production will have to come from more efficient use of land already under cultivation; significant expansion of cultivated area is not feasible in most of the world. But growth in food production has begun to lag.
- **Natural resources and agricultural inputs.** Degradation of natural resources undermines production capacity: 2 billion hectares have been degraded in the past 50 years, 180 million hectares of tropical forests were converted to other uses during the 1980s, marine fisheries are collapsing in parts of the world, and seasonal and regional water shortages afflict most developing countries.

The key challenge to realizing the 2020 Vision is to overcome the lack of commitment and to develop the political will to eradicate poverty and hunger and to protect the natural resource base.

- Markets, infrastructure, and international trade. As a result of inefficient markets and poor infrastructure, food marketing costs are too high, impeding access to food by the poor. Integrating developing countries into the global economy through international trade will influence their long-term economic prospects.
- Domestic resource mobilization and international assistance. Domestic savings and, consequently, investments are far too low in many developing countries. Private flows have risen substantially in recent years, especially to medium-income countries, but many of the poorer countries have been bypassed. International development assistance is slowing down.

Realizing the 2020 Vision calls for sustained action in six priority areas:

- Strengthen the capacity of developing-country governments to perform appropriate functions, such as maintaining law and order, establishing and enforcing property rights, promoting and assuring competition in private-sector markets, maintaining an appropriate macroeconomic environment, investing in or facilitating private-sector investment in public goods like education and infrastructure, and seeking improved access to international markets through trade negotiations. Predictability, transparency, and continuity in policymaking and enforcement are essential.
- Enhance the productivity, health, and nutrition of low-income people and increase their access to employment and productive assets by assuring access to primary education, primary health care, and clean water and sanitation for all people; strengthening and enforcing legislation and providing incentives to empower women; improving access by the poor to productive resources such as land; expanding employment through broad-based economic development; reducing population growth rates where they are high; and better targeting transfer programs to the poor.
- Strengthen agricultural research and extension systems in and for developing countries. Developing countries must sharply increase their national agricultural research expenditures to a target of at least 1 percent of the value of agricultural output with a longer-term target of 2 percent. Investment in international agricultural research to support national agricultural systems must be substantially increased. A clear policy on and agenda for biotechnology research must be developed.
- Promote sustainable agricultural intensification and sound management of natural resources, with increased emphasis on areas with agricultural potential, fragile soils, limited rainfall, and widespread poverty. Public- and private-sector investments in infrastructure, market development, natural resource management, and human resource development are required in these areas. Local control over resources must be strengthened and local capacity for organization and management improved. Farmers and communities must be encouraged to

implement integrated soil fertility programs through policies that ensure property rights to land and improved access to credit, efficient and effective markets for plant nutrients, investments in infrastructure, and temporary fertilizer subsidies where prices are high due to inadequate infrastructure or poorly functioning markets. Integrated pest management programs should be promoted as the central pest management strategy. The international community must develop and enforce a global program of coordination and restraint to prevent exploitation of marine fisheries beyond sustainable limits. Comprehensive water policy reforms are required to make better use of existing water supplies by providing appropriate incentives to water users, improving procedures for allocation, developing improved technology for water supply and delivery, providing secure water rights, and reforming distorted price incentives.

- Develop efficient, effective, and low-cost agricultural input and output markets by phasing out inefficient state-run firms in agricultural input and output markets; assuring effective competition; removing policies and institutions that favor large-scale, capital-intensive market agents over small-scale, labor-intensive ones; investing in or facilitating private-sector investment to develop or maintain market infrastructure; facilitating development of small-scale credit and savings institutions; and providing technical assistance and training to create or strengthen small-scale, labor-intensive competitive rural enterprises in trade, process-

ing, and related marketing activities.

- Expand international cooperation and assistance and improve its efficiency and effectiveness. Developing countries must promote national strategies for achieving the goals underlying the 2020 Vision, diversify sources of external financing, and seek measures to stem capital flights. International development institutions and bilateral donors should focus official government-to-government assistance on countries whose governments demonstrate commitment to the goals underlying the 2020 Vision, raise international assistance to reach the target of 0.7 percent of gross national product, realign international assistance to low-income developing countries, replace concessional aid to high-income developing countries with internationally available commercial capital, and maintain a certain minimum amount of food to be made available as food aid in emergency situations.

The action needed to realize the 2020 Vision will require new or strengthened partnerships between individuals, households, farmers, local communities, the private sector, nongovernmental organizations, national governments, and the international community. It will require a change in behavior, priorities, and policies. And it will require strengthened cooperation between industrial and developing countries as well as among developing countries. Failure to take action will lead to persisting hunger and poverty, continuing degradation of natural resources, increasing conflicts over scarce resources, and widening gaps between the rich and poor.

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The Vision

At the threshold of the twenty-first century, widespread poverty, hunger, and malnutrition threaten to destabilize global economic, social, political, and environmental conditions. Unless immediate steps are taken to reverse the trends of the 1980s and 1990s—overpopulation, mistreatment of the earth, and insufficient investment in development—even more people than today will live in abject poverty and hunger and even more children will be malnourished. Diseases spawned by hunger and malnutrition will persist, degradation of natural resources will continue, conflicts over scarce resources such as water and arable land will become even more common, and inequalities between the rich and the poor will widen. For most of humanity, the world will not be a pleasant place in the twenty-first century. Yet it does not have to be this way. With foresight and decisive action, a better world can be created for all people.

IFPRI's 2020 Vision is a world where every person has access to sufficient food to sustain a healthy and productive life, where malnutrition is absent, and where food originates from efficient, effective, and low-cost food systems that are compatible with sustainable use of natural resources.

The 2020 Vision is based on the principle affirmed by the United Nations and its members that freedom from hunger is a human right. National governments are not obligated to physically deliver food to every citizen, but they are responsible, with assistance by the international community, to create an economic, political, and social environment in which every person is able to meet his or her food needs throughout the year, every year. The Vision builds on deliberations and recommendations from recent United Nations conferences and other fora related to food, agriculture, and the environment.

The Challenge

Identifying, designing, and implementing actions to realize the 2020 Vision requires a solid understanding of the problems, challenges, and opportunities for change. Through 2020 Vision research and consultations, nine key sets of issues were identified that present challenges that must be overcome if the 2020 Vision is to be realized. These are

- Food security and nutrition;
- Poverty and economic growth;
- Human resource development;
- Food demand and diet changes;
- Population growth and movements;
- Food supply;
- Natural resources and agricultural inputs;
- Markets, infrastructure, and international trade; and
- Domestic resource mobilization and international assistance.

These issues do not form a hierarchy of priorities but rather are interlocking problems that must be addressed together.

For the 2020 Vision to be realized, enough food must be produced sustainably to meet the food needs of every person in the world, and everyone must have economic and physical access to sufficient food. Sustainable improvements in *food security and nutrition* are, therefore, the overall indicators of success in attaining the 2020 Vision.

Food security is jointly determined by access to food and availability of food. Access to food is closely related to *poverty* and *economic growth*: the poor usually do not have adequate means to gain access to

food in the quantities needed for healthy, productive lives. *Human resource development*, including education and health, is essential to raise the productivity of poor people and improve their access to remunerative employment and productive resources.

Population growth and movements, including urbanization, migration, and involuntary displacement of people, greatly influence food security and nutrition by increasing and changing the demand for food, changing dependency ratios and family sizes, and changing access to productive resources. Population pressures, in combination with poverty and insecure property rights, contribute to overuse and misuse of natural resources.

Food demand and supply trends influence food prices, the purchasing power of both the urban and rural poor, composition of diets, and many other factors related to food security, nutrition, and sound management of natural resources. Whether food needs can be met depends on agricultural growth, not simply for producing food but also for generating employment and incomes for poor people within and outside agriculture.

Natural resources and agricultural inputs are critical determinants of food supply: degradation of natural resources—soils, forests, marine fisheries, water—undermines production capacity, while availability of and access to agricultural inputs such as water, fertilizers, pesticides, energy, expertise, and technology determine productivity and production levels. Appropriate policies and market

Food insecurity is likely to continue to diminish rapidly in East Asia, but without new and accelerated action, it could persist in South Asia and, to a lesser extent, in Latin America, and accelerate substantially in Sub-Saharan Africa.

incentives are essential for sound management of natural resources and agricultural inputs. Climate change is not expected to challenge global food production in the next 25 years, but human behavior during this time will influence the extent and effects of climate change well beyond 2020.

The efficient functioning of *markets*, especially agricultural input and output markets, supported by governments that have the capacity to perform their appropriate roles, is of critical importance for attaining the 2020 Vision. *Infrastructure* supports efficient market operations and allows physical access to food and other inputs. The increasing integration of developing countries into the global economy through *international trade* will benefit both developing and developed countries by expanding markets, creating jobs, and generating income, making the 2020 Vision attainable.

Finally, without increased *domestic resource mobilization*—savings and investment—developing countries will not be able to accelerate the investments in economic growth and human resources that underpin the 2020 Vision. *International assistance* has a critical role to play in supporting developing countries as they implement the actions required to attain the 2020 Vision and embark on broad-based economic development. In addition, partnerships between higher- and lower-income developing countries as well as between industrial and developing countries to promote sustainable economic growth will be essential.

The action needed to realize the 2020 Vision is not new, but it will require unprecedented joint efforts by individuals, households, farmers, local communities, civil society, the private sector, national and local governments, and the international community. It will require political will and commitment to change behavior, priorities, and policies. And it will require strengthened cooperation between industrial countries and developing countries as well as among developing countries. The key challenge to realizing the 2020 Vision is to overcome the lack of commitment and to develop the political will to eradicate poverty and hunger and to protect the natural resource base.

Food Security and Nutrition

About 800 million people—20 percent of the developing world's population—are food insecure in 1995: they lack economic and physical access to the food required to lead healthy and productive lives. Their numbers declined from 950 million in 1970 primarily because of a 50 percent reduction in the number of food-insecure people in East Asia. South Asia remains home to about 270 million hungry people, while Sub-Saharan Africa has emerged as a major locus of hunger: the number of hungry people in Africa has increased by 46 percent since 1970 to 175 million in 1995. Food insecurity is likely to continue to diminish rapidly in East Asia, but without new and accelerated action, it could persist in South Asia and, to a

lesser extent, in Latin America, and accelerate substantially in Sub-Saharan Africa. Essentially, South Asia and Sub-Saharan Africa remain the “hot spots” of food insecurity.

Prospects for reducing malnutrition among the world’s children are grim. About 185 million children under the age of six years are seriously underweight for their age. Like food insecurity, child malnutrition is concentrated in South Asia and increasing rapidly in Sub-Saharan Africa. Female children are worse off than male children in South Asia. 2020 Vision research suggests that the proportion of malnourished children in the world could decline from 34 percent in 1990 to 26 percent in 2020. Because of population growth, however, the number of malnourished children would decline only slightly to 156 million by 2020. Reduction in child malnutrition is expected in all regions except Sub-Saharan Africa, where the number of malnourished children could increase by 50 percent between 1990 and 2020 to reach 43 million. In South Asia, the number of malnourished children may decline by more than 20 million over this period, but current malnutrition levels are so high that, even with these gains, two out of five preschool children are projected to be malnourished in 2020.

Hidden hunger, in the form of micronutrient deficiencies, is pervasive, even where food consumption is adequate. Micronutrient deficiencies have detrimental effects on human health and productivity. Nearly 2 billion people worldwide are iron deficient, resulting in

anemia in 1.2 billion; more than half of the pregnant women in developing countries are anemic; 125 million preschool children suffer from vitamin A deficiency, which has caused clinically visible eye damage to 14 million of them; and more than 600 million people have iodine-deficiency disorders.

Malnutrition in children inhibits their growth, increases their risk of morbidity, affects their cognitive development, and reduces their subsequent school performance. Malnutrition during childhood negatively affects work capacity and labor productivity in adults. And mild to moderate malnutrition has far more powerful effects on child mortality than previously believed.

Hunger is, and will remain, the primary challenge confronting developing countries. However, 2020 Vision research finds a paradoxical nutrition-related trend of obesity emerging in some areas, particularly in urban areas. In China’s cities, for example, obesity is forecast to increase 15 percent by 2020. Rapid income growth and urbanization are associated with changes to diets that include more fatty foods, such as livestock products, and with shifts toward more sedentary occupations. Because obesity helps increase chronic diseases such as heart conditions, obesity is becoming a serious public health risk in some developing countries, as it is in many developed countries.

Hunger is, and will remain, the primary challenge confronting developing countries.

Poverty and Economic Growth

Over 1.1 billion people in the developing world—30 percent of the population—live in absolute poverty, with incomes equivalent to a dollar a day or less per person. Every second person in South Asia and Sub-Saharan Africa is absolutely poor. Unless concerted action is taken, poverty will remain entrenched in South Asia and Latin America and will increase markedly in Sub-Saharan Africa. Only in East Asia is absolute poverty expected to decline substantially. More than 75 percent of the poor in Sub-Saharan Africa and South Asia are rural people, obtaining livelihoods from agricultural activities or from nonfarm activities that depend mostly on agriculture. Even in highly urbanized Latin America, a large share of the poor are rural. Moreover, there are more women than men among the poor, and individuals in female-headed households are often poorer than those in male-headed households. This income inequality has serious implications for children's nutrition and family food security since women are likely to spend a greater proportion of their incomes on food for the household and on their children's health, nutrition, and education.

Income levels and rates of growth vary considerably among developing countries. In 1982, per capita incomes in low-income developing countries were 18 percent of those in middle-income developing countries and 3 percent of those in developed countries. Ten years later, in 1992, these figures had dropped to 16 and 2 percent, respectively, reflect-

ing an increasing inequality. The gap between rich and poor is widening: the share of global incomes obtained by the poorest 20 percent of the world's population decreased dramatically from 2.5 percent in 1960 to 1.3 percent in 1990.

While East Asia had spectacular annual growth rates in per capita incomes of 6 percent or more during the 1980s and early 1990s, Africa, Latin America, and the Middle East have struggled with negative or negligible growth rates. Unless significant and fundamental changes occur in many developing countries, disparities in income levels and growth rates are likely to continue. 2020 Vision research projects that annual per capita income growth rates during 1990–2020 will range from 0.4 percent in Sub-Saharan Africa to 5.2 percent in East Asia. There is, however, considerable opportunity to accelerate income growth rates in the slow-growing countries, especially those of Sub-Saharan Africa, and to raise per capita incomes.

Human Resource Development

Poor, hungry, and illiterate people, and those suffering from chronic illnesses, have low productivity. Investments in health care and education—essential for raising productivity—and access to productive resources and remunerative employment are far below required levels, especially in rural areas of low-income developing countries. Investment in the health and education of women and girls

is particularly low. As a result, many people are denied the skills, capacity, and opportunity to improve their lives and to participate fully in all aspects of the economy and in social and political processes. These people also represent an underused resource that could be available to foster accelerated economic growth for the benefit of both the poor and nonpoor.

2020 Vision research finds that rapid economic growth alone is unlikely to reduce dramatically the number of malnourished children. An increase in incomes is necessary but not sufficient to guarantee good nutrition. There is growing evidence that the control of income within the household matters: incomes controlled by women are associated with improved food security and nutrition. Furthermore, nonfood factors such as education, health care, child care, clean water, and sanitation are of critical importance in determining nutritional status and must be improved in tandem with incomes and empowerment of women.

Developing-country public expenditure on education as a percentage of gross national product (GNP) has doubled since 1960 to 4 percent. Enrollment in primary education has risen considerably in the developing world. However, dropout rates are significant (about 30–35 percent drop out by Grade 4, a share that has not improved since 1970). While almost as many girls enroll in primary school as boys, they complete only about half as many years of schooling.

Public expenditure on health as a percentage of GNP in developing countries has doubled from 0.9 to 2.2 percent

between 1960 and 1990. However, about 1 billion people in developing countries lack access to health services; not surprisingly, infant mortality rates are 10 times higher than in industrialized countries.

About 1.3 billion people, primarily in rural areas of developing countries, are consuming unsafe water. About two-thirds of the population in developing countries has access to safe water, compared with one-third in the late 1970s. Almost 2 billion people, including more than half of the rural population in developing countries, do not have access to adequate sanitation systems.

Food Demand and Diet Changes

The extent to which food needs will be converted into effective market demand will depend on the purchasing power of the poor. 2020 Vision research forecasts that global effective market demand for foodgrains will increase by 55 percent between 1990 and 2020 to 2.7 billion metric tons (hereinafter “tons”), for livestock products by 75 percent to 280 million tons, and for roots and tubers by 50 percent to 875 million tons. With population growth, per capita demand for foodgrains is projected to increase by less than 3 percent to 340 kilograms, for livestock products by 17 percent to 36 kilograms, and for roots and tubers by 1 percent to 112 kilograms.

Because of more rapid population and income growth, market demand for foodgrains and livestock products is expected

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Around 90 million people—equivalent to Mexico's population in 1990—are likely to be added to the world's population every year in the next quarter century, the largest annual population increase in history.

to grow much faster in developing countries than in developed countries. 2020 Vision research forecasts that average per capita demand for foodgrains in developing countries will grow 0.4 percent per year between 1990 and 2020 and demand for livestock products 1.5 percent. Between 1990 and 2020, developing countries are projected to increase their market demand for foodgrains by 75 percent to 1.7 billion tons and for livestock products by 155 percent to 110 million tons. Population growth leads to a significantly smaller increase in per capita demand during this period, 11 percent for foodgrains and 56 percent for meat. In Sub-Saharan Africa, however, the amount of food demanded per person is not projected to increase during this period, which is cause for serious concern because per capita food consumption in that region is already below the bare minimum required for healthy lives. Even though total market demand for food is growing faster in developing than developed countries, developing-country citizens are projected to demand only 40 percent of the foodgrains and 33 percent of livestock products that citizens in developed countries demand by 2020, although developing countries will account for more than 80 percent of the world's population.

Urbanization and rising incomes are associated with more diverse diets: people are eating more livestock products and cutting back on cereals, and they are shifting to more processed foods. Asians are eating more livestock products and shifting from rice to wheat. Sub-Saharan Africans are moving from eating coarse

grains and roots and tubers to wheat and rice. 2020 Vision research forecasts per capita demand for rice to grow at half the rate for wheat and maize. Much of the growth in global demand for meat is taking place in China. 2020 Vision research suggests that, if India makes a large shift from a cereal-based diet to an increasingly meat-based diet, world food prices will increase and per capita food demand in poorer Sub-Saharan African and South Asian countries will fall as a consequence.

Changes in dietary patterns place strong pressures on the livestock industry and, indirectly, on feedgrain production. Demand for feedgrain is growing rapidly in developing countries. However, continued declines in the amount of feed needed to produce each kilogram of livestock products, because of better technologies and a shift from ruminants to poultry, will slow the rate of increase in demand for feedgrains, thereby reducing pressures on grain production from what was previously expected.

Population Growth and Movements

Four critical current trends in demography will need to be addressed to realize the 2020 Vision: high population growth, rapid urbanization, changing age composition, and involuntary displacement of people.

Around 90 million people—equivalent to Mexico's population in 1990—are likely to be added to the world's population every year in the next quarter century,

the largest annual population increase in history. By 2020, world population is likely to approach 8 billion. More than 90 percent of the population increase will occur in developing countries, whose share of world population will exceed 80 percent. The absolute increase will be largest in Asia (1.5 billion), but the rate of growth will be most rapid in Africa, where the population will double to about 1.2 billion in 2020. From its peak of 2.1 percent in the late 1960s, the global population growth rate is expected to slow to 1.04 percent by 2015–2020. Africa's projected population growth rate of 2.3 percent in 2015–2020 will be more than double the growth rates in other regions. If fertility rates in developing countries decline faster than expected, as has happened in a few African countries following increased support for poverty alleviation programs, reproductive health services, and education, especially for women, the population growth rate could decline at a faster rate. AIDS may also significantly reduce population growth rates by as much as half in some African countries by 2020. Should fertility rates not decline as expected, global population in 2020 could be higher than 8 billion.

Most of the population increase in developing countries between now and 2020 is expected in the cities. Rapid urbanization is expected to more than double the urban population in developing countries to 3.6 billion by 2020. By this time, urban dwellers will outnumber rural dwellers in all regions. This population pressure in urban areas will create enormous demand for services. Extreme poverty, insufficient economic growth,

and lack of employment opportunities in rural areas and hopes of employment and access to social services in urban areas will drive rural dwellers to migrate to cities in many low-income developing countries at rates beyond those justified by urban employment opportunities.

As people live longer and population growth rates continue to fall, the share of elderly people in middle- to higher-income developing countries is growing while the share of children is falling. This shift in the age composition of the population will significantly influence the design of future policy interventions to alleviate poverty and food insecurity. In the low-income developing countries, however, a large proportion of the population will continue to be young for some time, suggesting that education and employment generation will continue to be major priorities.

A 10-fold increase in the number of international refugees since 1974 to around 23 million today, along with 26 million refugees displaced within their home countries, reflects severe social and economic hardship. These problems often spill over into other areas, affecting many more people. Unless the underlying causes of these massive involuntary displacements of people—breakdown of civil society and governments, oppression, extreme poverty, hunger, and environmental degradation—are removed, this trend will continue, with increasing human misery and disruptions of productive activities. More than 40 countries and tens of millions of people today are experiencing hunger or are severely vulnerable to hunger because of past or

Food will have to be produced where it is most needed in developing countries, not simply to increase food supplies but also to generate incomes and employment through agricultural and resulting economic growth.

ongoing conflicts that have severely reduced food production and livelihood capacities and devastated natural resources. As the competition over scarce resources intensifies, many more people may come under the shadow of conflict, where food and water are often instruments for warfare and natural resources are often among the first casualties.

Food Supply

In the next 25 years, the world will be challenged to produce enough food to feed an additional 90 million people each year, as well as to meet increasing and changing food needs due to rising incomes and changing lifestyles. These needs will have to be met from more efficient use of land already under cultivation, as significant expansion of cultivated area is not an economically or environmentally sound option in most of the world. Food will have to be produced where it is most needed in developing countries, not simply to increase food supplies but also to generate incomes and employment through agricultural and resulting economic growth.

2020 Vision research suggests that the world is far from approaching biophysical limits to global food production. Warning signs, however, suggest that growth in food production has begun to lag. Increases in food production did not keep pace with population growth in more than 50 developing countries in the 1980s and early 1990s. The rate of growth of global grain production dropped from 3 percent in the 1970s to

1.3 percent in the 1983–93 period, and the amount of grain produced per person has fallen in the past decade. Yields of rice and wheat have been constant during the last few years in Asia, a major producer. Production from marine fisheries has peaked at 100 million tons and is now in decline.

If investments in agricultural research and infrastructure are maintained, at least at the already reduced levels of the 1980s, the future aggregate global food supply picture is likely to be good. 2020 Vision research projects that world foodgrain production will grow on average by 1.5 percent per year between 1990 and 2020, a rate high enough to increase global per capita availability of food and to reduce real prices for most commodities. World livestock production is projected to grow by 1.9 percent a year. Aquaculture production, which doubled between 1984 and 1992, is forecast to increase at a slower rate between 1990 and 2020, while marine fish catches are likely to be no higher than current levels in 2020. Foodgrain production in developing countries is projected to grow at an average annual rate of 2 percent (compared with 1 percent in developed countries) and livestock production at 3.3 percent (compared with 0.8 percent in developed countries).

2020 Vision simulations suggest that, if national and international institutions further cut back on public investments in agricultural research, health, nutrition, and education, the relatively favorable aggregate food situation could significantly worsen, reversing long-term world food price declines and increasing the number of malnourished children. But if

developing countries strengthen their investments in agricultural research, health, education, and clean water supplies; raise their income growth rates; and increase the enrollment of females in secondary schools, the number of malnourished children in developing countries could be substantially reduced and per capita market demand and supply of food significantly increased. A reduction in the population growth rate to the United Nations low-variant projection, so that the global population in 2020 is 7 billion instead of the anticipated 8 billion, would also significantly improve the food security situation.

Yield increases will have to be the source of most of the food production increases since cultivated area is likely to decline in many developed countries and only marginally increase in developing countries, except in Sub-Saharan Africa and Latin America, where some expansion of area is still economically and technologically feasible. However, these yield increases depend on continued research and successful dissemination of technologies and techniques to farmers. A second Green Revolution will be more difficult to achieve than the first. Should public investment in agriculture, particularly in agricultural research, continue to decline, and should extension systems fail to support small-scale farmers as they venture to adopt improved technologies, the aggregate food situation could significantly worsen.

The relatively favorable global food supply picture is not good for all regions. South Asia and Sub-Saharan Africa are of special concern. The gap between produc-

tion and market demand for cereals is forecast to widen from 1 million tons in 1990 to 24 million tons in 2020 in South Asia, and to triple to 27 million tons in 2020 in Sub-Saharan Africa. Unless poverty is significantly reduced, the gap between food production and need will be much larger. Sub-Saharan Africa in particular is unlikely to have the capacity to commercially import the difference between food needs and production. It is also unlikely that enough food aid will be available to bridge this gap. Food aid is likely to be increasingly scarce with the implementation of the Uruguay Round trade agreements, which will reduce domestic price support to agriculture and thus reduce surplus production in the industrial countries.

Sub-Saharan Africa's food economy is unlikely to have much effect on the global food situation—its share of the global market demand for foodgrains will probably not exceed 6 percent in 2020. However, what happens in two regions—China and Eastern Europe and the former Soviet Union—will greatly influence the global food projections. Any dramatic changes in China's food economy will reverberate around the globe. Structural changes in Eastern Europe and the former Soviet Union will determine the pace at which that region shifts from being a major cereal importer to a major exporter.

The central challenges between now and 2020 are to develop the global capacity to produce adequate food in an environmentally sustainable manner and to increase the capacity of poorer countries to produce food, not simply to increase their food supply, but to generate incomes and employment through agricultural growth.

Two-thirds of the world's degraded lands are found in Asia and Africa, but human-induced degradation is most severe in Africa, where 30 percent of the agricultural land, pastures, forests, and woodlands are degraded, followed by Asia (27 percent) and Latin America (18 percent).

Natural Resources and Agricultural Inputs

Soils. Concerns are growing about the extent and rate of soil degradation in the world and its effects on agricultural productivity and preservation of natural resources, including biodiversity. In the past half-century, about 2 billion of the 8.7 billion hectares of agricultural land, permanent pastures, and forest and woodlands have been degraded. Of these, about 750 million hectares of mildly degraded land could be restored through good land husbandry measures, while another 900 million hectares of moderately degraded land could be restored through significant on-farm investments. Restoring the remaining 300 million hectares of severely degraded lands will be much more costly, involving major engineering investments. About 5 to 10 million hectares annually become unusable due to severe degradation.

Two-thirds of the world's degraded lands are found in Asia and Africa, but human-induced degradation is most severe in Africa, where 30 percent of the agricultural land, pastures, forests, and woodlands are degraded, followed by Asia (27 percent) and Latin America (18 percent). Most of the degradation is taking place on agricultural and pasture lands, which are major sources of food, incomes, and employment for rural people in many developing countries. Soil degradation has affected 75 percent of agricultural lands in Central America and 65 percent in Africa, compared with 25 percent in Europe and North America. Most of the degradation is taking place in the "bread-

basket" areas (salinization), densely populated rainfed farming areas (nutrient depletion and erosion), and areas with important environmental roles (water erosion in upper watersheds).

Overgrazing, deforestation, and inappropriate agricultural practices account for most of the degradation. To a large extent, these problems result from or are exacerbated by inadequate property rights, poverty, population pressure, inappropriate government policies, and lack of access to markets, credit, and technologies appropriate for sustainable agricultural development. Crop productivity losses from degradation are significant and widespread in hilly areas, dryland cropping areas, rangelands, and irrigated areas. Unless nondegraded soils are protected and currently degraded soils are restored, increasing population and persisting poverty will hasten soil degradation between now and 2020.

2020 Vision consultations have identified "hot spots" of severe environmental deterioration by the year 2020. These areas include the Indus, Tigris, and Euphrates river basins, where continued salinization could threaten regional food security; the foothills of the Himalayas, where water erosion could exacerbate poverty and food insecurity; the highland areas of East Africa, where few ready sources of further productivity increases exist; the border zone between subhumid and semiarid areas in Africa, where migrations induced by dryland degradation could put additional pressure on the natural resource base; the forest margins of the lower Amazon, where overgrazing and nutrient loss are expected to worsen;

and the periurban areas around Mexico City, where pollution from agricultural chemicals could worsen. Soil fertility is a particularly serious problem in Africa, where a lack of replenishment of nutrients is leading to rapid deterioration.

Forests. During the 1980s, about 0.8 percent—15.4 million hectares—of tropical forests worldwide were converted to other uses every year. Latin America had the largest area of forest converted during that period—7.4 million hectares every year—but other areas, with smaller forest endowments, had higher rates of forest conversion and carry heavier risks of completely losing their forest assets. Rates of forest conversion are most rapid in continental Southeast Asia and Central America and Mexico, averaging about 1.5 percent a year. Deforestation has important local and global consequences, ranging from increased soil and water degradation to greater food insecurity (especially among indigenous peoples who depend on forest products for food, fiber, medicines, or income), escalating carbon emissions, and loss of biodiversity.

Small-scale, poor farmers clearing land for agriculture to meet food needs accounted for roughly two-thirds of the deforestation in the 1980s. Such forest conversion, driven by food insecurity, will continue between now and 2020, particularly in Africa, unless farmers have alternative ways of meeting food needs. And these needs will accelerate with population growth in rural areas. Commercial logging interests account for much of the remaining deforestation, especially in East Asia and West Africa. Although there is no consensus on the amount or location of

forest that this generation should bequeath to the next, there is evidence that the world's forests are neither properly managed nor, when converted into other assets, sufficiently productive to allow future generations to meet their needs.

Marine Fisheries. The world's fisheries are in crisis. Following a period of rapid expansion of harvesting from the oceans, more than a quarter of the 200 main marine fisheries worldwide are overexploited, depleted, or recovering, while another two-fifths are fully exploited. Fisheries are collapsing in some parts of the world, and international disputes over fish stocks are increasing. Resource management has failed to restrain fishers from exploiting natural fisheries beyond sustainable limits, leading to increasing conflicts as fish become more scarce. Even where access is restrained, most fisheries have too many fishers with legitimate access. 2020 Vision research projects that in 2020 fish catches will be, at best, no more than current levels, as losses from poor resource management and protection of some areas and species offset gains from better handling and exploitation of underused stocks. The challenge is to maintain the present levels of harvest from natural fisheries while sustainably increasing aquaculture production.

Water. Enough freshwater is available worldwide to meet needs for the foreseeable future if it were evenly distributed and appropriately used. But water is poorly distributed across countries, across regions within countries, and across seasons. Virtually all developing countries, even those with adequate water in the aggregate, suffer from debilitating seasonal and

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regional shortages. About 30 countries today are water stressed, with major problems in drought years. Of these, 20 are water scarce, with annual internal renewable water resources below the threshold required for socioeconomic development and environmental quality. By 2020, the number of water-scarce countries could approach 35. Competition for water is becoming more acute, increasing the potential for conflicts between sectors and water wars between countries.

2020 Vision research has identified several major water-related challenges to realizing the 2020 Vision. Development of new water resources has slowed since the late 1970s. New sources of water are increasingly expensive to exploit because of high construction costs for dams and reservoirs and concerns about environmental effects and displacement of people. Investment in irrigation projects has slowed, especially in Asia, even though increased production from irrigated lands is likely to be decisive in meeting future food needs. Efficiency of water use in agriculture, industry, and urban areas is generally low. Pressures to degrade land and water resources through waterlogging, salinization, and groundwater mining are mounting. Between 0.3 and 1.5 million hectares of land are lost each year worldwide from waterlogging and salinization. Pollution of water from industrial effluent, poorly treated sewage, and runoff of agricultural chemicals is a growing problem. Inadequate and unsafe domestic water supplies, compounded by inadequate or nonexistent sewage and sanitation systems, are a major cause of disease and death, particularly among

children, in developing countries. Inappropriate policies, distorted incentives, and massive subsidies provide water at little or no cost to rural and urban users, encouraging overuse and misuse of water. Water for irrigation, the largest use, is essentially unpriced. The overarching challenge between now and 2020 is to treat water as the scarce resource it is.

Fertilizers. According to 2020 Vision research and consultations, the use of mineral fertilizers will have to be substantially increased in developing countries to meet food needs by 2020, although organic sources can and should supply a larger share of plant nutrients. Fertilizers also play a key role in enhancing the natural resource base. 2020 Vision research forecasts that between 1990 and 2020, global fertilizer demand will grow, on average, by 1.2 percent per year to 208 million tons in 2020, a significantly lower rate than the 2.8 percent rate in the 1980s. Average annual growth rates are projected to be about 1.8–2.4 percent in Africa, Asia, and Latin America. Asia will account for more than half of the growth in global fertilizer use.

Depletion of soil nutrients is a critical constraint to food production in Sub-Saharan Africa. The projected growth in fertilizer use will be inadequate, given nutrient requirements for food production and for resource conservation. Fertilizer applications are low because of high prices (resulting from thin markets, lack of domestic production capacity, poor infrastructure, and inefficient marketing systems), insecure supplies, and the greater risks associated with food production in marginal areas.

Raw materials, capital investment, or technology do not appear to be critical constraints to future fertilizer production. Negative environmental and health consequences of fertilizer use and production must be avoided. In most developing countries, however, the problem is not excessive but insufficient fertilizer use. The major challenge is to promote a balanced and efficient use of plant nutrients from both organic and inorganic sources at farm and community levels to intensify agriculture in a sustainable manner.

Pesticides. Pre- and postharvest losses in potential crop production due to pests are very large in developing countries. However, past practices of pesticide use cannot be sustained. Since 1945, global pesticide use has increased 42-fold to about 2.5 million tons today. Concerns are multiplying in developed and developing countries that overuse or misuse of pesticides compromises human health; contaminates soils and water and damages ecosystems; suppresses species; and leads to pesticide resistance, pest resurgence, and evolution of secondary pests. Moreover, evidence shows that overuse of pesticides can lead to decreased food production: in Indonesia, introduction of an integrated pest management (IPM) program that combined biological controls and host-plant resistance with reduced use of chemical pesticides in the late 1980s was associated with an increase in rice yields. According to 2020 Vision consultations, it is clear that environmentally sound alternatives or methods of use must be developed and adopted. Available pest management means must be combined to achieve effective pest control

with little or no negative environmental effects or health risks.

Energy. Agriculture consumes only 5 percent of global commercial energy. However, energy use in agriculture has significantly grown in recent decades because of increases in cropped and irrigated area; rising mechanization in irrigation, land preparation, and harvesting; and use of chemical fertilizers. Chemical fertilizers alone account for almost 70 percent of developing-country energy use in agriculture. Increasing agricultural production and agroprocessing in developing countries will call for substantial increases in use of commercial energy. Still, agriculture will continue to be a minor user of energy.

Research and Technology. All of the food needed in 2020 and beyond cannot be produced using existing technology and knowledge alone. Low-income developing countries are grossly underinvesting in agricultural research compared with industrialized countries, even though agriculture accounts for a much larger share of developing countries' employment and incomes. Their public-sector expenditures on agricultural research are typically less than 0.5 percent of agricultural gross domestic product (GDP), compared with about 1 percent in higher-income developing countries and 2–5 percent in industrialized countries. Developing countries have far fewer agricultural researchers relative to the economically active population engaged in agriculture or to the agriculture acreage. Growth in public-sector expenditures on agricultural research in developing countries has slowed to 2.7 percent per year in the past decade, compared with

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7.0 percent in the 1960s. Many developing countries are even reducing their support for agricultural research. This trend has been under way for several decades in Africa (agricultural research expenditures per scientist have fallen by about 2.6 percent per year since 1961) and is more recent in Latin America. Further reductions in public investment in agricultural research will have severe consequences for global food production by reducing yield growth: projected world food price declines will be reversed and the number of malnourished children will increase.

Climate Change. A trend toward global warming is evident, but it will not significantly affect global food production in the next 25 years. This does not imply, however, that considerations related to climate change should be set aside. Human behavior in the next quarter century—the carbon dioxide and fluorocarbons injected into the atmosphere, the forests burnt down, the pollution added to the atmosphere—will determine the extent, longevity, and effects of climate change. Foresight is essential: while the effects of climate change may not be felt immediately or for some years to come, once it is set in motion, climate change may take a very long time to be reversed.

Markets, Infrastructure, and International Trade

In recent years, many countries have embarked on market reforms to move away from state-controlled or parastatal organizations toward reliance on private

firms operating in free markets. The need for such reforms is apparent in former centrally planned countries, but it is also evident in a number of mixed economies in the developing world. While clearly desirable, such reforms must be undertaken with care, taking into account the organizational structure of the affected markets. In some cases, inefficient parastatals are being replaced by oligopolistic or monopolistic private firms, with little or no gains to farmers and consumers. The ongoing and unprecedented transition from controlled to market economies and from patrimonial to open political systems has generated confusion about the appropriate role of government and weakened the capacity of governments to perform needed functions. “Free” markets are not necessarily the same as “competitive” markets, and government policy has an important role in ensuring the emergence of efficient, competitive markets as part of the reform process.

In many regions, especially Sub-Saharan Africa, food marketing costs are extremely high. Lowering these costs through investment in improved transportation infrastructure and marketing facilities (which also increase competition) may be as important in lowering food prices to consumers as increasing agricultural productivity. Many countries have made major improvements in recent years, but investments in infrastructure, especially transport and communication, are far below needed levels. Road, rail, port, and storage infrastructures are inadequate, while telecommunications, electricity, piped water, and sanitation systems reach only certain segments of society.

Past investments have tended to favor urban areas. Investments in creating and maintaining basic infrastructure in African countries, in particular, lag behind investments in Asian and Latin American countries.

The rapid growth of world trade and increased integration of developing countries into the global economy since World War II have changed the nature of the development process. No country can insulate itself from the world economy: trade policy and development policy go hand-in-hand. The value of world exports grew, on average, by 11 percent per year between 1950 and 1990, much faster than world income. The share of developing countries in world trade rose to 26 percent in 1992–93, doubling in just over 20 years. Many developing countries have gained enormously from increased participation in world markets as world trade has become increasingly liberalized, largely through a series of major rounds of trade negotiations under the General Agreement on Tariffs and Trade (GATT), including the recently completed Uruguay Round. There has also been a proliferation of regional trading arrangements, such as the North American Free Trade Association (NAFTA), MERCOSUR in Latin America, and a proposed Asia-Pacific free trade area. All indications are that these trends will continue into the future.

The results of 2020 Vision research and other work indicate that increased regional integration and further global liberalization are good for most developing countries. World trade in agricultural

goods will continue to increase, implying that developing countries should not seek food self-sufficiency but should pursue self-reliance through specialization and increased trade in agricultural and manufactured goods for which they have comparative advantage. 2020 Vision research also shows that developing countries benefit from regional trade arrangements that include one or more developed economies, but that they gain little from integration with other developing countries alone. For the low-income, food-importing countries, global trade liberalization and policy reform in agricultural subsidy policies in developed countries is a mixed blessing. They gain from increased access to developed-country markets, but they are less able to compete in those markets than other, better situated, developing countries. And they lose from higher food prices that may occur in the medium term with cutbacks in agricultural subsidies in the developed countries.

Domestic Resource Mobilization and International Assistance

The major source of aggregate investment in virtually all countries is domestic savings. For the low-income countries, the vicious circle of poverty still exists—low income leads to low savings, low investment, low growth, continued poverty, and continued low savings. Developing countries vary widely in their ability to mobilize savings and achieve high rates of investment. During the past 20 years,

N*o country can insulate itself from the world economy: trade policy and development policy go hand-in-hand.*

several countries in Asia and Latin America have become economic successes, with rising investment rates and rapid growth. For example, investment rates now exceed 35 percent of GDP in Indonesia, Malaysia, and Thailand. In Sub-Saharan Africa, however, the share of GDP devoted to investment has fallen in the past two decades from 20 to 16 percent, while the domestic savings rate has fallen from 18 to 15 percent. These rates are far from those needed to bring about target economic growth rates. Existing foreign debt in many developing countries makes increased domestic savings and investment extremely difficult for these countries. Current efforts to relieve debt burdens must be strengthened to permit developing countries to generate the necessary domestic investment to realize the 2020 Vision.

Foreign private investment, loans from international organizations, and official development assistance (ODA) have long been seen as ways to increase investment in developing countries and to break out of the poverty cycle, although there is widespread recognition now that such foreign investment must be accompanied by complementary domestic policy reforms if it is to be successful. Private flows to developing countries have increased substantially since the late 1980s. In 1993, these flows, which include direct investments, international bank lending, and bond lending, constituted 56 percent of total net resource flows to developing countries, up from

39 percent in 1989. Most of these flows, however, go to a small number of medium-income, semi-industrial countries in Latin America and Asia. Poorer countries, especially in Sub-Saharan Africa, are almost entirely left out and depend much more on aid flows.

ODA to developing countries is slowing, however. ODA from the 21 members of the Organization for Economic Cooperation and Development (OECD) grew at an annual rate of 3 percent in real terms from the early 1970s to 1992, peaking at \$60.9 billion in 1992. Driven by cuts in foreign assistance in 17 countries, ODA dropped by more than 6 percent in 1993. Its share of GNP fell to a 20-year low of 0.3 percent. Assistance from non-OECD countries has dropped even more dramatically; Arab OPEC countries provided 25 percent of world ODA in the early 1980s but contributed less than 2 percent in 1993. While foreign aid budgets rose during the 1980s, assistance to developing-country agriculture declined in real terms from \$12 billion to \$10 billion. Agriculture's share of total development assistance declined from 20 to 14 percent during the same period. Given these trends in aid availability, developing countries are challenged to devise strategies for accomplishing their goals with less aid.

A summary of the actions required to address each of the challenges described in this section appears in tabular form in the appendix.

Recommended Action

The above review of problems and challenges suggests that the 2020 Vision—eradication of hunger and malnutrition, sustainable management of natural resources, and efficient, effective, and low-cost agricultural systems—will be realized only if broad-based economic development is accelerated, particularly in low-income developing countries; if sound practices for managing natural resources are adopted; if investments in research, technology, and infrastructure are enhanced; if competitive markets are encouraged; if women have a greater voice in decisionmaking at all levels; if low-income people, especially women, gain greater access to remunerative employment, productive assets, markets, education, and health care; and if armed conflicts and civil strife are limited.

Agriculture's dual contribution in fostering broad-based sustainable economic development and meeting future food needs must be better recognized and exploited. Agriculture is a major contributor to overall economic development in developing countries, especially the lowest-income ones where it provides three-quarters of employment, nearly half of GDP, and more than half of all export earnings. The recent tendency by international development institutions and developing-country governments to reduce investments in agriculture because the global food supply situation is sufficient to meet current market demand fails to recognize that many people go hungry because they are too poor to convert their food needs into effective market demand. It also fails to recognize the tremendous opportunities the agriculture sector offers

for accelerating broad-based economic development and reducing poverty in both rural and urban areas, thereby improving food security. Developing countries must take advantage of the opportunities offered by the agriculture sector to realize the 2020 Vision.

No magic solution will make the 2020 Vision a reality. The action needed is not new, but it will require joint efforts by and new or strengthened partnerships between individuals, households, farmers, local communities, the private sector, civil society, national governments, and the international community. It will require a change in behavior, priorities, and policies. And it will require strengthened cooperation between industrialized and developing countries as well as among developing countries.

Each country must design its own action program. As a general guideline, however, research and consultations identified the need for sustained action in six priority areas to realize the 2020 Vision. Specific recommendations for action are provided below for each of these areas. These recommendations may serve as a point of departure for the design of country-specific strategies and action:

1. Strengthen the capacity of developing-country governments to perform appropriate functions;
2. Enhance the productivity, health, and nutrition of low-income people and increase their access to employment and productive assets;
3. Strengthen agricultural research and extension systems in and for developing countries;

Developing countries must take advantage of the opportunities offered by the agriculture sector to realize the 2020 Vision.

Each country must identify the appropriate functions of its government vis-à-vis other parts of society. The government's capacity to perform these functions must be strengthened while it relinquishes those functions better performed by others.

4. Promote sustainable agricultural intensification and sound management of natural resources, with increased emphasis on areas with agricultural potential, fragile soils, limited rainfall, and widespread poverty;
5. Develop efficient, effective, and low-cost agricultural input and output markets; and
6. Expand international cooperation and assistance and improve its efficiency and effectiveness.

The strategy discussed here is focused mostly on developing-country governments; however, it should be recognized that industrialized countries have a responsibility to maintain policies, including agriculture and trade policies, that facilitate, rather than impede, the realization of the 2020 Vision.

Strengthening the Capacity of Developing-Country Governments to Perform Their Appropriate Functions

More effective national and local governments are essential to realize the 2020 Vision. The other partners—individuals, households, farmers, private sector, NGOs, and other members of civil society—cannot realize the 2020 Vision on their own. The success of their efforts depends on the economic, social, and political conditions created or supported by governments.

A transition in the role of governments has been under way in a number of

countries in recent years, but there remains considerable confusion and disagreement about their role. Current efforts to reform the public sector threaten to weaken the ability and capacity of many governments to carry out the activities they should undertake. Each country must identify the appropriate functions of its government vis-à-vis other parts of society. The government's capacity to perform these functions must be strengthened while it relinquishes those functions better performed by others. Predictability and transparency in policymaking and enforcement, currently lacking in many countries, are critical to assist the private sector to anticipate the investment environment. Continuity in policy design and implementation is also important.

Improved security and personal safety in rural and urban areas are prerequisites for realizing the 2020 Vision; governments must maintain law and order. Where armed conflicts and civil strife are occurring or are imminent, civil society, governments, and the international community must give priority to conflict resolution and prevention. International development institutions, in partnership with governments and communities, should expand and strengthen early warning systems and response mechanisms for food and political crises. National and international development agencies should incorporate conflict prevention into program and project planning by identifying areas where the potential for conflict is high and defusing them by delivering aid in a manner that avoids competition and fosters or demands cooperation among groups or communities; by directing resources to

those areas that might be conflict-prone; by finding and promoting “engines of growth” to overcome perceived scarcities and to move people beyond scarcities; and by providing opportunities for men and women from conflict-affected areas to participate in project planning, implementation, and evaluation.

Governments must develop and enforce rules, regulations, standards, and measures in private-sector markets and promote and assure competition in these markets. States play an important role in assuring that conditions necessary for competition in private-sector markets are present. Governments must also invest in or facilitate private-sector investment in education, health care, agricultural research, infrastructure, and other public goods.

Policies to support the 2020 Vision should be guided by a long-term national strategy for food security, human nutrition, agricultural development, and management of natural resources. The agricultural system (including production, processing, distribution, and related activities) is likely to be the most appropriate cornerstone of such a strategy, especially in low-income developing countries, given its pivotal role in food production, income generation, employment provision, export earnings, and general economic development.

If, as many countries have agreed, freedom from hunger is a basic human right, governments should live up to this commitment by facilitating a social and economic environment that provides all citizens with the opportunity to obtain

adequate food. Rather than striving for national self-sufficiency in food (by producing all of the food needed to meet market demand), countries should strive for sustainable self-reliance in food (by producing or importing enough food to meet market demand at reasonable prices).

An appropriate macroeconomic environment is essential to realize the 2020 Vision. Governments must maintain exchange rates and monetary and fiscal policies appropriate for accelerated broad-based economic development. Subsidies (explicit and implicit), policies, and regulations that lower the cost of capital relative to labor and promote capital-intensive growth where labor is relatively cheap must be avoided. Macroeconomic reforms and structural adjustment programs should be continued, but redesigned where necessary to promote enhanced access by the poor to income-generating assets and to protect the poor from negative effects.

Governments can facilitate the transition to more open international markets and increased trade by investing in market information facilities and other infrastructure; by adopting policies to help diversify production of goods and services in response to emerging markets and changing relative prices; by improving the competitiveness of agricultural and other systems; and by developing and expanding small-scale, labor-intensive, private-sector agricultural processing in both rural and urban areas. Governments should invest in or facilitate private-sector investment in storage, transfer, transport, and marketing services.

For the 2020 Vision to be realized, the efforts and contributions of civil society must be fully recognized and supported and a more effective coordination and distribution of labor between government and civil society must be achieved.

Developing countries must enhance their access to international markets through bilateral and multilateral trade negotiations and regional integration. They should push for full and timely implementation of the recently concluded GATT agreement, and press for further reform of global trade in agriculture and other sectors to accelerate income growth and assure that the increasing trend toward regional trade or economic arrangements is compatible with subsequent international trade liberalization. At the same time, they should implement existing regional integration agreements in a manner that does not preclude subsequent global integration.

As governments strengthen their capacity to fulfil their proper role, they must let go of activities best done by other groups in society, such as private enterprise or NGOs. In many countries, NGOs and other parts of civil society have come to play a much more important role in areas traditionally covered by government, such as poverty relief and other transfer programs for low-income people, health care and nutrition programs, income-generation schemes, credit programs for low-income rural households, management of natural resources, and agricultural extension. NGOs have also been effective in influencing government action through advocacy. For the 2020 Vision to be realized, the efforts and contributions of civil society must be fully recognized and supported and a more effective coordination and distribution of labor between government and civil society must be achieved.

National governments must delegate more policy responsibility and authority to provincial and local governments and encourage fuller participation by local people in local decisions. This will make government policies and public-sector spending more effective and responsive to local needs and resources while providing a better foundation for interaction between government and civil society.

In summary, the 2020 Vision initiative recommends that governments should

- Assure predictability, transparency, and continuity in policymaking and enforcement;
- Engage in conflict resolution and prevention, in collaboration with civil society and the international community;
- Establish and enforce property rights in collaboration with local communities;
- Develop a national strategy to achieve the goals embodied in the 2020 Vision;
- Facilitate the work of NGOs;
- Enforce rules, regulations, and measures to promote and assure competition in private-sector markets;
- Maintain exchange rates and monetary and fiscal policies appropriate for broad-based economic development;
- Seek improved access to international markets through bilateral and multilateral trade negotiations and regional integration and press for further reform of global trade; and
- Delegate policy responsibility and authority to local governments and encourage local participation in decision making.

The international assistance agencies, including bilateral donors and multilateral institutions, should support these actions through technical and financial assistance.

Enhancing the Productivity, Health, and Nutrition of Low-Income People and Increasing Their Access to Employment and Productive Assets

The 2020 Vision will not be realized unless developing countries invest in poor people to improve their well-being, increase their productivity, and enhance their access to remunerative employment and productive assets.

Governments, local communities, and NGOs should assure access to a complete primary education for all children, with immediate emphasis on improved access for female and rural children; to primary health care, including reproductive health services, for all people; to clean water and sanitation services; and to training for basic literacy and skill development in adults. They should work together to strengthen and enforce legislation and provide incentives for gender equality. Improved access by the rural poor, especially women, to productive resources can be facilitated through land reform and sound property rights legislation, strengthened credit and savings institutions, more effective labor and land markets, and infrastructure for small-scale enterprises. Labor-intensive public works

programs have proven effective in generating employment, raising incomes, alleviating poverty and food insecurity, and creating infrastructure. Governments must expand employment through broad-based economic development, using agriculture as the engine of growth in low-income developing countries, and removing implicit and explicit subsidies on labor-replacing capital.

Investments to increase the productivity of rural people should take high priority in most developing countries, partly because the majority of the poor are found in rural areas and partly because failure to increase productivity of rural people can result in excessive outmigration and associated increases in urban poverty as well as further degradation of natural resources in areas receiving the migrants.

The rate at which population grows in developing countries is one of the key factors conditioning when and whether the 2020 Vision is realized. Strategies to reduce population growth rates include providing full access to reproductive health services to meet unmet needs for contraception; eliminating risk factors that promote high fertility, such as high rates of infant mortality or lack of security for women who are dependent on their children for support because they lack access to income, credit, or assets; and providing young women with education. Female education is among the most important investments for realizing the 2020 Vision.

Direct transfer programs, including programs for poverty relief, food security, and nutrition intervention, are needed in

many countries, at least in the short term. Such programs must be better targeted to the poor, and their food security effects monitored. Social safety nets for the rural poor are urgently needed. To assure appropriateness, the intended beneficiaries and the communities where they are located should be involved in the design, implementation, and monitoring of programs. Empowering women to have a voice in local decisionmaking will enable their needs to be recognized and addressed. The national capacity of most developing countries for identifying and targeting vulnerable individuals, households, and communities should be strengthened. Governments must maintain support for effective famine early warning systems and other disaster preparedness and management systems.

While national governments will continue to have a critical role in supporting the policies and programs described, the contributions of local communities and NGOs must also be strengthened. A better integration of the various actors and their responsibilities is urgently needed. Governments should find ways to transfer public funds to NGOs and local communities for programs best handled by them. Governments and NGOs should identify low-cost methods for providing social services to rural areas and seek opportunities for financing through user fees and other means of community-based resource mobilization.

In summary, the 2020 Vision initiative recommends that governments should

- Assure access to and support for a complete primary education for all chil-

dren, with immediate emphasis on female and rural children;

- Assure access to primary health care, including reproductive health services, for all people;
- Improve access to clean water and sanitation for all people;
- Provide training in literacy and skill development for adults;
- Strengthen and enforce legislation and provide incentives to empower women;
- Improve access by the poor to productive resources;
- Improve targeting of programs to the poor; and
- Maintain support for effective early warning systems and other disaster preparedness and management systems.

International assistance agencies should provide financial support for these actions on grant terms or as long-term low-interest loans.

Strengthening Agricultural Research and Extension Systems in and for Developing Countries

To realize the 2020 Vision of access to low-cost food for all people, developing countries, especially the low-income ones, must increase the productivity of agricultural production per unit of land and per agricultural worker and decrease unit costs in agricultural production, processing, and distribution.

The required productivity gains will be possible only if agricultural research systems are mobilized to develop improved agricultural technologies and techniques and if extension systems are strengthened to assure dissemination of the improved technologies and techniques to both male and female farmers. In many developing countries, especially the low-income ones, the public sector will have to carry out much of the needed agricultural research. Private-sector agricultural research is virtually nonexistent in these countries and is unlikely to increase significantly in the near future because private companies cannot capture enough benefits to make such investment worthwhile. If appropriate laws on intellectual property rights are designed and enforced, some of the required research could be undertaken, or at least financed, by the private sector, but it is likely that private-sector agricultural research will continue to play a much more important role in higher-income developing countries than in lower-income ones. Interactions between public-sector agricultural research systems, farmers, private companies that conduct research, private enterprises in food processing and distribution, and NGOs should be strengthened to assure relevance of research and appropriate distribution of responsibilities.

Each country must decide how much to invest in agricultural research, given its own priorities and options as well as expected economic benefits and the benefits forgone by not investing the funds elsewhere. If the 2020 Vision is to be realized, however, low-income developing countries must sharply expand their

investments in agricultural research. A minimum target of 1 percent of the value of total agricultural output is appropriate for most low-income developing countries, with a longer-term (5–10 year) target of 2 percent. Priority should be given to redressing the balance between scientific personnel and other expenses; in many low-income countries, including most of those in Sub-Saharan Africa, available funds per agricultural researcher are insufficient to assure efficient and effective use of the human resources.

Each country should develop a portfolio of research activities that addresses its needs, including needs articulated by small farmers, and expected social returns. Agricultural research should also be conducted on crops that women grow, and should utilize more fully women's indigenous knowledge base. Research activities should aim to reduce unit costs in agricultural production, processing, and distribution; increase the quantity and improve the quality (including the nutritional quality) of food produced; assure sustainability in production through sound use of natural resources; reduce risks and losses in production, processing, and distribution; and reduce the use of chemical pesticides where possible.

Although more research is needed for all ecoregions, there is an urgent need for research on areas with significant agricultural potential; low or irregular rainfall, fragile soils; large populations of poor people; and high risks of land degradation, deforestation, and loss of biodiversity. Although specific research priorities should be determined separately for each

In many developing countries, especially the low-income ones, the public sector will have to carry out much of the needed agricultural research.

Since the tools and techniques of modern molecular biology are being developed primarily in OECD countries, new partnerships need to be forged between private- and public-sector research in these countries, developing-country research institutions, and international agricultural research centers.

region, additional research is necessary to develop drought-tolerant and pest- and disease-resistant crops, biological pest management, nitrogen fixation, more effective use of locally available organic materials, intercropping systems, and perennial crops, including agroforestry.

National agricultural research must be supported by a vibrant international agricultural research system that undertakes strategic research of a public-goods nature with large international benefits. Current investment in international and regional agricultural research is grossly insufficient to provide the support needed by national agricultural systems and must be substantially increased to realize the 2020 Vision.

In industrial countries, biotechnology research by private companies and public-sector agricultural research institutions is producing exciting breakthroughs and significant gains for agriculture. However, this research is focused on temperate-zone agriculture. With some notable exceptions, such as the work on rice sponsored by the Rockefeller Foundation and the work done by some member centers of the Consultative Group on International Agricultural Research (CGIAR), advances in biotechnology for agriculture are bypassing developing countries, particularly the low-income ones located in tropical regions, because the results are often irrelevant to their agricultural problems. It is urgent that modern molecular biology be brought to bear on the agricultural problems of developing countries.

Few developing countries can afford to develop the tools of biotechnology. Even fewer can afford not to use these

tools as they become available. Since the tools and techniques of modern molecular biology are being developed primarily in OECD countries, new partnerships need to be forged between private- and public-sector research in these countries, developing-country research institutions, and international agricultural research centers. Each developing country should develop a clear policy on and research agenda for biotechnology based on existing and potential future research capacity and opportunities for regional cooperation and partnerships. To enhance the social benefits of agricultural research, including biotechnology, developing countries should develop clear intellectual property rights and biosafety regulations and remove inappropriate legal and institutional barriers to private investment in research needed to bring about the 2020 Vision.

International assistance is required to support a research portfolio appropriate for each developing country; to increase support for international agricultural research; and to facilitate biotechnology research in OECD countries that is sharply focused on developing-country problems. Partnerships need to be enhanced among national agricultural research institutions in developing countries, international agricultural research institutions, and relevant public- and private-sector institutions and companies in OECD countries in order to expand research of critical importance for developing countries.

Effective interactions between farmers and research institutions are essential for disseminating research results and tech-

nology and assuring that research priorities reflect the needs of farmers. In some countries, the private sector and farmer cooperatives effectively perform these extension functions. Because of its public-goods nature, however, agricultural extension for small-scale farmers producing staple foods must continue to be provided primarily by the public sector.

Public-sector extension in developing countries has a mixed performance record. Innovative strategies and techniques are required to assure effectiveness in the future. Extension services must strengthen communications between researchers and farmers and among farmers themselves. The importance of information for the agricultural system will increase dramatically between now and 2020. Mass media—utilizing satellite communications technology, radio, and video—can help transmit to farmers technical and market information adapted to their regions or farming systems. Extension programs conducted by the public sector and nongovernmental organizations can help local farmers or groups to improve land husbandry, make community investments, coordinate farm investments, obtain access to various sources of information, experiment with farming techniques, and share local innovations. New approaches to extension include providing farmer groups with matching resources to contract for private or public extension services.

In summary, the 2020 Vision initiative recommends that governments should

- Raise national agricultural research expenditures in developing countries

rapidly to a target of at least 1 percent of the value of agricultural output with a longer term (5–10 years) target of 2 percent;

- Develop a portfolio of research activities that address the country's needs;
- Expand agricultural research for all ecoregions, with emphasis on areas with significant agricultural potential but with fragile soils, low or irregular rainfall, and widespread poverty and natural resource degradation;
- Strengthen interaction between public-sector agricultural research systems, farmers, private enterprises, and NGOs to assure relevance of research; and
- Develop a clear policy on and agenda for biotechnology research; forge partnerships between developing-country research systems, international research institutions, and private- and public-sector research institutions in industrialized countries; and provide incentives for the private sector to undertake biotechnology research focused on the problems of developing-country farmers.

International assistance agencies should

- Increase financial support for national and international agricultural research for developing countries;
- Facilitate biotechnology research sharply focused on developing-country problems in public-sector research institutions of industrialized countries; and
- Strengthen partnerships among national agricultural research institutions in developing countries, international agricultural research institutions, and

The importance of information for the agricultural system will increase dramatically between now and 2020.

relevant public- and private-sector institutions and companies in industrialized countries to expand research of critical importance for developing countries.

Promoting Sustainable Agricultural Intensification and Sound Management of Natural Resources, with Increased Emphasis on Areas with Agricultural Potential, Fragile Soils, Limited Rainfall, and Widespread Poverty

A large share of the world's poor, food-insecure, and malnourished people live in rural areas with significant agricultural potential, limited and unreliable rainfall, and fragile soils. The land in these areas is often degraded and deforested. The 2020 Vision cannot be realized without large investments in these areas. They require public- and private-sector investments in infrastructure, market development, natural resource conservation, soil improvements, agricultural research, reproductive health services and family planning, primary education, and primary health care and nutrition programs. Although, in the long run, outmigration may be the answer for some of these areas, few countries are in a position to take in large numbers of mostly poor and poorly educated people between now and 2020. Moreover, outmigration merely transfers poverty and population pressures to urban areas and rural areas with

better natural resources. Failure to address the problems within the areas themselves will accelerate degradation of natural resources and increase poverty, food insecurity, and malnutrition.

In areas where current productivity is low but agricultural potential is significant, public policy and public-sector investment should promote sustainable use of existing natural resources to enhance the productivity of agriculture and other rural enterprises. Governments, in close collaboration with local communities and nongovernmental organizations, should establish and enforce clearly specified systems of rights to use and manage natural resources, including land, water, and forests. Incentives, such as partial coverage of costs, should be provided to farmers and local communities to undertake activities to restore degraded lands. Local control over resources should be enhanced and enforced, and local capacity for organization and management should be improved. Public institutions responsible for managing and regulating publicly and privately owned natural resources must be reformed to increase user participation in management and to provide incentives for private and community investment in and protection of resources. New forms of land- and other resource-improving investments, such as cofinancing between local communities, government, and private corporations should be explored. Appropriate policies are needed to address the problem of externalities, in which the costs of a decision made by a person or group of persons may have to be borne by others. Such externalities,

including failure to account fully for the effects of actions on future generations, may lead to another problem: inappropriate pricing of resources.

Efforts at natural habitat preservation should be pursued where critical to protect biodiversity, preferably in areas that are sparsely populated, have little or no infrastructure, and are of a size that can be effectively policed. Intensified agricultural production may be inappropriate for these areas. A moratorium on construction of infrastructure, particularly roads, that attract new migrants to these areas should be considered. Farmers and communities can be encouraged to establish protected habitat areas, such as wildlife corridors, and sacred groves, or to reestablish native vegetation along waterways or roads. Where protecting such areas presents clear international benefits, international contributions should support alternative sources of livelihood for populations in and around the areas.

Low and declining soil fertility is a widespread and serious problem in many developing countries, including most of those in Sub-Saharan Africa. Past and current failures to replenish soils with the nutrients removed must be rectified through the balanced and efficient use of plant nutrients from both organic and inorganic sources and through improved soil management practices. In view of the size and seriousness of the soil fertility problem in many low-income, food-deficit developing countries, policies providing incentives for farmers and communities to implement integrated soil fertility programs are needed. Such policies should

focus on assuring clear, long-term property rights to land; access to credit, improved crop varieties, and relevant information about efficient fertilizer use in various production systems; efficient and effective markets for plant nutrients; investments in roads and rural transportation systems; and temporary fertilizer subsidies where prices are high due to inadequate infrastructure or poorly functioning markets. Fertilizer subsidies, which are not generally desirable or advisable, may be the only way to raise fertilizer use in some locations where it is most needed. In the longer term, fertilizer costs to farmers can be reduced and the need for price subsidies eliminated by investing in distribution infrastructure, providing innovative ways to share risks and finance, and encouraging regional cooperation for country-level fertilizer production facilities and procurement.

As concerns build about the environmental and health consequences of chemical pesticides, alternative pest management techniques must be developed to lower the substantial crop losses that occur every year due to pests. These losses must be reduced if an increasing world population is to be fed largely from existing land. Developing countries should adopt national policies to use only enough chemical pesticides to be effective and to minimize the negative effects of such pesticides. IPM programs should be promoted as the central pest management strategy. Such programs rely on safe and environmentally sound techniques such as biological control, host-plant resistance, and biopesticides, while using chemical pesticides only as a last resort.

Developing countries should adopt national policies to use only enough chemical pesticides to be effective and to minimize the negative effects of such pesticides.

According to 2020 Vision consultations, a large share of existing land degradation is technically reversible, but the cost of doing so is high.

Extension of IPM, which has been successfully implemented in many locations, should receive both national and international support. Governments are also advised to remove pesticide subsidies; to increase investment in research on safe and environmentally sound alternatives to chemical pesticides; to facilitate private-sector investment in new strategies; to retrain research and extension staff in new techniques; and to ensure that farmers accept and implement the effective and appropriate strategies of pest management that are developed.

According to 2020 Vision consultations, a large share of existing land degradation is technically reversible, but the cost of doing so is high. For example, large investments are needed to drain waterlogged areas and to replenish soil nutrients. In most cases, neither market nor policy incentives are presently strong enough for farmers or other private-sector agents to undertake them. Thus, either the government must make the investment or the land will be left to deteriorate further until incentives are right. When prices for productive agricultural land increase, prices for food or other agricultural commodities rise, or technological improvements create a potentially profitable situation, the degraded land will be restored. Another option is to increase the productivity of degraded land through research: for example, crop varieties with higher salt tolerance could be developed to permit planting in salinized soils. Even though some damage from degradation can be overcome, minimizing degradation in the first place is usually much less expensive.

Natural fisheries are another resource for which government action is urgently needed to avoid unsustainable exploitation. Recognizing that natural fisheries are open access areas, the international community must develop and enforce a global program of coordination and restraint to prevent exploitation of these areas beyond sustainable limits. International codes and regulations must allow for recovery of fisheries that have been overexploited and must halt intensive use in areas where fisheries are fully exploited. Since takes from marine fishing are already far in excess of sustainable limits and economic efficiency, governments should reduce fishing in the short run and help fishermen move to other occupations.

Growing national, regional, and local water scarcities will depress agricultural production, worsen water-related health problems, degrade land and water resources, and catalyze water conflicts between users within a country and between countries. To address water scarcities, new water resources must be developed and better use made of existing water supplies. National governments should invest in carefully selected, economically efficient projects to develop new sources of water from dams and wells.

Because developing new water resources is expensive and potentially harmful to the environment, and because it may displace people from dam and reservoir sites, only a portion of rising demand can be met from new sources. A larger share of water to meet growing demands will have to come from more

efficient use of water in agriculture, industry, and urban areas. National governments must embark on comprehensive water policy reforms to improve incentives to users to save water to improve procedures for water allocation, and to develop and disseminate better technology for water supply and delivery. Policy reforms must provide secure water rights vested in individuals or groups of water users to provide investment incentives, improve water use efficiency, reduce incentives to degrade the environment, and increase flexibility in resource allocation. In some countries and regions, these rights should be tradable, which will provide further incentive to conserve water. Irrigation infrastructure and management should be turned over to water user associations where well-defined water rights provide incentives for user groups to economize on water use. Governments must reform distorted price incentives and reduce or remove subsidies on water to prevent overuse or misuse of water. In estimating the value of water, the time women spend transporting it and the health benefits that accrue from drinking clean water should be evaluated. Regulatory instruments and market incentives should be introduced to conserve water and to protect land and water resources. Governments should help make appropriate water conservation technology available.

The precise nature of water policy reform will vary from country to country, depending on underlying economic conditions and institutional capability, relative water scarcity, and level of agricultural intensification. Water policy reform

must also transcend national boundaries. In many regions, long-term solutions will require international cooperation between countries sharing scarce water resources.

In summary, the 2020 Vision initiative recommends that governments should

- Invest in and facilitate private-sector investments in agricultural research, infrastructure, natural resource management, and human resource development in areas with significant agricultural potential, limited rainfall, fragile soils, and widespread poverty;
- Establish and enforce clearly specified systems of rights to use and manage natural resources;
- Provide incentives to farmers and communities to restore degraded lands and protect natural resources;
- Strengthen local control over resources and improve local capacity for organization and management;
- Provide incentives to farmers and communities to implement integrated soil fertility programs in areas with low soil fertility through
 - policies to assure clear, long-term property rights to land and access to credit, improved crop varieties, and information about production systems;
 - effective and efficient markets for plant nutrients;
 - investments in roads and rural transportation systems; and
 - temporary fertilizer subsidies where prices are high due to inadequate infrastructure or poorly functioning markets;

For the 2020 Vision to be realized, it is essential that developing countries adopt a systems view of agriculture.

- Promote IPM programs as the central strategy for pest management, remove pesticide subsidies, seek safe and environmentally sound techniques, and increase farmers' participation in developing effective and appropriate strategies for pest management; and
- Undertake comprehensive water policy reforms to make better use of existing water supplies by providing incentives to water users, improving procedures for allocation, developing improved technology for water supply and delivery, providing secure water rights, and reforming distorted price incentives.

The international community must develop and enforce codes and regulations to allow recovery of overexploited marine fisheries and to prevent exploitation beyond sustainable limits. International assistance agencies should provide long-term low-interest loans to support investments in low-potential areas and to support credit for integrated soil fertility and drainage programs.

Developing Efficient, Effective, and Low-Cost Agricultural Input and Output Markets

Many developing countries are privatizing their agricultural input and output markets, replacing inefficient, poorly functioning state marketing companies and excessive, inappropriate government regulations with private-sector marketing agents. It is essential that this process

results in efficient, effective, and competitive markets for at least three reasons: (1) the gains from improved efficiency and reduced costs of marketing of staple foods can have a significant effect on food security through lower consumer prices and higher producer prices; (2) with the rapid urbanization expected in developing countries, efficient and effective food marketing becomes increasingly important; and (3) the rapid dietary transition projected for developing countries and international trade liberalization provide substantial opportunities in developing countries for competitive agricultural systems to expand employment in processing, packaging, and other value-added activities based on agricultural commodities. Agricultural systems will be competitive only if all components of the system, for example, input markets, production, and output markets, are efficient and effective. For the 2020 Vision to be realized, it is essential that developing countries adopt a systems view of agriculture.

To facilitate a successful transition, governments should identify their role in agricultural input and output markets and strengthen their capacity to perform this role, while disengaging from functions better performed by other agents. The role of the state is to create an environment conducive to competition among private agents in order to provide efficient and effective services to producers and consumers, while assuring access to productive resources by the poor to enable them to compete on equal terms. Policies and institutions that favor large-scale, capital-intensive market agents over small-scale, labor-intensive ones should be removed.

Market infrastructure that serves the public good, such as market information, roads and other rural transportation facilities, electricity, and communications facilities, should be developed and maintained by direct public-sector investment or effective regulation of private-sector investment. Governments should develop and enforce standards, weights and measures, and regulatory instruments essential for the markets to function. The failure of governments to invest in these public goods will result in lack of competition and in fewer and larger private companies, because larger companies are more likely to be able to fill the government's role where these basic public goods are absent.

Other tasks for government include removing institutional barriers to the creation and expansion of small-scale credit and savings institutions and making them available to small traders, transporters, and processing enterprises. Such institutions have also been effective in many countries in helping the poor to face risk and to generate more income. Governments should provide technical assistance and training to create or strengthen small-scale, competitive, private-sector market arrangements. Policies and practices that increase distribution costs, such as formal and informal road tolls associated with the transportation of agricultural commodities, should be abolished except when justified to cover the costs of constructing or maintaining the facility. Where distribution costs in agricultural input and output markets in low-income developing countries are high, opportunities exist for reducing unit costs of food to consumers without reducing producer incomes.

Governments should allocate the resources necessary to develop and maintain infrastructure, especially in rural areas. They should also help revitalize local governments in rural areas and create institutions to help them develop and coordinate new infrastructure. To improve efficiency, governments should recover costs through user fees, select projects based on careful evaluation of potential demand for services, and involve private contractors in executing projects.

As international trade becomes more open and more countries join regional economic arrangements, countries that do not reduce high transactions costs will fail to be competitive in both domestic and foreign markets. Efficient and competitive markets for agricultural goods are also important for supporting developing countries' efforts to expand employment and export earnings by producing and processing high-value products. Expanded agro-processing can be an important source of additional rural and urban employment. While agroprocessing itself should be undertaken by the private sector, governments should facilitate the expansion.

Finally, effective seed multiplication and distribution systems, critical for disseminating improved seeds from agricultural research, are absent in many developing countries. While the multiplication and distribution activities may be undertaken by either the public or the private sector, the government should assure a conducive environment for the private sector to enter these activities and should develop and enforce regulations to assure quality control, competition, and access to improved seeds by small farmers.

In summary, the 2020 Vision initiative recommends that governments should:

- Phase out inefficient state-run firms in agricultural input and output markets;
- Remove policies and institutions that favor large-scale, capital-intensive market agents over small-scale, labor-intensive ones;
- Invest in or facilitate private-sector investment to develop and maintain market infrastructure of a public-goods nature;
- Facilitate development of small-scale credit and savings institutions;
- Provide technical assistance and training to create or strengthen small-scale, labor-intensive, competitive rural enterprises in trade, processing, and related marketing activities; and
- Facilitate private-sector seed multiplication and distribution through regulations to assure quality control, competition, and access to improved seeds by small-scale farmers.

The international assistance community should assist through technical advice and selective financial support of, for example, revolving funds for small-scale credit programs.

Expanding International Cooperation and Assistance and Improving Its Efficiency and Effectiveness

The 2020 Vision will be achieved only if individuals, households, communities, civil society, and local and national governments undertake the required actions. International development assistance can provide only a fraction of the financial resources that will be needed to achieve the 2020 Vision. But these resources are crucial and must be allocated in ways that complement national and local efforts. Therefore, donors of international development assistance should focus their official government-to-government assistance on countries whose governments have demonstrated commitment to eradicating poverty, food insecurity, and malnutrition; to supporting an efficient, effective, and low-cost agriculture sector; and to protecting the natural resource base from degradation—goals embodied in the 2020 Vision.

The amount of international development assistance required to support the actions described here will exceed the development assistance currently available. Therefore, both donor and recipient countries must renew their efforts to assure that available international assistance is put to the best possible use. International development assistance should focus on four areas: (1) activities with large international benefits, such as international agricultural research and alleviation of global environmental problems; (2) investments in public goods

with high social payoffs and long-term benefits for broad-based economic growth and poverty alleviation, such as primary education, primary health care, nutrition programs, agricultural research, sustainable use of natural resources, and physical and institutional infrastructure; (3) programs to foster more efficient and effective use and allocation of resources shared by more than one country, such as allocation of water from a given river basin among countries bordering the basin; and (4) efforts to assure that low-income developing countries realize their fair share of the benefits from international trade liberalization.

The current downward trend in international assistance from the OECD countries must be reversed, and industrial countries currently giving below the agreed-upon target of 0.7 percent of their GNP should rapidly move toward that target. It is in the self-interest of donors to provide development assistance, not only to address important humanitarian considerations in developing countries, but also to enhance employment and trading opportunities in the donor countries. Developing countries are the largest potential market in the world, but that potential must be developed. The faster these countries grow, the more they import. By helping them to grow, development assistance creates export markets and economic growth for donor countries.

International assistance must be realigned to low-income developing countries, primarily in Sub-Saharan Africa and South Asia where the potential for further deterioration of food security

and degradation of natural resources is great. In higher-income developing countries, concessional aid such as grants should be replaced by internationally available commercial capital, freeing resources for low-income countries.

As the GATT agreements are implemented and distortions in the agriculture sectors of developed countries are reduced, the amount of food aid available for developing countries is likely to fall. Yet, the need for food aid, both for meeting humanitarian emergencies and for chronic food insecurity, is unlikely to be diminished. The international community will thus need to reassess how gaps between countries' food needs and their economic ability to meet these needs are to be filled.

International emergency assistance has increased dramatically during recent years at the expense of development assistance. Future emergency assistance should be linked with development to help prevent such emergencies and to enhance the ability of households to withstand such emergencies.

Measures to diversify sources of external financing should be pursued, together with measures to stem capital flight. To improve effectiveness of aid, each recipient country should develop a coherent, detailed, and operationally useful strategy for achieving the goals underlying the 2020 Vision, identifying the most appropriate use of international assistance. Where such a strategy already exists, it should be reviewed periodically. The role of international assistance should be clearly specified.

It is in the self-interest of donors to provide development assistance, not only to address important humanitarian considerations in developing countries, but also to enhance employment and trading opportunities in the donor countries.

In summary, the 2020 Vision recommends that developing-country governments should

- Develop a national strategy for achieving the goals underlying the 2020 Vision, specifying the role of international assistance;
- Diversify sources of external financing; and
- Seek measures to stem capital flights.

International development institutions and bilateral donors should

- Focus official government-to-government assistance on countries whose governments demonstrate commitment to the goals underlying the 2020 Vision;
- Raise international assistance to reach the target of 0.7 percent of GNP;

- Realign international assistance to low-income developing countries;
- Replace concessional aid to high-income developing countries with internationally available commercial capital;
- Maintain a certain minimum amount of food to be made available as food aid in emergency situations; and
- Focus international assistance on
 - activities with large international benefits,
 - provision of public goods with large social payoffs,
 - programs to encourage sharing of resources across boundaries, and
 - efforts to ensure that developing countries realize their fair share of benefits from international trade liberalization.



What If We Do Not Take Action?

Existing resources are sufficient to achieve the 2020 Vision if we, the global community, take appropriate action, including the necessary reallocation of resources. If appropriate action is not taken, a time will come when natural resource constraints will dictate our future. Therefore, we must act now. Failure to do so will result in more human misery and more degradation of natural resources, which in turn will impose misery on future generations and cause continued misallocation of scarce

resources. The benefits of appropriate action will not be limited to poor people in developing countries. Everyone will be affected. A world of extreme poverty on the part of many and overt material excesses for some is an unstable world. A continuation of the dramatic widening of the gap between rich and poor experienced during the past 30 years will lead to more social and political instability, poor use of available resources, and falling living standards for all. We must act while we still have choices.

Regional Strategies to Realize the 2020 Vision

As part of the 2020 Vision initiative, IFPRI co-sponsored workshops in three developing regions of the world. Policymakers, researchers, and technical experts in each region developed regional strategies to realize the 2020 Vision. The workshop on Latin America, co-sponsored by the Inter-American Institute for Cooperation on Agriculture (IICA) and the Centro Internacional de Agricultura Tropical (CIAT), was held in Cali, Colombia, March 20–22, 1995. The Institute for Integrated Development Studies of Nepal co-sponsored the workshop on South Asia, which took place in Kathmandu, Nepal, March 26–29, 1995. The workshop on Sub-Saharan Africa was held in Saly Portudal, Senegal, December 14–17, 1994, and co-sponsored by the Office of the Coordinator-General of the Conference of Ministers of Agriculture of West and Central Africa.

Key elements of the strategies devised for each region are presented here. Further details may be obtained from the full texts of the 2020 regional strategies.

Latin America

- Develop highly productive, sustainable food and agricultural systems. Develop technologies for all viable producers, especially small farmers, that increase productivity and protect the natural resource base. Develop system components beyond production to include storage, processing, and distribution.
- Facilitate responsible exploitation and protection of natural resources. Develop a consensus about the need to protect natural resources among producers and the general public; improve pesticide, water, and soil management; evaluate the environmental impact of policies and programs; and incorporate the value of natural resources in national accounts.
- Strengthen market forces. Ensure appropriate legal and regulatory frameworks to promote and, where necessary, regulate competition in the private sector; provide stable and transparent macroeconomic policies; and ensure complementarity between macroeconomic and sectoral policies.
- Support the needs of the private sector. Provide and maintain public goods, such as communications and transportation infrastructure and agricultural research and extension, in collaboration with the private sector where appropriate.
- Move decisionmaking and financial control from the central to local levels. Create new institutional frameworks that promote participatory democracy and allow local communities to identify their needs and design and administer programs congruent with locally available financial and human resources.
- Increase public-sector investment in human resources and basic infrastructure. Improve the quality of and access to education, primary health care, clean water, and sanitation, especially in rural areas and for women.

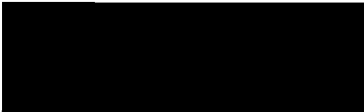
South Asia

- Increase investment in the agriculture sector through research and technology development and transfer, irrigation expansion, and development of human resources and rural infrastructure.
- Enhance access to improved agricultural technologies by strengthening linkages between research, extension, and farmers through a participatory approach; increasing information sharing and communication; and developing regional networks.
- Develop productive, sustainable, environmentally friendly technologies by giving high priority to formulation of a systems approach to agricultural development.
- Strengthen efforts to protect the environment by gradually discontinuing policies that lead to environmental degradation and promoting approaches that increase agricultural productivity and sustainability.
- Improve commercialization of agriculture through better production and marketing by increasing the role of the private sector, developing rural infrastructure, and improving market intelligence.
- Increase investment in human resources by introducing and strengthening programs that target poor individuals and households, emphasizing maternal and child health and nutrition programs, improving access to clean water and sanitation, providing safety nets for the poor, and investing in education.

- Improve trade linkages with the global economy and with the Asia-Pacific region, liberalize trade in feedgrains, and continue to liberalize trade and exchange rates.
- Improve government policies and the quality of governance at national and local levels, implement agrarian reforms, adopt macroeconomic policies neutral if not favorable to agriculture, and ensure local participation in decisionmaking.

Sub-Saharan Africa

- Proactively pursue national and international competitiveness. At the national level, develop lower-cost local products and marketing systems for them, improve product quality, and create innovative products through agroprocessing; at the regional level, implement existing regional integration agreements, harmonize national taxation policies, support policies for more efficient cross-border trade, and remove infrastructure and institutional barriers to flow of commodities across borders; and, at the global level, develop collective strategies for global trade negotiations to ensure fair access to markets.
- Reduce malnutrition and alleviate poverty through broad-based economic growth, taking direct measures in the near term such as targeted subsidies for vulnerable groups, targeted public works and other employment programs, and child nutrition programs for at-risk groups.



To accomplish these goals on a sustainable basis will require three actions:

- Increasing the productivity of agricultural production resources to achieve a sustained 4 percent rate of agricultural growth through in-depth scientific research, research on better practices for farm conditions, improved incentives, adequate attention to fertilizer supply, and improved transport;
- Boosting national public investment in

agriculture to 30 percent of national budget outlay from the historical average of 7 percent with effective and increased domestic resource mobilization; and

- Improving the quality, stability, probity, and consistency of agricultural policy, encouraging effective rural participation in political systems and developing a locally based process of analytical input into policymaking.

Appendix

Challenge	Current Status/Future Trend	Change in Status/ Trend Required	Highlights of Actions
Food security and nutrition			
Food security	Number of food-insecure people declining, but 800 million still lack access to sufficient food for healthy, productive lives	Enhance	Alleviate poverty, generate employment and incomes, and improve food distribution systems
Malnutrition	Bleak prospects for reducing malnutrition among children in Sub-Saharan Africa; reductions expected in other regions	Reverse in Sub-Saharan Africa; enhance elsewhere	Increase incomes, especially of women; enhance access to education, health care, clean water, and sanitation
Obesity	Emerging in some areas, notably cities; likely to increase in coming years	Reverse	Change underlying behavioral trends; improve eating habits
Poverty and economic growth			
Poverty	Likely to persist in South Asia and Latin America and increase considerably in Sub-Saharan Africa	Reverse	Accelerate broad-based economic growth, with agriculture as the engine of growth in low-income countries
Economic growth	Growth rates expected to remain high in Asia and improve in Africa and Latin America, but disparities likely to continue as Sub-Saharan Africa lags behind	Enhance	Accelerate income growth in slow-growing countries through macroeconomic stabilization, market reforms, and improved human resources
Income disparities	Income gap widening between the rich and poor within and across countries	Reverse	Narrow gap by removing disparities in access to markets, assets, and human development resources
Human resource development			
Education	Enrollment rates increasing but dropout rates remain high; girls complete fewer years of schooling than boys	Reverse	Assure access to and support for completing primary education for all children, especially female and rural children
Health care	Improving, but 1 billion still lack health care	Enhance	Assure access to primary health care for all, especially women and children
Clean water	Improving; 70 percent have access to safe water now compared with 36 percent in late 1970s	Enhance	Improve access to clean water
Sanitation	Improving, but almost 2 billion people do not have access to sanitation services	Enhance	Improve access to sanitation and sewage services

Challenge	Current Status/Future Trend	Change in Status/ Trend Required	Highlights of Actions
Food demand and diet changes			
Food demand	Global per capita demand for foodgrains forecast to grow 4 percent and demand for livestock products 18 percent between 1990 and 2020; demand growing faster in developing than developed countries; not expected to increase in Sub-Saharan Africa	Enhance	Generate employment and incomes, especially in Sub-Saharan Africa; lower unit cost of food production and marketing
Diet changes	Diets becoming more diverse: demand for livestock products growing faster than for foodgrains; demand for wheat and maize growing faster than for rice	Subdue feedgrain demand	Improve feed conversion rates (feed needed for each unit of animal product produced) to reduce pressure on grain production
Demographic variables			
Population growth	World population likely to increase by about 2.2 billion between now and 2020, 94 percent of it in the developing world	Subdue	Reduce population growth rates, particularly in Africa; alleviate poverty; increase education, especially for women; and strengthen reproductive health services
Urbanization	Urban population of developing countries expected to more than double to 3.6 billion by 2020	Subdue	Alleviate conditions in rural areas causing excessive migration; invest in both urban and rural areas to respond to migration
Age composition	Shifting toward older people in middle-income countries, while remaining very broad at young ages in low-income countries		Invest in education, employment creation, and income generation
Displacement of people	50 million people displaced inside or outside their countries; rapidly growing trend during past 10–20 years likely to continue	Reverse	Address sources of displacement: breakdown of civil society, poverty, and environmental degradation; enforce mechanisms for conflict resolution and laws protecting civilians during conflicts
Food supply			
Food production	Growth rate of food production lagging, but foodgrain production likely to grow by 1.5 percent per year and livestock by 1.9 percent; relatively good global food situation masks serious food problems in Sub-Saharan Africa and South Asia	Enhance	Invest in agricultural research; encourage efficient, low-cost, and effective agricultural systems

Challenge	Current Status/Future Trend	Change in Status/ Trend Required	Highlights of Actions
Food prices	Likely to remain stable or decline for most foods	Enhance	Increase food production; reduce marketing, distribution, storage, and processing costs
Yields	Stagnation or slowdown in rate of growth of major cereals	Reverse	Invest in yield-enhancing research and technology; reduce pre- and postharvest losses
Natural resources and agricultural inputs			
Soils	2 billion hectares degraded in past 50 years, much of which can be restored; 5–10 million hectares lost annually to severe degradation	Reverse	Prevent soils from becoming degraded by alleviating poverty, removing distorted resource policies, and securing property rights. Restore degraded soils through land husbandry measures and on-farm investments
Forests	15.4 million hectares of forests annually converted to other uses, two-thirds by small-scale, poor farmers seeking food security; such forest conversion likely to continue	Reverse	Help small-scale farmers obtain alternative ways of meeting food security; reforestation
Marine fisheries	World's fisheries are overexploited; production is at upper limits and is not likely to be higher in 2020	Reverse	Develop mechanisms to prevent exploitation beyond sustainable limits; intensify aquaculture production; improve resource management of natural fisheries
Water	Growing shortages of water across seasons, regions, and countries; competition for water becoming more acute between sectors and countries	Reverse	Reform water rights and water laws; improve procedures for water allocation between sectors; improve incentives for appropriate water use; improve technology for efficient water supply and delivery; improve international cooperation in sharing water
	Deteriorating quality and increasing pollution of water	Reverse	Adopt regulatory and market mechanisms to discourage pollution; invest in provision of clean water and sanitation services
Fertilizers	Global fertilizer use projected to grow annually by 1.2 percent between 1990 and 2020 compared with 2.8 percent in the 1980s	Enhance	Promote balanced and efficient use of plant nutrients from both organic and inorganic sources
Pesticides	Increased recognition of need to reduce chemical pesticides to protect human and environmental health	Reverse	Adopt environmentally sound alternatives such as integrated pest management

Challenge	Current Status/Future Trend	Change in Status/ Trend Required	Highlights of Actions
Energy	Increasing agricultural production likely to call for increased energy use	Subdue	Develop additional sources of energy, especially renewable sources, and improve efficiency of energy use
Research and technology	Low-income countries underinvesting in agricultural research and cutting back on it; declining support to international agricultural research	Reverse	Expand support to national and international agricultural research systems
	Fragile areas, where a large share of poor reside, neglected in past research priorities	Reverse	Direct more research to fragile areas
	Public-sector extension services not effective in communicating between farmers and research	Reverse	Develop innovative strategies and techniques to reach farmers; use mass media
Climate change	Global warming unlikely to change global food production in next 25 years, but could have varying regional effects	Subdue	As investment in longer-term future, change human behavior that is contributing to global warming

Markets, infrastructure, and international trade

Market reforms	Growing trend in developing countries, but often there is insufficient competition in private sectors; considerable confusion over role of governments	Enhance	Improve sequencing of market reforms; strengthen capacity of governments to perform needed functions
Distribution costs	High in developing countries, especially Africa	Subdue	Invest in improved transportation, infrastructure, and marketing facilities
Infrastructure	Infrastructure conditions and coverage poor; past investments have favored urban areas	Reverse	Invest in infrastructure construction and maintenance, especially in rural areas
International trade	Increased integration of developing countries into regional trading arrangements and world markets likely to continue	Enhance	Encourage increased regional integration and further global trade liberalization

Domestic resource mobilization and international assistance

Domestic savings	Falling in low-income developing countries; too low to support investments needed to achieve the 2020 Vision	Reverse	Improve savings and credit markets
International assistance	Official development assistance to developing countries is slowing; assistance to agriculture declined in 1980s	Reverse	Increase assistance, especially to agriculture and agricultural research; improve targeting and effectiveness of aid

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2033 K Street, N.W.
Washington, D.C. 20006-1002
U.S.A.
Tel +1-202-862-5600
Fax +1-202-467-4439
E-Mail ifpri@cgiar.org
Web www.ifpri.org
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