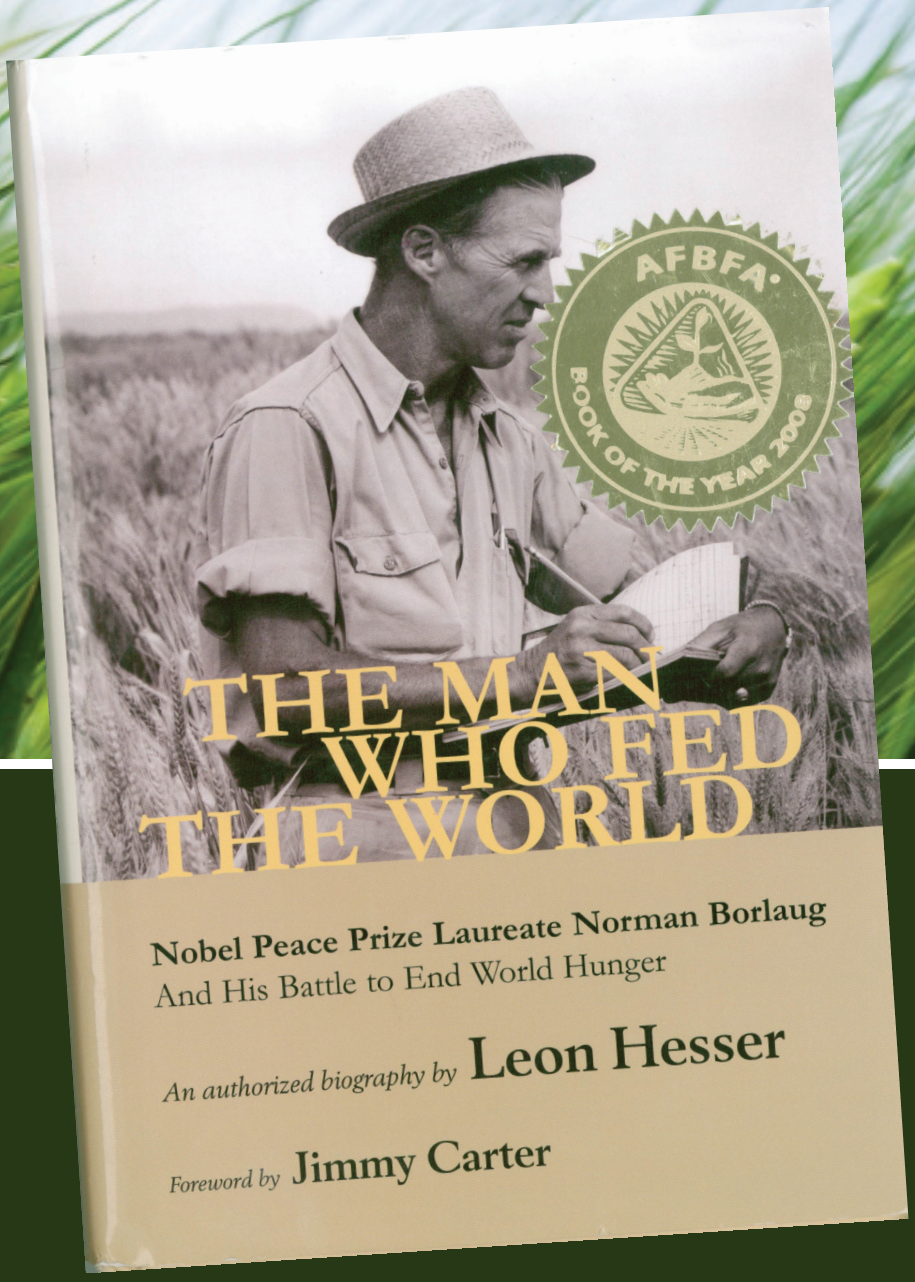
AccurateAg Books

GRADES 9-12

FEEDING THE WORLD



TEACHER'S GUIDE

Teacher's Guide to *The Man Who Fed the World*

Table of Contents

Introduction

Overview

How do we cultivate a sustainable future for Earth's growing population? What role does agriculture play in ensuring food security? These are questions students will answer as they study *The Man Who Fed the World*. The teacher's guide to the book contains modules and instructional materials designed to help high school students examine the elements of sustainable international development efforts, specifically with respect to the role agriculture plays in spurring economic transformation and growth in developing countries. Through reading *The Man Who Fed the World*, a biography about Nobel Peace Prize Laureate Norman Borlaug by Leon Hesser, students gain a first-hand account of the Green Revolution. The selected readings from the book illustrate a concrete example of a past international development effort for students to analyze from multiple perspectives, including its impact on food production, economic transformation, government policies, technological research and development, and the environment. At the end of the lesson, students will articulate a position, informed by fact, regarding how modern agriculture can be applied to sustainably accommodate Earth's growing population through future development efforts.

Implementation

The lesson is designed for 11th- and 12th-grade-level courses in social studies, environmental sciences and agriculture. It will take approximately four 50-minute class periods to implement the lesson (plus some student homework). The following list is a general flow for the four modules included in the lesson.

Module I – summary of the Green Revolution

Module II – summary of more recent international agricultural development efforts

Module III – small groups analyze a specific aspect of successful development efforts

Module IV – simulation in which students conduct a mock summit titled Cultivating a Sustainable Future: The Role of Agriculture in a Growing World

The Final Project asks students to develop their own position for the scenario based on all of the issues.

Educational Standards Addressed

The Standards for the English Language Arts

Reading for Information

- Read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; and to respond to the needs and demands of society and the workplace.

Writing with Purpose

- Employ a wide range of strategies to write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

Conducting Research

- Conduct research on issues and interests by generating ideas and questions, and by posing problems.
- Gather, evaluate and synthesize data from a variety of sources to communicate discoveries in ways that suit the purpose and audience.

Adapted from: National Council of Teachers of English & International Reading Association. *The standards for the English language arts*, Washington D.C., 1996.

Expectations of Excellence: Curriculum Standards for Social Studies

Science, Technology & Society

- Utilize technology to formulate possible solutions to real-life issues and problems – weighing alternatives and providing reasons for choices.
- Seek and evaluate varied perspectives when weighing how specific applications of science and technology have impacted individuals and societies in an interdependent world.

Global Connections

- Give examples of cooperation among individuals, groups and nations in different parts of the world.
- Identify and examine issues and problems that impact people in different parts of the world.

Production, Distribution & Consumption

- Analyze complex aspects of production, distribution and consumption.

Adapted from: National Council for the Social Studies. *Expectations of excellence: Curriculum standards for social studies*, Silver Spring, MD: 1994.

National Science Education Standards

Science in Personal and Social Perspectives

- Give students a foundation on which to base decisions they will face as citizens around issues such as: population growth, natural resources, and science and technology in local, national and global challenges.

Science as Inquiry

- Think and act in ways associated with scientific inquiry.

Science and Technology

- Develop an understanding about the relationship between science and technology. Students should develop abilities to identify and state a problem, design a solution – including a cost and risk-and-benefit analysis – implement a solution and evaluate the solution.

Adapted from: National Research Council. *National science education standards*, Washington, D.C.: National Academies Press. 1996.

Lesson Plan Overview

Grade Level

11–12

Description

How do we cultivate a sustainable future for Earth's growing population? What role does agriculture play? These are questions students will answer as they study *The Man Who Fed the World*. The teacher's guide to the book contains modules and instructional materials designed to help high school students examine the elements of sustainable international development efforts.

Educational Objective

Following the lesson, students will synthesize a position paper regarding the application of modern agricultural technologies and practices as a solution for stimulating growth in developing countries.

Students will be evaluated on the degree to which they are able to effectively:

- Summarize and support a personal position on applying modern agricultural technologies and practices in developing countries as a way to accommodate population growth and spur economic development.
- Analyze at least one social, political or environmental issue that must be considered in order to design an effective and sustainable agricultural development effort in a country that is currently designated as developing.
- Evaluate how the debate over social, political and environmental issues related to agricultural development efforts abroad may affect agriculture in the United States (U.S.).

Subjects

Environmental science, U.S. history, government, world history and agriculture

Essential Concepts

- Food security is a complex and global issue that continues to affect millions worldwide.
- The U.S. and other developed nations have a long history of providing foreign assistance to improve global food security.
- Current population growth is occurring most rapidly in developing nations, and this pressure creates an immediate need to find solutions to the food security problem.
- Food insecurity is most closely associated with poverty, and poverty rates for both rural and urban poor are the highest in less developed nations.
- Economic growth through agriculture is a central and proven tool for many developing countries.
- There are a number of factors that influence the productivity and profitability of agriculture in developing and developed countries.

Skills

Information literacy, composition and argumentation, problem solving, and issue analysis

Required Text

The Man Who Fed the World by Leon Hesser

Estimated Teaching Time

- Module I – 45 minutes
- Module II – 50 minutes
- Module III – 50 minutes
- Module IV – 50 minutes

Module I

Introduction to The Man Who Fed the World

Module Snapshot

45 minutes

Materials

- Copies of *The Man Who Fed the World* by Leon Hesser – 1 per student
- Copies of Study Guide 1 – A Different Kind of Revolution – 1 per student

Vocabulary

- Food security
- Foreign assistance
- Undernourishment
- Moral imperative

Required Reading

- None

Preparation

- Review the Module I Cliff Notes
- Prepare copies of Study Guide 1 – A Different Kind of Revolution

Interest Approach

Feeding a Family on $1.25 per Day (15 Minutes)

Step 1: Present the following scenario to the class.

> *According to the World Bank, in 2005 approximately 1.4 billion people around the world lived in extreme poverty, which means they earned less than $1.25 per day. Imagine you are the only wage earner in your family of three and you make $1.25 per day. At the end of the week, you have $8.75 to spend on meals the next week. Work individually or in pairs to make a list of groceries for your family of three that fits within this budget. Try to estimate the total number of calories provided by the items on your list.*

- If possible, present this scenario to the class as a homework assignment. Encourage them to visit a local grocery store to collect price information along with information about the number of total calories represented by the items on their list. (e.g., three medium-sized apples provides a total of 165 calories since each apple is approximately 55 calories)
- Students can look up calories associated with common food items on a number of Internet sites, such as Calorie King (www.calorieking.com).

Step 2: Ask the following questions to debrief.

- What kinds of groceries did you identify?
- How many total calories did you estimate the groceries on your list will provide?
- If you divide the total calories provided by seven, approximately how many calories per day will the items on your list provide?
- Now divide the total calories provided per day by three to identify the number of calories the items on your list will provide per person in your family per day.
- According to the Food and Agriculture Organization (FAO) of the United Nations, in 2003–05 the average minimum dietary energy requirement in developing nations was approximately 1,824 calories per person per day. Would the groceries you purchased provide adequate nourishment for each person in your family for a day (i.e., is the number of calories/person/day calculated earlier greater or less than 1,824)? What about for a week (i.e., is the total number of calories provided greater than or less than 38,304)?
- What are some of the problems you might encounter trying to live on this budget week after week? (Listen for: undernourishment, malnutrition, poor health, inability to function or work, etc.)

Step 3: Conclude and transition to the teacher-led discussion for this module with the following message.

- 1.4 billion people around the globe live on $1.25 or less per day. As you discovered, this situation can lead to numerous problems with accessing the food needed to live a healthy and productive lifestyle. Let's take a closer look at this global issue.

Teacher-Led Discussion

A Snapshot of Food Security, Hunger and Foreign Assistance (15 minutes)

Step 1: Introduce and define the terms food security and undernourishment.

- Food security means having access at all times to enough food for an active, productive and healthy life.
- Food insecurity means not having access, at all times, to enough food for an active, productive and healthy lifestyle.
- One measure of food insecurity is the number of undernourished people in a nation or region.
- Undernourishment means that a person's calorie consumption is continuously below a minimum requirement for maintaining healthy and productive activities.

Step 2: Share key statistics about food security and undernourishment from the Module I Cliff Notes.

- In 2008, the FAO estimated that 923 million people were undernourished.
- From 2003–05, the FAO estimated that 832 million of the 923 million undernourished people lived in developing countries.
- Of these people, 65 percent lived in only seven countries: India, China, the Democratic Republic of the Congo, Bangladesh, Indonesia, Pakistan and Ethiopia.
- China has made significant progress in reducing undernourishment following years of rapid economic growth.
- Nearly 16 million of the undernourished individuals lived in developed countries.
- According to the United Stated Department of Agriculture (USDA) Economic Research Service (ERS), in 2007 88.9 percent (104 million) of U.S. households were food-secure, meaning they had access at all times to enough food for an active, healthy life for all household members.
- Of the 11.1 percent (13 million) of U.S. households that were considered food-insecure:
  - 7 percent (8.3 million) were considered low food security, meaning that they obtained enough food to avoid substantially disrupting their eating patterns or reducing food intake by using a variety of coping strategies, such as eating less varied diets, participating in federal food assistance programs or getting emergency food from community food pantries.
  - 4.1 percent (4.7 million) were considered very low food security, meaning that normal eating patterns of one or more household members were disrupted and food intake was reduced at times during the year because they had insufficient money or other resources for food.
- Food insecurity is still growing. As of June 2009, the number of undernourished people worldwide was estimated to be 1.02 billion. The next State of Food Insecurity (SOFI) will be released in October 2009.

Step 3: Outline current efforts to ensure global food security using the following key points.

- The U.S. and other economically developed countries have a long history of foreign assistance. In particular, since World War II, there have been concerted efforts to promote food security worldwide. However, the problem still persists.
  - If your curriculum includes a section on political philosophy, consider discussing the U.S. involvement in foreign assistance in light of publications such as American philosopher John Rawls' *The Law of Peoples* or *A Theory of Justice* or Immanuel Kant's notion of a moral imperative to help students understand the underlying political philosophy behind foreign assistance.
- Reducing food insecurity is a global priority. In fact, in September 2000, 189 world leaders came together at United Nations Headquarters in New York to adopt the United Nations Millennium Declaration, a set of eight goals that have become known as the Millennium Development Goals. These goals are intended to be accomplished by 2015. One of the eight goals is to eradicate extreme poverty and hunger. While some progress has been recorded, recent increases in world food prices have created new challenges.

- Recent examples of the U.S. government's commitment to solving this problem include the following:
    - » According to the United States Agency for International Development (USAID), the U.S. has committed more than $5.5 billion for fiscal years 2008 and 2009 to fight world hunger.
    - » In 2009, Senators Dick Lugar (R-IN) and Bob Casey (D-PA) reintroduced the Lugar-Casey Global Food Security Act. The act is designed to increase resources for long-term rural development and poverty alleviation; to enhance human and institutional capacity through higher education for agriculture and extension; to establish a Global Food Security Strategy overseen by a Special Coordinator for Global Food Security; and to improve the U.S. emergency response to food crises.

Module Summary

Application (10 minutes)

Step 1: Introduce the study questions for lesson.

- Have students record the following study questions for the lesson in their notes:
    - » Why do problems with food security persist?
    - » What has been done to solve the food security problem?
    - » How does modern agriculture play a role in solving the food security problem?
    - » What can be done to solve the food security problem in the future?

Step 2: Share information about the author as you introduce and distribute *The Man Who Fed the World* by Leon Hesser.

- *The Man Who Fed the World* by Leon Hesser is a biography of Dr. Norman Borlaug's life and work. Through the book, you will gain insights into the study questions for the lesson as you discover Dr. Borlaug's mission to save hundreds of millions of lives from starvation.
- Dr. Borlaug was awarded a Nobel Peace Prize in 1970 for his scientific and humanitarian efforts to reduce world hunger and modernize agriculture in the developing world.
- During the 20th century, Dr. Borlaug was the only person to have been awarded the Peace Prize for work on food production.

Homework Assignments (5 minutes)

- Preview the first assigned reading from *The Man Who Fed the World*.
    - » Assign students to read Chapters 3–7 in preparation for the next module.
    - » Encourage students to skim Chapters 1 and 2 as background information about Dr. Borlaug's childhood and college experiences.
- Hand out the study guide pages for students to complete as they read Chapters 3–7.

Module I Teaching Notes

A Different Kind of Revolution

Chapters 3–7

What was Henry A. Wallace's vision?

Briefly describe the program the Rockefeller Foundation started in Mexico.

What were some of the challenges facing Norman Borlaug in Mexico, India and Pakistan before he arrived?

What were the three innovations that formed the foundation of a wheat revolution in Mexico?

What happened as a result of the innovative wheat breeding program in Mexico?

What was happening globally with regard to food production in the 1960s? (HINT: review pages 72–74)

A Different Kind of Revolution

Chapters 3–7

What did Thomas Malthus say about population growth? (HINT: look for Malthusian thought on page 79)

What was happening to population growth in India and Pakistan in the 1960s and 70s?

To ensure the success of the new agricultural technology, what things did Norman Borlaug advocate for from the governments in India and Pakistan?

Why do you think those things are just as important as the farmers receiving the seed from Mexico?

On page 91, the author talks about the U.S. Food for Peace program. Do you agree or disagree with the statement that the food aid program is not a permanent solution to the food security problem in Pakistan? Why or why not?

Who are five of the key people or organizations that made the first Green Revolution possible? What role did they play?

Module II

A Different Kind of Revolution

Module Snapshot

50 minutes

Materials

- The number of copies for Activity Sheets 1A–1F will vary based on your class size. To determine the number of copies, divide your class into 6 smaller groups. Each group will work with one of the activity sheets (e.g., one group with 1A, another with 1B, etc.). Each group member should receive a copy of the activity sheet assigned to the group.
- Copies of Activity Sheet 2 – Calling All Future Leaders – 1 per student
- Copies of Study Guide 2 - Making Agriculture Profitable and Productive – 1 per student
- 3 to 6 sheets of large newsprint or flip chart paper
- Markers

Vocabulary

- Poverty
- Development
- Human development index

Required Reading

- Chapters 3–7 in *The Man Who Fed the World*

Preparation

- Review the Module II Cliff Notes
- Read or review the Cliff Notes for Chapters 3–7 for *The Man Who Fed the World*
- Prepare the appropriate number of copies of each version of Activity Sheet 1 for each small group
- Prepare copies of Activity Sheet 2 and Study Guide 2 for each student

Interest Approach

Myth or Truth (5 minutes)

Step 1: Present the following statement to the class and have them determine if they believe it is the truth or a myth.

> *People are hungry because the world cannot produce enough food to sustain its current population.*

Step 2: Elicit responses from the class and share the answer.

- This statement is a myth. In the aggregate, the world actually produces a surplus of food. If we divided the world food supply evenly among the world's population, each person would receive substantially more than the minimum amount of nutrients required for survival. In the U.S. we are fortunate that farmers embrace technologies and practices that ensure an abundant, accessible and safe food supply.
- The problem is an issue of unequal distribution. There are certain factors that prohibit food from being evenly distributed among the world's population.

Step 3: Preview Module II.

- During the previous module, students briefly explored the ongoing global food security problem.
- During this module, students will examine issues related to the global food security problem.

Assigned Reading Recap

Chapters 3–7 (15 minutes)

Step 1: Setup a gallery with tasks.

- Place three posters on newsprint or flip chart paper around the room.
- Label each poster with one of the following tasks:
  - » Summarize the situation in Mexico, India and Pakistan before implementing Norman Borlaug's famous wheat-breeding program.

  - » List the "ingredients" that made Norman Borlaug's wheat-breeding program successful in India, Pakistan and Mexico.
  - » Think of these chapters as the script for a play. Create a list of the "cast" who made the Green Revolution possible. List the people and organizations involved and a brief description of their "starring role."
- Provide markers and have students move around the room to each poster and respond to each task.
- For a large class, create more than one poster for each task.
- To conduct this activity in a class with limited space, place the tasks at the top of a sheet of typing paper and have students pass the sheets of paper around the room to complete the "gallery" activity.

Step 2: Discuss the completed gallery with students.

- Ask students the following questions:
  - » What common themes emerge about the situation in Mexico, India and Pakistan prior to Dr. Borlaug's program?
  - » Based on the reading, which of the "ingredients" were most important to achieving success?
  - » Which characters played a critical role in this overall story?
- Use the Module II Cliff Notes and the Cliff Notes for Chapters 3–7 to add in additional details.

Teacher-Led Discussion

A Snapshot of Poverty, Population Growth and Development through Agriculture (20 minutes)

Step 1: Students analyze charts and tables with data regarding poverty, population growth and development.

- Divide the class into six smaller groups.
- Provide each group with copies of one of the following tables or charts:
  - » Activity Sheet 1A – World Population Growth Throughout History
  - » Activity Sheet 1B – Growth in More, Less Developed Countries and 2009 (Est.) Percent Annual Population Growth Rates for Selected Countries
  - » Activity Sheet 1C – Poverty Rates by Region (Rural vs. Urban)
  - » Activity Sheet 1D – Labor Breakdown by Country
  - » Activity Sheet 1E – Relationship Between Agricultural Productivity and Poverty
  - » Activity Sheet 1F – Human Development Index Trends from 1975–2005 for Selected Countries
- Have student groups review the chart and respond to the questions posed.

Step 2: Debrief and highlight the essential concepts.

- Ask each group to share and explain how to interpret their diagram and/or table.
- Each group also should share responses to the questions included on their activity sheet.
- Highlight the following essential concepts as students share their information:
  - » Current population growth is occurring most rapidly in developing nations, and this pressure creates an immediate need to find solutions to the food security problem (Activity Sheets 1A and 1B).
    - Population growth rates began to accelerate in the late 18th century.
    - Population continues to grow today, but the growth rate has slowed to approximately 1.4 percent according to 2000 estimates.
    - The majority of population growth now and in the future will occur in less developed countries.

- » Food insecurity is most closely associated with poverty, and poverty rates for both rural and urban poor are highest in less developed nations (Activity Sheet 1C).
    - The rate of absolute poverty increased most in Sub-Saharan Africa and South Asia from 1993 to 2002.
- » Economic growth through agriculture is a central and proven tool for many developing countries (Activity Sheets 1D, 1E and 1F).
    - Development efforts seek to reduce poverty and raise the overall productivity of the people in a nation.
    - There are many dimensions and paths to development; however, throughout history, including the U.S., increasing agricultural productivity has driven economic growth and helped reduce poverty.
    - Employment in the agriculture sector initially tends to be highest in less developed countries. As countries develop, so does the productivity of agriculture; thus, in more developed countries, fewer people may be involved, but production stays steady or increases.
    - Examples from South Asia and Sub-Saharan Africa demonstrate that productivity in the agriculture sector (typically beginning with cereal grains) leads to a reduction in absolute poverty.
    - Since the events associated with the Green Revolution in the 1960s and 70s, countries such as Pakistan, India, Mexico and China have all trended upward on the human development index.

Module Summary

Application (5 minutes)

Step 1: Introduce the final project.

- Have students read Activity Sheet 2 – Calling All Future Leaders.
- Have students complete the questions provided on the handout.
- If time permits, elicit responses from students regarding their initial answers to the questions.
- Preview the objectives listed under "Looking Ahead."
- For the final project, students can share their answers via the medium of their choosing:
    - » 5000-word essay
    - » 3- to 5-minute YouTube video
    - » 3- to 5-minute audio podcast with visuals
    - » 10- to 15-slide PowerPoint presentation

Homework Assignment (5 minutes)

- Preview the next assigned reading from *The Man Who Fed the World*.
    - » Assign students to read Chapters 9 and 12–14 in preparation for the next module.
    - » Encourage students to skim Chapters 8 and 10–11 as background information about Dr. Borlaug's family life during his time in Mexico and his experiences with earning the Nobel Peace Prize in 1970.
- Hand out the study guide pages for students to complete as they read Chapters 9 and 12–14.

Assessment (Time Required Varies)

- Collect students' study guides to assess reading comprehension and completion of homework.
- Collect a finished copy of Activity Sheets 1A–1F from each small group to assess in-class participation.

Optional Extension Activities (Time Required Varies)

Activity 1: Newspaper Article

- Present students with the following scenario:

  Imagine you are writing an article about world hunger for the local newspaper. What would you tell the citizens in your community about this issue?

- After considering the scenario, students should write a 500-word response appropriate for publishing as a newspaper article.

Activity 2: Short Position Paper

- Have students read the following articles:

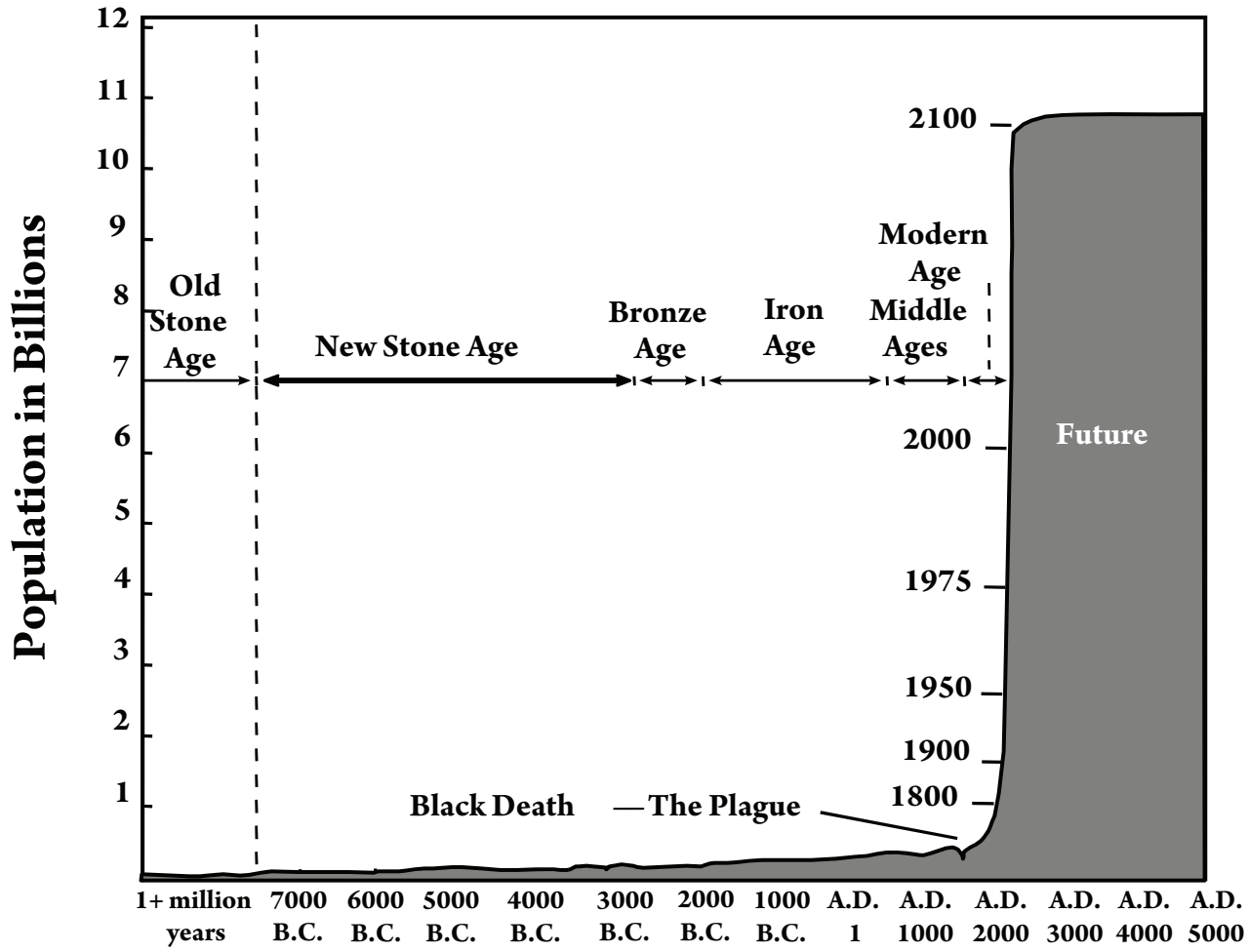
  » Norman Borlaug's 2002 article "The Green Revolution Revisited and the Road Ahead" located at http://nobelprize.org/nobel_prizes/peace/articles/borlaug/index.html.

  » International Food Policy Research Institute's (IFPRI) 2002 article "Green Revolution: Blessing or Curse" located at http://www.ifpri.org/pubs/ib/ib11.pdf.

- After reading the articles, students should write a 500-word essay to identify what they personally believe to be the major achievements of the Green Revolution as well as what they believe to be a valid criticism of the effort.

Module II Teaching Notes

World Population Growth Throughout History



Sources: Population Reference Bureau; and United Nations, *World Population Projections to 2100*. 1998.

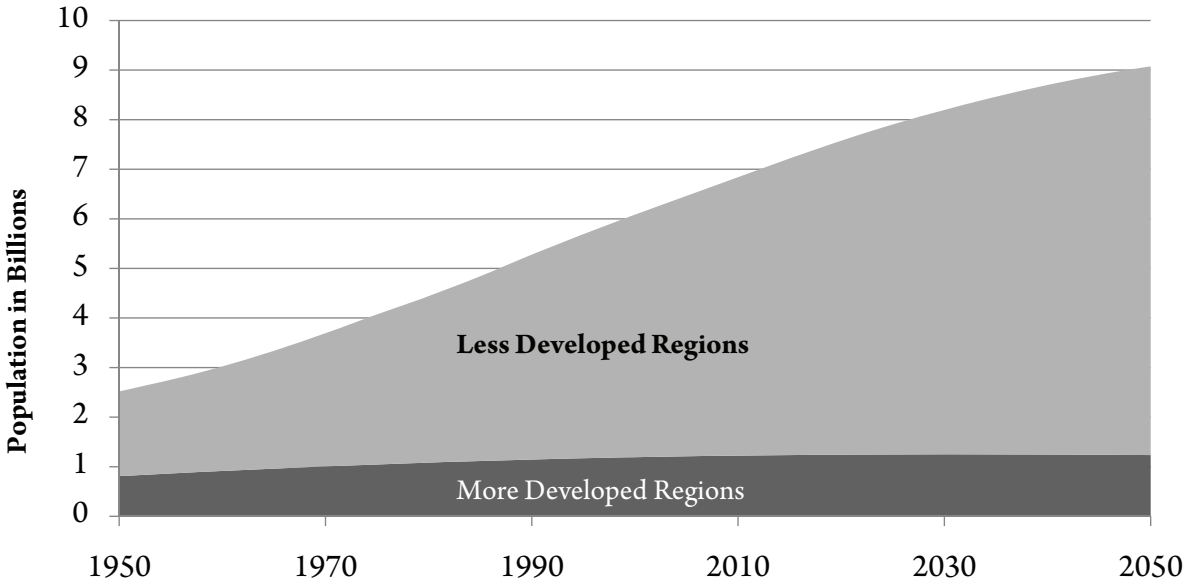
Questions to Consider

1. What trend(s) do you notice with the data presented in the graph?

2. Based on what you know about history, why do you think population growth began to spike in the 1800s?

3. How does the information on this graph relate to what you read in Chapters 3–7 of *The Man Who Fed the World*?

Growth in More, Less Developed Countries



Source: United Nations. *World Population Prospects: The 2004 Revision* (medium scenario). *2005.*

2009 (Est.) Percent Annual Population Growth Rates for Selected Countries

HDI Rank		
High Human Development		
8	Japan	-0.191
10	France	0.549
12	United States	0.975
20	Italy	-0.047
22	Germany	-0.053
26	South Korea	0.266
38	Argentina	1.053
52	Mexico	1.13
67	Russian Federation	-0.467
70	Brazil	-1.199
Medium Human Development		
75	Colombia	1.337
78	Thailand	0.615
81	China	0.655
94	Iran	0.833
107	Indonesia	1.136
115	Honduras	1.956
117	Bolivia	1.772
128	India	1.548
136	Pakistan	1.947
140	Bangladesh	1.292
148	Kenya	2.691
Low Human Development		
158	Nigeria	1.999
159	Tanzania	2.04
169	Ethiopia	3.208

Sources: United Nations, *Human Development Report*, 2008; and CIA, *World Factbook*. 2009.

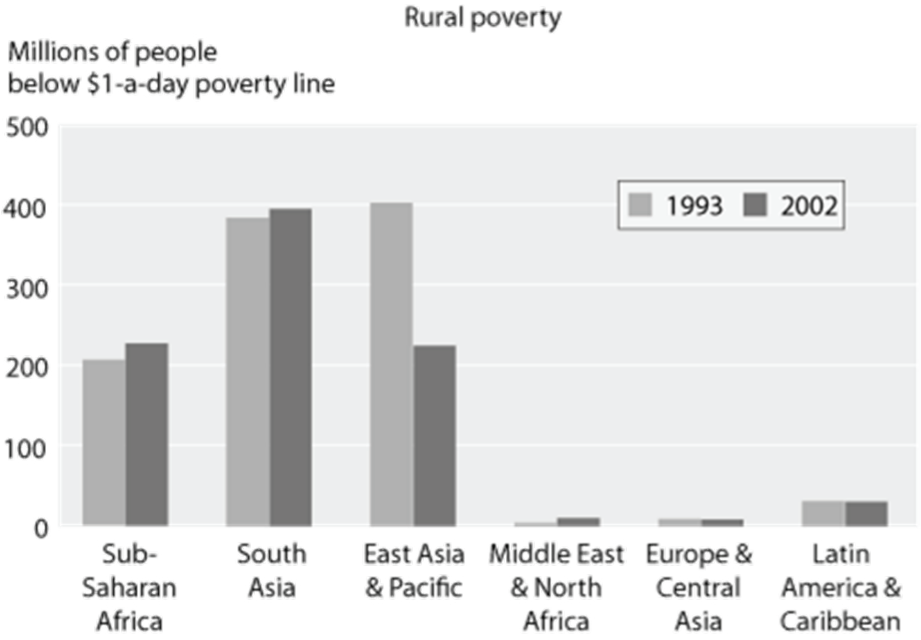
Questions to Consider

1. What trend(s) do you notice with the data presented in the population growth rate table?

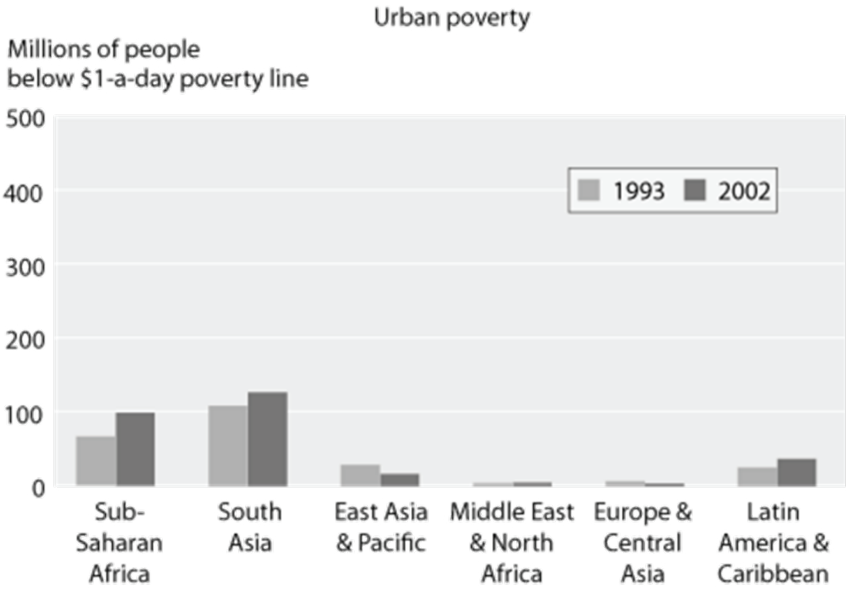
2. What conclusions can you draw from the graph about population growth trends in the next 20 to 50 years?

3. How does the information on the table or graph relate to what you read in Chapters 3–7 of *The Man Who Fed the World*?

POVERTY RATES BY REGION (RURAL VS. URBAN)



Source: World Bank. *World Development Report*. 2008.



QUESTIONS TO CONSIDER

1. What trend(s) do you notice with the data presented in the graph about rural poverty?

2. What trend(s) do you notice with the data presented in the graph about urban poverty?

3. How does the information on the graphs relate to what you read in Chapters 3–7 of *The Man Who Fed the World*?

Labor Breakdown by Country

HDI Rank		Employment in agriculture (% of total employment)	Employment in industry (% of total employment)	Employment in services (% of total employment)
High Human Development				
8	Japan	4	28	66
10	France	4	25	71
12	United States	2	21	78
20	Italy	4	31	65
22	Germany	2	30	68
26	South Korea	8	27	65
38	Argentina	1	24	75
52	Mexico	15	26	59
67	Russian Federation	10	27	63
70	Brazil	20	14	66
Medium Human Development				
75	Colombia	22	19	59
78	Thailand	43	20	37
81	China	44	18	16
94	Iran	25	30	45
107	Indonesia	44	18	38
115	Honduras	39	21	40
117	Bolivia	40	17	43
128	India	67	13	20
136	Pakistan	43	20	27
140	Bangladesh	52	14	35
148	Kenya	75	15	10
Low Human Development				
158	Nigeria	70	10	20
159	Tanzania	82	3	15
169	Ethiopia	93	3	5

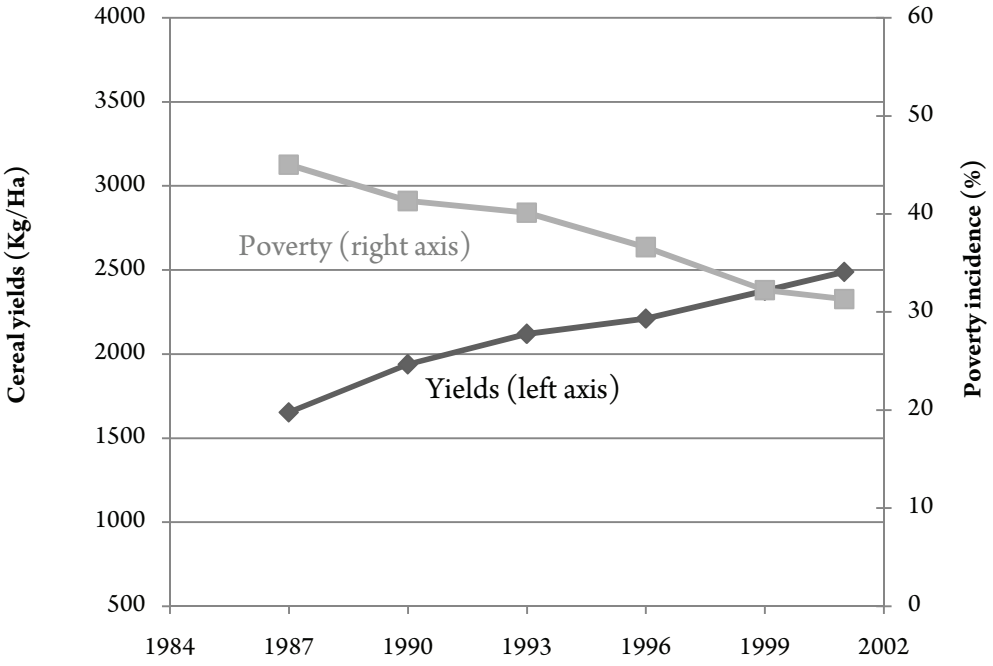
Sources: United Nations, *Human Development Report*, 2008; and CIA, *World Factbook*. 2008.

Questions to Consider

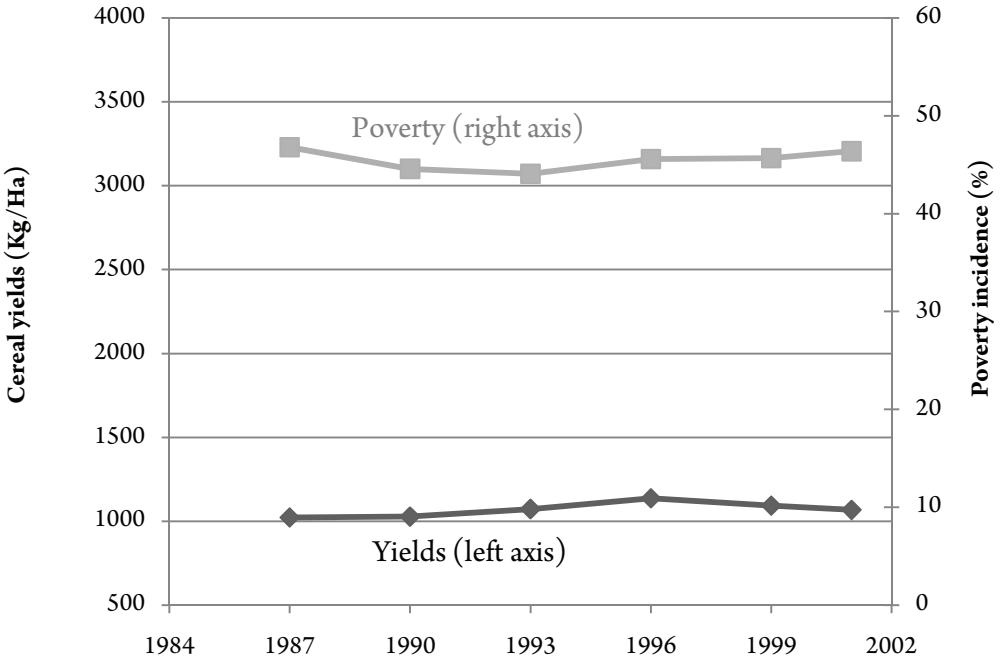
1. What trend(s) do you notice with the data presented in the table about labor breakdown by country?
2. How does the information on the table relate to what you read in Chapters 3–7 of *The Man Who Fed the World*?

RELATIONSHIP BETWEEN AGRICULTURAL PRODUCTIVITY AND POVERTY

Cereal Yields and $1 a day Poverty Incidence in South Asia



Cereal Yields and $1 a day Poverty Incidence in Sub-Saharan Africa



QUESTIONS TO CONSIDER

1. What happened to cereal production in South Asia from 1984 to 2002? How was that different than Sub-Saharan Africa in the same time period?

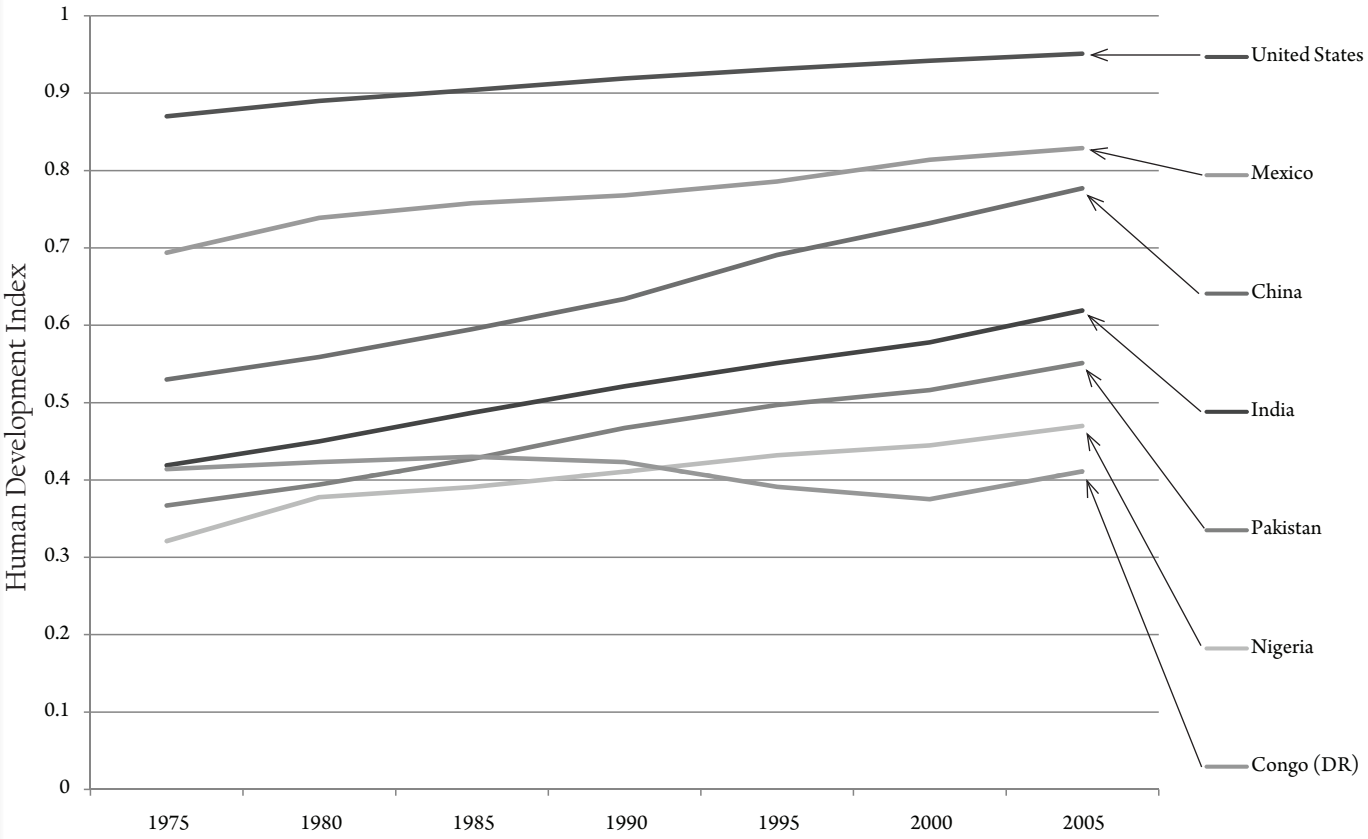
2. What happened to poverty in South Asia from 1984 to 2002? How was that different than Sub-Saharan Africa during the same time period?

3. Based on this information, what can you infer about the relationship between productivity of cereal grains and absolute poverty?

4. How does the information on the graphs relate to what you read in Chapters 3–7 of *The Man Who Fed the World*?

Source: World Bank. *World Development Report*. 2008.

Human Development Index Trends from 1975–2005 for Selected Countries



Source: United Nations. *Human Development Report*. 2007/2008.

The human development index is assigned by the United Nations Development Program and is based on the following ideas:

- Social progress – greater access to knowledge, better nutrition and health services
- Economics – the importance of economic growth as a means to reduce inequality and improve levels of human development
- Efficiency – in terms of resource use and availability, human development is pro-growth and pro-productivity as long as such growth directly benefits the poor, women and other marginalized groups
- Equity – in terms of economic growth and other human development parameters
- Participation and freedom – empowerment, democratic governance, gender equality, civil and political rights, and cultural liberty, particularly for marginalized groups defined by urban-rural, sex, age, religion, ethnicity, physical/mental parameters, etc.
- Sustainability – preservation in ecological, economic and social terms for future generations
- Human security – security in daily life against such chronic threats as hunger and abrupt disruptions, including joblessness, famine, conflict, etc.

Questions to Consider

1. Since 1975, what has happened to the human development index for India, Pakistan, Mexico and China?

2. How does the information on the graph relate to what you read in Chapters 3–7 of *The Man Who Fed the World*?

Calling All Future Leaders

You're a future leader in our nation and world. Your voice matters! What do you think about the following issue?

By 2050, the Earth's population will exceed 9 billion people. What's more, most of this growth will take place in developing countries where the demand for food and water outpaces the supply. Increasing the productivity of the agriculture sector in developing countries is one approach for stimulating growth and enhancing the welfare of a significant portion of the population. In the 1960s and 70s, agricultural development efforts in Mexico, India and Pakistan led to a "Green Revolution" – a period of rapid agricultural technology development and diffusion that significantly increased crop yields. The first Green Revolution produced a number of important advancements in agricultural technology and left behind several lessons learned to inform future development efforts.

Recent efforts in developing nations have reinvigorated public debate regarding the sustainability of international development efforts that promote the use of modern agricultural technologies. Proponents of these efforts contend that modern agricultural technologies, such as biotechnology, are necessary and will lead to a "new" Green Revolution to meet the needs of the growing population in today's developing countries. Opponents of these efforts caution the application of modern agricultural technologies to aid in development efforts by citing a number of social and environmental issues associated with the first Green Revolution.

Your Initial Thoughts

- What do you already know about this issue?

- What role should the U.S. play in providing assistance to fight hunger and eliminate poverty in developing countries?

- Do you think agriculture plays an important role in the development of other nations? Why or why not?

Looking Ahead

By the end of this lesson, you will be able to:

- Summarize and support your position on promoting modern agricultural technologies and practices in developing countries as a way to solve the food security problem, accommodate population growth and spur development.

- Analyze at least one social, political or environmental issue that must be considered in order to design an effective and sustainable agricultural development effort in a country that is currently designated as developing.

- Evaluate how the debate over social, political and environmental issues related to agricultural development efforts abroad may affect agriculture in the U.S.

Making Agriculture Productive and Profitable

Chapters 9 and 12–14

Describe the role scientific research plays in meeting the challenge of "Feeding 10 Billion People." Support your answer with at least two examples from the assigned reading.

Describe the role education and extension play in meeting the challenge of "Feeding 10 Billion People." Support your answer with at least two examples from the assigned reading.

Describe the role government policies play in meeting the challenge of "Feeding 10 Billion People." Support your answer with at least two examples from the assigned reading.

Norman Borlaug claims that China was a "success" story with respect to agricultural development. What factors contributed to this success?

Sub-Saharan Africa has been a development challenge. What were some issues discussed in Chapter 13 that have prohibited economic and human development?

In response to the question "Does the Green Revolution indicate that the war against hunger is won?" Norman Borlaug says, "By no means. No good student of the world food situation would claim that the problem of hunger has been whipped" (page 171). Do you agree with his assessment? Why or why not? What do you suggest needs to be done?

Module III

Making Agriculture Productive and Profitable

Module Snapshot

50 minutes

Materials

- The number of copies for Activity Sheets 3A–3F will vary based on your class size. To determine the number of copies, divide your class into 6 smaller groups. Each group will work with one of the activity sheets (e.g., one group with 3A, another with 3B, etc.). Each group member should receive a copy of the activity sheet assigned to the group.

Vocabulary

- Infrastructure
- Protectionism
- Free trade
- Biotechnology
- Physical water scarcity
- Economic water scarcity

Required Reading

- Chapters 9 and 12–14 in *The Man Who Fed the World*

Preparation

- Review the Module III Cliff Notes
- Read or review the Cliff Notes for Chapters 9 and 12–14 in *The Man Who Fed the World*
- Prepare the appropriate number of copies of each version of Activity Sheet 3 for each small group of students

Interest Approach

Helping at Home (5 minutes)

Step 1: Present the following scenario to the class.

> *During this lesson, you have discussed how to feed a hungry planet. Eleven percent of U.S. households are food-insecure at some point during the year. Based on what you know about the issue of food insecurity, what do you think can be done in more developed areas to prevent or eradicate hunger?*

Step 2: Elicit responses from the class.

- There is not a "correct" answer to this problem. However, some of the same factors that create food insecurity in less developed areas are involved in creating the situation at home. Fluctuations in food prices, instable employment, poverty, natural disasters and illness are just a few of the issues that create food insecurity at home. Likewise, programs that focus on raising incomes through employment with fair wages are a cornerstone of domestic policy to solve the problem.

Step 3: Preview Module III.

- During the previous modules, students explored the nature of the global food security problem, past efforts to solve this problem and the role of agriculture in solving the problem.
- During this module, students will examine various aspects that need to be considered when designing a solution to the food security problem.
- Many of the things that make agriculture productive and profitable in developing countries are the same factors that U.S. producers need to be productive and profitable.

Assigned Reading Recap

Chapters 9 & 12–14 (10 minutes)

Step 1: Students reflect on the key points about agricultural development efforts from the reading using the metaphor of laying a foundation for a house.

- Instruct students to draw a building or house on a sheet of paper; they should leave plenty of space underneath the structure to complete the rest of the activity.
- Explain that the strength of modern architecture is the foundation upon which structures are built. Without a strong foundation, the structure becomes unstable. The same principle applies to designing a solution for the global food security problem.
- Ask students to reflect on the assigned reading and pose the following question:
  - » What is one component of the foundation upon which we can build a solution to the world food security problem?

Step 2: Debrief the activity.

- Have students compare and contrast their components with someone sitting next to them.
- Have each pair join another pair of students to compare and contrast the components identified among their group of four.
- Ask students, "What common themes emerge about the solution to the challenge of ensuring food security?"
- Use the Module III Cliff Notes and the Cliff Notes for Chapters 9 and 12–14 to add in additional details.

Teacher-Led Discussion

Advocating for Ways to Make Agriculture Productive and Profitable (33 minutes)

Step 1: Students work in expert groups to examine an issue for which they will advocate during the summit scenario.

- Divide the class into six smaller groups.
- Explain the following summit scenario:

  A summit is a type of meeting that government leaders and institutions such as the U.S. government or United Nations use to ensure multiple perspectives are voiced regarding an issue. These voices are then considered when drafting legislative action or resolutions to set standards and direction for policy. We are going to hold a summit regarding the issue of food security. The summit is called Cultivating a Sustainable Future: The Role of Agriculture in a Growing World. You have each been invited to the summit as experts on a particular topic area. As the expert, it is your job to present the facts and issues as you advocate your position. However, as experts, you must consider the impact of your position on agriculture here in the U.S. To prepare, you will be provided with information, questions to consider and additional resources to review. You will work in teams and must prepare a short three- to five-minute presentation about your issue using the directions provided.

- Provide each group with copies of one of the following handouts:
  - » Activity Sheet 3A – Agricultural Markets and Free Trade Policies
  - » Activity Sheet 3B – Scientific Research and Technology Development
  - » Activity Sheet 3C – Water Use and Efficiency
  - » Activity Sheet 3D – Education and Training
  - » Activity Sheet 3E – Sustainable Agricultural Practices
  - » Activity Sheet 3F – Infrastructure Development
- Have student groups review the information provided on the sheet, answer the questions posed, review additional resources and prepare to advocate for their solution during the summit scenario.

- Make yourself available to answer any questions.
- If possible, ensure students have access to the Internet and productivity software such as Microsoft PowerPoint or Word to complete this portion of the lesson.
- If your curriculum has a particular focus on certain countries, encourage students to tailor their efforts to one of those countries.

Module Summary

Application (2 minutes)

Step 1: Remind students about the final project.

- Refer to Activity Sheet 2 – Calling All Future Leaders.
- Mention the objectives in the "Looking Ahead" section of the activity sheet.
  - » Students may respond to the objectives via a 5000-word essay, a short YouTube video, a podcast or a PowerPoint presentation.

Homework Assignment (Time Required Varies)

- Have students finish working in their expert groups to prepare for the summit scenario.

Assessment (Time Required Varies)

- Collect students' study guides to assess reading comprehension and completion of homework.
- Collect a finished copy of Activity Sheets 3A–3F from each small group to assess in-class participation.

Optional Extension Activities (Time Required Varies)

Activity 1: Agriculture in the News

- Have students locate articles about agriculture.
- Ask students to consider how these messages might influence public opinion about domestic agriculture and agricultural development efforts abroad.
- Have students write a 500-word response to the message that is appropriate for a newspaper article.

Activity 2: Adopt a Country

- Have students use the most recent Human Development Report from the United Nations to identify a low development country to research.
- Have students create a short profile about the country that includes the following items:
  - » Map
  - » Population statistics (including population growth rates)
  - » Snapshot of agriculture, industrial and service labor divisions
  - » Description of past agricultural development efforts (if any)
  - » Recommendations for development efforts

Module III Teaching Notes

Agricultural Markets and Free Trade Policies

Instructions

- Read the background information provided.
- Answer the questions.
- Create a 3- to 5-minute presentation to cover the issues and advocate for your topic at the summit.

Background Information

To be effective, producers must have opportunities to increase their share of domestic, regional or international markets. Globalization allows farmers in developed and developing countries to participate in markets beyond their national borders. By becoming participants in the global economy, farmers in both developed and developing countries can raise their incomes and, in the end, achieve food security for their families and countries, in general. Additionally, as economies develop abroad, domestic producers benefit because new markets for products develop as an economy grows. For example, as incomes in developing countries rise protein consumption also tends to increase. As such, expanding discretionary incomes develops new markets for agricultural products.

Important to market development is the development of trade agreements. In the 1980s and 90s, many developing countries sought to "protect" the development of their agricultural industry through high tariffs and subsidies that kept the price of food very low. Throughout history, protectionist policy has been applied to restrain trade between countries through methods such as tariffs and restrictive quotas. The problem with protectionist policies is that, if misapplied, they can create a false sense of security for producers and consumers in a country. Abroad, these policies hinder free market development. When these policies go away due to changes in leadership or governance, it leaves behind higher food prices and producers who are not equipped to participate in the realities of a global marketplace.

Free trade policy, on the other hand, promotes keeping government barriers at a minimum. A free trade agreement eliminates tariff and non-tariff barriers between nations. Today, free trade agreements between countries and regions, such as the North American Free Trade Agreement, are promoting agricultural market development and expanding opportunities for producers.

Additional Resources

U.S. Department of Commerce. *International Trade Association Free Trade Agreement.* 2009 ‹http://www.trade.gov/fta/›.

USAID. *Agricultural Markets and Trade.* 2009 ‹http://www.usaid.gov/our_work/agriculture/ag_markets_trade.htm›.

FAO. World Food Summit, Technical Background Document, *Food and International Trade, vol. 3, ch. 12.* 1996. ‹http://www.fao.org/WFS/index_en.htm›.

» Tip: On the World Food Summit site, click Documents on the left menu and then Technical Background Documents. Then locate Volume 3, document number 12 in the list provided.

World Bank. *World Development Report.* 2008 ‹http://go.worldbank.org/ZJIAOSUFU0›.

USDA. Foreign Agriculture Service. 2009 ‹http://www.fas.usda.gov/›.

Questions

1. Why is this issue important to growing the agricultural economy in developing nations?

2. What key points or evidence will you use to support your position?

3. How does your position on this subject relate to the U.S. agricultural industry?

Scientific research and technology development

Instructions

- Read the background information provided.
- Answer the questions.
- Create a 3- to 5-minute presentation to cover the issues and advocate for your topic at the summit.

Background Information

Given the population growth projections, it is known that food needs will continue to expand – especially in developing countries. Science and technology can enable increased agricultural productivity to meet this growing demand. Organized, effective scientific research is the primary mechanism for generating the new knowledge needed to increase agricultural productivity. Some of the problems agricultural research is solving include increasing yields; protecting crops from drought, pests and disease; improving food storage; and enhancing food's nutritional qualities. In *The Man Who Fed the World*, several chapters discuss an existing network of agricultural research institutions called the Consultative Group on International Agricultural Research. CGIAR is an alliance of 15 centers that carry out research and technology development to support agriculture around the globe. In the book, Norman Borlaug's focus at CIMMYT was on training new scientists in developing countries like Mexico, Pakistan and India. Having access to training institutions such as CIMMYT and others in the CGIAR network are essential to developing the next generation of scientists and technology developers to support innovations such as those during the Green Revolution. Application of biotechnology is a current focus of international agricultural research. Biotechnology can result in efficient, safe use of natural resources while improving the productivity of plant and animal agriculture in a sustainable way. Biotechnology can enhance the sustainability of agriculture in the following ways:

- Reducing pesticide and excess fertilizer use
- Battling damaging plant diseases and pests by developing new resistant crop varieties
- Making widely grown food crops more resilient and drought-tolerant
- Enabling better livestock disease diagnosis and the development of effective livestock vaccines

Additional Resources

USAID. *Science and Technology Web page*. 2009 ‹http://www.usaid.gov/our_work/agriculture/science_technology.htm›.

USAID. *Biotechnology Web page*. 2009 ‹http://www.usaid.gov/our_work/agriculture/biotechnology/index.html›.

World Food Summit. Technical Background Document, *Role of Research in Global Food Security and Agricultural Development, vol. 2, ch. 9*. 1996 ‹http://www.fao.org/WFS/index_en.htm›.

» Tip: On the World Food Summit site, click Documents on the left menu and then Technical Background Documents. Then locate Volume 2, document number 9 in the list provided.

World Bank. *World Development Report*. 2008 ‹http://go.worldbank.org/ZJIAOSUFU0›.

USDA. Agricultural Research Service. 2009 ‹http://www.ars.usda.gov/›.

Questions

1. Why is this issue important to growing the agricultural economy in developing nations?

2. What key points or evidence will you use to support your position?

3. How does your position on this subject relate to the U.S. agricultural industry?

Water use and efficiency

Instructions

- Read the background information provided.
- Answer the questions.
- Create a 3- to 5-minute presentation to cover the issues and advocate for your topic at the summit.

Background Information

Water use and efficiency is a growing concern. USAID estimates that 70 percent of all water used today is for agricultural purposes. Additionally, water demand is doubling approximately every 20 years. Currently, more than 1 billion people lack access to an improved water supply and more than 2 billion people lack access to improved sanitation, undermining efforts to protect public health. By 2025, estimates suggest that 2.8 billion people will be living in either water-scarce or water-stressed regions of the world. Ensuring the safety and availability of water for drinking, sanitation, agriculture and industry is a top priority for future agricultural development efforts.

There are two different types of water scarcity to consider: physical and economic. Physical water scarcity occurs when there is not enough water to meet all demands. Arid regions of the world are most affected by this type of scarcity. In particular, agriculture in U.S. states such as Arizona, New Mexico, Colorado, Utah and Nevada are all affected by physical water scarcity. Internationally, areas in the Middle East are most affected by physical water scarcity. Economic water scarcity, on the other hand, is a condition caused by a lack of investment in water or a lack of human capacity to satisfy the demand for water in areas where water is already abundant. Many times this is an issue with not having the infrastructure built to make use of the available water supply. Sub-Saharan Africa is affected by economic water scarcity.

Averting this looming global water crisis requires meeting two great challenges: improving water use efficiency to ensure that the quantity of water reserves remain adequate for humanity's many competing demands and reducing pollution and other threats to water quality to ensure that the water supplies we do have continue to be usable.

Additional Resources

USAID. *Water Productivity and Efficiency Web page*. 2009 ‹http://www.usaid.gov/our_work/cross-cutting_programs/water/water_productivity_efficiency.html›.

FAO. World Food Summit, Technical Background Document, *Food Production: The Critical Role of Water*, *vol. 2, ch. 7*. 1996. ‹http://www.fao.org/WFS/index_en.htm›.

» Tip: On the World Food Summit site, click Documents on the left menu and then Technical Background Documents. Then locate Volume 2, document number 7 in the list provided.

World Bank. *World Development Report*. 2008 ‹http://go.worldbank.org/ZJIAOSUFU0›.

FAO. *Water Web page*. 2009 ‹http://www.fao.org/nr/water/›.

USDA. Natural Resources Conservation Service. 2009 ‹http://www.nrcs.usda.gov/›.

Questions

1. Why is this issue important to growing the agricultural economy in developing nations?

2. What key points or evidence will you use to support your position?

3. How does your position on this subject relate to the U.S. agricultural industry?

Education and training

Instructions

- Read the background information provided.
- Answer the questions.
- Create a 3- to 5-minute presentation to cover the issues and advocate for your topic at the summit.

Background Information

In order for farmers to implement innovations from scientific and technological research, they must have access to the information. In the U.S., farmers have access to information on the latest technology through an expansive network of colleges, universities, public institutions, membership organizations, government agencies and private industry. Rural isolation is one of the challenges facing many developing countries. For example, in Sub-Saharan Africa, low to no access to roads and modern communication technologies makes it difficult for new information to flow into the area.

Rural extension is one way to meet the immediate needs of farmers and other rural people as they change their production and livelihood systems. In the U.S., the cooperative extension service is responsible for providing citizens with information from the state and federal levels related to national problems. They also relay needs related to agriculture, the environment, human health and well being, and community development. In many developing countries, this kind of system is not available, yet information flow is critical to improving economic conditions – especially in agriculture.

Development efforts need to encourage extension and education services to:

- Provide advice to farmers about problems or opportunities in agriculture.
- Facilitate development of organizations where farmers can come together to learn.
- Develop links with research programs.
- Ensure that farmers understand how to use new technologies in a responsible manner.
- Address public interest issues in rural areas.

Additional Resources

USAID. *Rural Extension and Advisory Services Web page*. 2009 ‹http://www.usaid.gov/our_work/agriculture/extension_services.htm›.

Association for International Agricultural and Extension Education. 2009 ‹http://www.aiaee.org/›.

FAO. *Educating Rural People Web page*. 2009 ‹http://www.fao.org/sd/erp/›.

World Bank. *World Development Report*. 2008 ‹http://go.worldbank.org/ZJIAOSUFU0›.

USDA. Cooperative State Research, Education and Extension Service ‹http://www.csrees.usda.gov/index.html›.

Questions

1. Why is this issue important to growing the agricultural economy in developing nations?

2. What key points or evidence will you use to support your position?

3. How does your position on this subject relate to the U.S. agricultural industry?

Sustainable agricultural practices

Instructions

- Read the background information provided.
- Answer the questions.
- Create a 3- to 5-minute presentation to cover the issues and advocate for your topic at the summit.

Background Information

Agriculture is a natural resource-based industry. According to USAID, of the 11 percent of the world's land surface that is suitable for agriculture, 38 percent has become degraded by poor natural resource management practices. Good stewardship of the available land through conservation techniques focused on protecting soil, air, water and animal health quality is necessary to maintain agricultural productivity. In the U.S., producers and ranchers embrace practices such as renewable agricultural products, precision agriculture and natural pest control practices to protect our nation's soil, water, air and wildlife. Doing so ensures continued economic growth, protection of local biodiversity and maintenance of vital resources. Similar measures focused on sustainability in the long term should be an important consideration when planning international development efforts.

In the past, many developing countries have met the need for increased productivity by expanding the area on which they are able to plant and grow livestock. This is typically done through a method called "slash and burn," which has led to problems such as deforestation, wildlife displacement and the reduction of valuable biodiversity. The Green Revolution in Asia was an example of another way to increase food production; however, it was unique in that it promoted increasing productivity on the available land rather than putting more land into production. For instance, they doubled cereal production between 1970 and 1995, yet the total land area cultivated with cereals increased by only 4 percent (World Bank, 2008). The FAO estimates that by 2030, an additional 121 million hectares (300 million acres) will be needed for global agriculture. This number represents an area that is larger than the amount of U.S. land currently devoted to the production of our nation's four largest crops: corn, soybeans, hay and wheat. Increasing productivity on the land currently in production is a far more sustainable route.

Additional Resources

USAID. *Sustainable Agriculture Web page*. 2009 ‹http://www.usaid.gov/our_work/agriculture/sustainable_ag.htm›.

FAO. *SD Dimensions Web page*. 2009 ‹http://www.fao.org/SD/›.

World Bank. *World Development Report*. 2008 ‹http://go.worldbank.org/ZJIAOSUFU0›.

USDA. Alternative Farming Systems Information Center. 2009 ‹http://afsic.nal.usda.gov›.

Questions

1. Why is this issue important to growing the agricultural economy in developing nations?

2. What key points or evidence will you use to support your position?

3. How does your position on this subject relate to the U.S. agricultural industry?

Infrastructure development

Instructions

- Read the background information provided.
- Answer the questions.
- Create a 3- to 5-minute presentation to cover the issues and advocate for your topic at the summit.

Background Information

The Oxford English Dictionary defines infrastructure as "the basic physical and organizational structures needed for the operation of a society or enterprise, or the services and facilities necessary for an economy to function." Think of infrastructure as a set of systems. One issue related to infrastructure and agriculture deals with ensuring that producers are able to access systems that allow them to move their product from the farm gate to the consumer's plate. U.S. farmers are able to do this because they have access to systems to transport, store, distribute and market their products; information and technologies necessary to make wise choices about production; and the credit and capital needed to secure the inputs necessary for production.

In developing countries, rural producers are often isolated from any organized system for marketing or distributing their products. Issues such as poor road systems, lack of access to information on pricing and other factors can hinder rural farmers' efforts to become competitive in the global marketplace. To develop markets, efforts must promote infrastructure development supported by fair and equitable access to those systems. For example, to produce products, farmers in developed and developing countries must be able to access and pay for inputs, such as seed, water, fertilizer, etc. However, inputs come at a price. In developing nations, many farmers do not have access to the capital needed to purchase these important inputs. In some cases, government policies subsidize the purchase of inputs. Generally, this act can create problems because it does not create the added benefits of building the economy through developing input industries. *The Man Who Fed the World* highlights the vital role the development of a fertilizer industry played in India. Another way governments can support producers in developing countries is by ensuring credit for the purchase of inputs. Through credit, producers are able to participate in the developing agricultural economy, and private input industries are able to develop. The result is development of the economy.

Additional Resources

USAID. *Agricultural Markets and Trade Web page*. 2009 ‹http://www.usaid.gov/our_work/agriculture/ag_markets_trade.htm›.

World Food Summit. Technical Background Document, *Food for Consumers: Marketing, Processing and Distribution, vol. 2, ch. 8*. 1996. ‹http://www.fao.org/WFS/index_en.htm›.

» Tip: On the World Food Summit site, click Documents on the left menu and then Technical Background Documents. Then locate Volume 2, document number 8 in the list provided.

World Bank. *World Development Report*. 2008 ‹http://go.worldbank.org/ZJIAOSUFU0›.

USDA. Rural and Community Development. 2009 ‹http://www.rurdev.usda.gov/›.

Questions

1. Why is this issue important to growing the agricultural economy in developing nations?

2. What key points or evidence will you use to support your position?

3. How does your position on this subject relate to the U.S. agricultural industry?

Module IV

Cultivating a Sustainable Future: The Role of Agriculture in a Growing World

Module Snapshot

50 minutes

Materials

- 6 sheets of cardstock
- Markers

Vocabulary

- None

Required Reading

- None

Preparation

- Students should have prepared a three- to five-minute presentation on their topic (assigned in the previous module)
- Ensure the room has access to the necessary audio-visual technology for the presentations

Interest Approach

Name Plates for Each Expert Group (5 minutes)

Step 1: Have each expert group develop a name tent that represents their group's position for the summit.

- Provide each group with a sheet of card stock and markers.
- Instruct each group to reflect on what they learned about their group's topic.
- Have each group create a name tent that states the group topic and has icons to illustrate their position.
  - » For example, the Agricultural Markets group might draw an icon that shows the word "Protectionism" inside a circle with a line through it, indicating "no protectionist policies."

Step 2: Preview Module IV.

- During the previous modules, students explored the nature of the global food security problem, past efforts to solve this problem, and the role of agriculture in solving the problem.
- During this module, students will advocate for a particular issue related to future international agricultural development efforts.

Mock Summit

Cultivating a Sustainable Future: The Role of Agriculture in a Growing World (40 minutes)

Step 1: Introduce the flow and agenda for the summit.

- Each expert group will have three- to five-minutes to advocate for their issue.
- During the presentation, the other expert groups should be capturing notes about the topic.
- At the end of the three- to five-minute time frame, another expert group must ask the presenting group at least one question. (If time permits, more than one expert group may ask questions.)
- After each group has finished, the entire group will create a "resolution" that identifies the class recommendations for directing future agricultural development efforts.

Step 2: Have each expert group share their presentations, followed by audience questions.

Step 3: Facilitate the development of a resolution.

- Use the resolution as a means to review the entire lesson.
- Start with the goal of the resolution by stating what the class is trying to accomplish.
  - » *For example, "Our goal is to ensure food security by reducing poverty through agricultural development."*

- List the rationale of the goal by stating why it is important.
    - » For example, "*Nearly 1.4 billion individuals worldwide live in absolute poverty and 1.02 billion are undernourished. Food security is a global imperative.*"
- Declare the recommendations for policy and action by stating what should be done about the situation.
    - » *For example, "We support the use of regional free trade agreements to build markets for agricultural products produced in rural areas."*

Module Summary

Application (5 minutes)

Step 1: Discuss the final project.

- Refer to Activity Sheet 2 – Calling All Future Leaders.
- Set a specific due date for the project.
- Mention the objectives in the "Looking Ahead" section of the activity sheet.
    - » Students may respond to the objectives via a 5000-word essay, a short YouTube video, a podcast or a PowerPoint presentation.
- Give students an opportunity to record the resolution content.
- If possible, schedule time for students to present their final projects as a class.

Assessment (Time Required Varies)

- Evaluate students' presentations using the following scoring guide:
    - » Content (5 points) – Was the content accurate?
    - » Research (5 points) – Did the group demonstrate adequate effort to research the topic?
    - » Participation (5 points) – Did all group members participate equally in the presentation?
- Evaluate students' final projects using the Final Project Scoring Rubric.

Optional Extension Activities (Time Required Varies)

Activity 1: Other Nobel Peace Prize Heroes

- Have students visit www.nobelprize.org.
- Once there, they should identify a past Nobel Laureate they find interesting.
- Using the materials provided on the site, they should answer the following questions:
    - » Who was this person?
    - » In what area were they honored?
    - » What did they do to earn the honor?
- After conducting sufficient research, have students report their findings to the rest of the group.

Activity 2: Learning about Local Agriculture

- Invite a local producer to speak with the class about trends in the agricultural industry.
- Encourage students to consider how the issues discussed during this module affect the local agricultural industry.

Module IV Teaching Notes

SCORE OF 6

A project in this category demonstrates clear and consistent command of the content and effective composition techniques, but it may have a few minor errors. A typical project:

- Effectively and persuasively develops a position on solving the food security problem.
- Demonstrates exceptional critical thinking regarding the implications of various solutions internationally and domestically and uses appropriate examples, reasons and other evidence to support the position taken.
- Is well organized and clearly focused, demonstrating coherence and a natural progression of ideas.
- Exhibits a skillful use of language, using a varied, accurate and appropriate vocabulary.
- Demonstrates a variety in sentence structure.
- Is free of most errors in grammar, usage and mechanics.

SCORE OF 5

A project in this category demonstrates a reasonably consistent mastery of the content and effective composition techniques, but it has occasional errors or lapses in quality. A typical project:

- Effectively develops a position on solving the food security problem.
- Demonstrates strong critical thinking about the implications of various solutions internationally and domestically and generally uses appropriate examples, reasons and other evidence to support the position taken.
- Is well organized and focused, demonstrating coherence and a progression of ideas.
- Exhibits competence in the use of language, using appropriate vocabulary.
- Demonstrates a variety in sentence structure.
- Is generally free of most errors in grammar, usage and mechanics.

SCORE OF 4

A project in this category demonstrates adequate mastery of the content and effective composition techniques, but it has lapses in quality. A typical project:

- Develops a position on solving the food security problem.
- Demonstrates competent critical thinking regarding potential implications of various solutions and uses adequate examples, reasons and other evidence to support the position taken.
- Is generally organized and focused, demonstrating some coherence and a progression of ideas.
- Exhibits adequate but inconsistent use of language, using generally appropriate vocabulary.
- Demonstrates some variety in sentence structure.
- Contains some errors in grammar, usage and mechanics.

SCORE OF 3

A project in this category demonstrates developing mastery of the content and effective composition techniques and is marked by ONE OR MORE of the following weaknesses. A typical project:

- Develops a somewhat weak position on solving the food security problem.
- Demonstrates some critical thinking but may do so inconsistently or use inadequate examples, reasons or other evidence to support the position taken.
- Is limited in its organization or focus or may demonstrate some lapses in coherence or a progression of ideas.
- Displays developing facility in the use of language but sometimes uses weak vocabulary or inappropriate word choice.
- Lacks a variety of or demonstrates problems in sentence structure.
- Contains a number of repeated errors in grammar, usage and mechanics.

SCORE OF 2

A project in this category demonstrates little mastery of the content and effective composition techniques and is flawed by ONE OR MORE of the following weaknesses. A typical project:

- Develops a weak position on solving the food security problem that is vague or seriously limited.
- Demonstrates weak critical thinking, providing inappropriate or insufficient examples, reasons or other evidence to support the position taken.
- Is poorly organized and focused or demonstrates serious problems with coherence or a progression of ideas.
- Displays very little facility in the use of language, using very limited vocabulary or incorrect word choice.
- Demonstrates frequent problems in sentence structure.
- Contains errors in grammar, usage and mechanics so distracting that it is difficult to understand the essay.

SCORE OF 1

A project in this category demonstrates very little or no mastery of the content and effective composition techniques and is severely flawed by ONE OR MORE of the following weaknesses. A typical project:

- Develops no viable position on solving the food security problem or provides little to no evidence to support the position.
- Is disorganized or unfocused, resulting in a disjointed or incoherent essay.
- Displays fundamental errors in vocabulary.
- Demonstrates severe flaws in sentence structure.
- Contains pervasive errors in grammar, usage or mechanics that persistently interfere with meaning.

FINAL PROJECT SCORE _____

FEEDBACK:

Module 1 Cliff Notes

Introduction to The Man Who Fed the World

Essential Concepts Taught in Module 1

- Food security is a complex and global issue that continues to affect millions worldwide.
- The U.S. and other developed nations have a long history of providing foreign assistance to improve global food security.

Cliff Notes

Food security is a global issue, and it remains one of the greatest challenges facing our world. Food security is a foundation for building social and economic development. It means that all people in a society have access at all times to enough food for an active and healthy life. Conversely, food insecurity means that individuals or groups do not have access at all times to enough food for an active, productive and healthy lifestyle.

One measure used to track the pervasiveness of food insecurity is the number of undernourished people in a nation or region. Organizations such as the FAO of the United Nations and the United Nations Development Programme (UNDP) are institutions that closely monitor the population of undernourished people globally. From 2003–05, the FAO estimates that 832 million of the 923 million undernourished people lived in developing countries. Of these people, 65 percent lived in only seven countries: India, China, the Democratic Republic of the Congo, Bangladesh, Indonesia, Pakistan and Ethiopia. China has made significant progress in reducing undernourishment following years of rapid economic growth. Nearly 16 million of the undernourished individuals lived in developed countries. According to the USDA ERS, in 2007 88.9 percent (104 million) of U.S. households were food-secure, meaning they had access at all times to enough food for an active, healthy life for all household members. The 11.1 percent (13 million) of U.S. households that were considered food-insecure were further divided into low food-secure households and very low food-secure households. Seven percent (8.3 million) were considered low food-secure, meaning they obtained enough food to avoid substantially disrupting their eating patterns or reducing food intake by using a variety of coping strategies, such as eating less varied diets, participating in federal food assistance programs or getting emergency food from community food pantries. The other 4.1 percent (4.7 million) were considered very low food-secure, meaning normal eating patterns of one or more household members were disrupted and food intake was reduced at times during the year because they had insufficient money or other resources for food.

Food insecurity is still growing. As of June 2009, the number of undernourished people worldwide was estimated to be 1.02 billion. The next SOFI will be released in October 2009.

Food security most affects individuals who live in extreme or moderate poverty around the world. According to the World Bank, in 2005 extreme poverty was defined as living on $1.25 per day, where as moderate poverty was defined as living on approximately $2 per day. Approximately 1.4 billion individuals worldwide live in extreme poverty, whereas the World Bank estimates nearly 2.1 billion live in moderate poverty on less than $2 per day.

Ensuring reliable access to a safe and affordable food supply in the U.S. and abroad is a priority in reducing the number of undernourished individuals around the globe. With a global economy where goods, services and capital flow rapidly from one country to the next, dealing with the issue of hunger and food security globally continues to remain an important aim of industrialized nations, such as the U.S. Improving food security is both a humanitarian and economic improvement imperative. From a humanitarian perspective, improving food security and eradicating poverty improves the quality of life for all people around the world. From an economic perspective, eradicating poverty and improving food security in other nations improves the world economy as a whole.

The United Nations has taken global action on this issue. In September 2000, 189 world leaders came together at United Nations Headquarters in New York to adopt the United Nations Millennium Declaration, a set of eight goals that have become known as the Millennium Development Goals. These goals are intended to be accomplished by 2015. One of the eight goals is to eradicate extreme poverty and hunger. While some progress has been recorded, recent increases in world food prices have created new challenges.

The U.S. also has a long history of foreign assistance. In particular, since World War II, there have been concerted efforts to promote food security worldwide. An example of the U.S. government's commitment to solving this problem includes increasing the budget for the USAID to $5.5 billion for fiscal years 2008 and 2009. Additionally, in 2009, Senators Dick Lugar (R-IN) and Bob Casey (D-PA) reintroduced the Lugar Casey Global Food Security Act. The act is designed to increase resources for long-term rural development and poverty alleviation; to enhance human and institutional capacity through higher education for agriculture and extension; to establish a Global Food Security Strategy overseen by a Special Coordinator for Global Food Security; and to improve the U.S. emergency response to food crises. In his opening statement to introduce the bill, Senator Lugar stated,

> *"Food insecurity is a global tragedy, but it is also an opportunity for the United States. The United States is the indisputable world leader in agricultural production and technology. A more focused effort on our part to join with other nations to increase yields, create economic opportunities for the rural poor, and broaden agricultural knowledge could begin a new era in U.S. diplomacy. Such an effort could improve our broader trade relations and serve as a model for similar endeavors in the areas of energy and scientific cooperation. Achieving food security for all people also would have profound implications for peace and U.S. national security. Hungry people are desperate people, and desperation often sows the seeds of conflict and extremism."*

Why do these problems persist? What has been done to solve this problem in the past? How does modern agriculture play a role in solving this enduring problem? What can be done to address this problem in the future? These enduring issues continue to consume space in the public discourse. As informed citizens and future leaders in our nation's local, state and federal government, our youth must be equipped to express informed views regarding these questions.

Through reading *The Man Who Fed the World* and completing the associated lesson activities, students will explore the issues involved in solving the world food security problem. *The Man Who Fed the World* by Leon Hesser is a biography of Dr. Norman Borlaug. In 1970, Dr. Borlaug was awarded a Nobel Peace Prize for his scientific and humanitarian efforts to reduce world hunger and modernize agriculture in the developing world. During the 20th century, Dr. Borlaug was the only person to have been awarded the Peace Prize for work on food production.

Module I References and Additional Resources

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FAO. *The State of Food Insecurity in the World 2008*. Rome, Italy. 2008.
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Lugar-Casey Global Food Security Act: lugar.senate.gov/food/legislation/

UN, Millennium Development Goals: www.un.org/millenniumgoals/index.shtml

UN, World Food Programme: www.wfp.org/

USDA ERS, Briefing Room on Food Security in the United States: www.ers.usda.gov/Briefing/FoodSecurity/

World Bank, PovertyNet: go.worldbank.org/33CTPSVDC0

Module II Cliff Notes

A Different Kind of Revolution

Essential Concepts Taught In Module II

- Current population growth is occurring most rapidly in developing nations, and this pressure creates an immediate need to find solutions to the food security problem.
- Food insecurity is most closely associated with poverty, and poverty rates for both rural and urban poor are highest in less developed nations.
- Economic growth through agriculture is a central and proven tool for many developing countries.

Cliff Notes

Note: Reference the charts and tables shown in Activity Sheets 1A–1F for visuals that corroborate this lesson's information.

The human race dates back approximately 3 million years. After agriculture replaced hunting and gathering of food (around 6000 to 8000 B.C.), population began to grow more quickly. Larger numbers of people could be supported due to increased food production. According to the 1984 World Bank World Development Report, by the year 1 A.D., there were approximately 300 million people worldwide, and by 1650 A.D., the population was approximately 500 million.

Another population growth spurt began during the industrial revolution in the 18th century and accelerated again after World War II when populations in developing countries began to grow rapidly. According to the U.S. Census Bureau Historical Estimates of World Population, the population in 1800 was approximately 1 billion. In 1930, the population reached 2 billion. In 1960, it was 3 billion, and by 2000, it reached more than 6 billion. The United Nations Population Division estimates that the population will grow to near 9 billion by 2050 and will stabilize at approximately 10 billion after 2200.

According to the CIA World Factbook, the annual rate of population growth peaked at 2 percent in 1965–70 and has declined to about 1.4 percent in 2000. However, growth rates in developing nations continue to remain more than 2 percent annually. According to the 2008 Data Population Sheet published by the Population Reference Bureau, the proportion living in the developing countries of Africa, Asia, Latin America and the Caribbean has expanded from 68 percent to more than 80 percent. India and China, with one billion-plus each in 2008, make up approximately 37 percent of the remaining total. Projections for 2050 show this shift to developing countries continuing. Rapid growth in these nations will intensify the effect many of these factors have on poverty and create additional pressure on the local food and agricultural markets to increase productivity.

Are people hungry because the world does not produce enough food to feed its quickly growing population? The answer is no. In total, the world actually produces a surplus of food. If we divided the world's food supply evenly among the world's population, each person would receive substantially more than the minimum amount of nutrients required for survival. This begs the question, why does food insecurity still exist? The problem is an issue of unequal distribution. There are certain factors that prohibit food from being evenly distributed among the world's population as it grows.

Food insecurity and hunger are most closely associated with poverty. Generally, poverty is defined as the failure to achieve certain minimum standards of living. As discussed in the Module I Cliff Notes, according to the World Bank, in 2005 extreme poverty was defined as living on $1.25 per day, whereas moderate poverty was defined as living on approximately $2 per day. Approximately 1.4 billion individuals worldwide live in extreme poverty, whereas the World Bank estimates nearly 2.1 billion live in moderate poverty on less than $2 per day.

To solve the food security problem requires efforts that focus on eradicating poverty. However, eradicating poverty is a complex problem. Other factors, such as climate change, natural disasters, war, illiteracy, lack of systemic education, poor health, malnutrition and environmental degradation, create situations where poverty becomes a chronic problem. In addition, as the world population continues to grow, the majority of that growth will be concentrated in developing nations.

How do nations work toward solving these problems? As demonstrated in the book, there are some short-term strategies that provide temporary relief, such as foreign assistance from other countries (i.e., food aid through the U.S. Food for Peace program). Other approaches focus

on longer-term economic and social changes. Generally, longer-term efforts are referred to as development efforts. Development refers to the improvement in the standard of living of the entire population of a country. An interactive map showing the current development indices for each nation in the world is accessible from the United Nations Human Development Report Program at http://hdr.undp.org/external/flash/hdi_map/.

Development efforts focus on reducing poverty by raising the productivity of the people in a nation. There are many paths to development (e.g., industrialization); however, throughout history, including in the U.S., agriculture has driven economic growth, increasing incomes of farm families and creating off-farm employment for others. According to the United Nation's 2008 World Development Report, gross domestic product (GDP) growth generated by agriculture is up to four times more effective in reducing poverty than growth in other sectors.

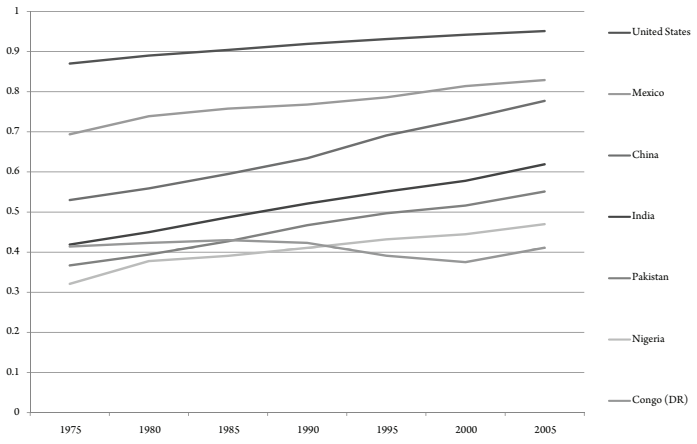
With agriculture being the main livelihood for an estimated 86 percent of the rural population and providing jobs for an estimated 1.3 billion smallholders and landless workers, it is central to development efforts. However, the initial productivity of agriculture in many developing areas is typically low. The initial size and low productivity of agriculture in most developing countries suggests an opportunity for raising income levels and developing the national economy by starting with developing the agriculture sector.

Increasing productivity in agriculture requires new knowledge and technology through structured research, reliable infrastructure and supportive policies. The selected readings from *The Man Who Fed the World* illustrate the influential role that structured research and technology development efforts. Chapters 3–5 provide students with an account of an initial agricultural development project conducted in Mexico during the 1940s and 50s. The technical achievements in Mexico laid an important foundation for the development efforts in India and Pakistan. Chapters 6–7 provide an account of the "Green Revolution" – a period of rapid technology diffusion resulting in significantly increased yields in the 1960s and 70s. Through this account, the chapters help answer the following question: What has been done in the past to solve the issue of food insecurity? Additionally, the chapters highlight some of the external pressures that intensify food security issues.

The graph in this section provides some evidence of success in terms of the transformational role agriculture has played in the overall development of the countries discussed in *The Man Who Fed the World*. The diagram illustrates the 2007/2008 human development index trends from 1975 to 2005 for the United States, Mexico, China, India, Pakistan, Nigeria and the Democratic Republic of Congo. The points on the graph represent the human development indices for each country at each point in time covered by the graph. The human development index is assigned by the United Nations Development Program and is based on the following dimensions of a nation:

- Social progress – greater access to knowledge, better nutrition and health services
- Economics – the importance of economic growth as a means to reduce inequality and improve levels of human development
- Efficiency – in terms of resource use and availability, human development is pro-growth and pro-productivity as long as such growth directly benefits the poor, women and other marginalized groups
- Equity – economic growth and other human development parameters
- Participation and freedom – empowerment, democratic governance, gender equality, civil and political rights, and cultural liberty, particularly for marginalized groups defined by urban-rural, sex, age, religion, ethnicity, physical/mental parameters, etc.
- Sustainability – preservation in ecological, economic and social terms for future generations
- Human security – security in daily life against such chronic threats as hunger and abrupt disruptions, including joblessness, famine, conflict, etc.

Human Development Index Trends from 1975–05 for Selected Countries



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Module II References and Additional Resources

Documents

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Norton, G., Alwang, J. & Masters, W. *Economics of Agricultural Development: World Food Systems and Resource Use*. 2001.

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World Bank. *World Development Report 2008: Agriculture for Development*. 2008.
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Wikipedia, 2009 Population Growth Article: en.wikipedia.org/wiki/Population_growth

World Bank, PovertyNet: go.worldbank.org/33CTPSVDC0

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- Labor Force by Occupation: https://www.cia.gov/library/publications/the-world-factbook/fields/2048.html

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United Nations. *HDR 2007/2008 Data Files*. 2008.
- Available online at hdr.undp.org/en/statistics/data/

U.S. Census Bureau. *International Programs Historical Estimates of World Population.* 2008.
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Module III Cliff Notes

Making Agriculture Productive and Profitable

Essential Concepts Taught in Module III

- Economic growth through agriculture is a central and proven tool for many developing countries.
- There are a number of factors that influence the productivity and profitability of agriculture in developing and developed countries, including access to agricultural markets and fair trade practices, conducting science and technology research efforts, encouraging supportive government policies, providing access to information and knowledge, and promoting sustainable agriculture through biotechnology and conservation.

Cliff Notes

Throughout history, growth in agriculture has been a precursor for industrial growth – from mid-18th-century England to late-19th-century Japan to modern China, whose rural poverty declined from 53 percent in 1981 to 8 percent in 2001. However, as demonstrated in *The Man Who Fed the World*, solving the world food security problem is not as simple as increasing production. Eradicating extreme poverty and hunger requires helping developing countries harness agriculture for economic growth in the long term.

The assigned chapters from *The Man Who Fed the World* provide students with a broader overview of the challenges and opportunities for solving food insecurity worldwide. Several cornerstones discussed in the book also are discussed during this module. The following aspects are important to scaling up and sustaining a productive and profitable agriculture sector in a country:

- Agricultural markets and free trade practices
- Scientific research and technology development
- Education and training
- Water use and efficiency
- Sustainable agricultural practices
- Infrastructure development

Agricultural Markets and Free Trade Practices

To be effective, producers must have opportunities to increase their share of domestic, regional or international markets. Globalization allows farmers in developed and developing countries to participate in markets beyond their national borders. By becoming participants in the global economy, farmers in both developed and developing countries can raise their incomes and, in the end, achieve food security for their families and countries, in general.

Important to market development is the development of trade agreements. In the 1980s and 90s, many developing countries sought to "protect" the development of their agricultural industry through high tariffs and subsidies that kept the price of food very low. Throughout history, protectionist policy has been applied to restrain trade between countries through methods such as tariffs and restrictive quotas. The problem with protectionist policies is that, if misapplied, they can create a false sense of security for producers and consumers in a country. Abroad, these policies hinder free market development. When these policies go away due to changes in leadership or governance, it leaves behind higher food prices and producers who are not equipped to participate in the realities of a global marketplace. Free trade policy, on the other hand, promotes keeping government barriers at a minimum. A free trade agreement eliminates tariff and non-tariff barriers between nations. Today, free trade agreements between countries and regions, such as the North American Free Trade Agreement, are promoting agricultural market development and expanding opportunities for producers.

Scientific Research and Technology Development

Given the population growth projections, it is known that food needs will continue to expand – especially in developing countries. Science and technology can enable increased agricultural productivity to meet this growing demand. Organized, effective scientific research is the primary mechanism for generating the new agricultural knowledge needed to increase productivity. Some of the modern problems agricultural research is taking on include increasing yields; protecting crops from drought, pests and disease; improving food storage; and enhancing food's nutritional qualities. In *The Man Who Fed the World*, several chapters discuss an existing network of agricultural research institutions called the Consultative Group on International Agricultural Research. CGIAR is an alliance of 15 centers that carry out research and technology development to support agriculture around the globe. In the book, Norman Borlaug's worked with CIMMYT, one of the research centers in the CGIAR network. His focus was on training new scientists to return to developing

countries. Having access to training institutions such as those in the CGIAR network are essential to developing the next generation of scientists and technology developers to support innovations such as those during the Green Revolution. Application of biotechnology is a current focus of international agricultural research. Biotechnology can result in efficient, safe use of natural resources while improving the productivity of plant and animal agriculture in a sustainable way. Biotechnology can enhance the sustainability of agriculture in the following ways:

- Reducing pesticide and excess fertilizer use
- Battling damaging plant diseases and pests by developing new resistant crop varieties
- Making widely grown food crops more resilient and drought-tolerant
- Enabling better livestock disease diagnosis and the development of effective livestock vaccines

Water Use and Efficiency

Water use and efficiency is a growing concern. USAID estimates that 70 percent of all water used today is for agricultural purposes. Additionally, water demand is doubling approximately every 20 years. Currently, more than 1 billion people lack access to an improved water supply and more than 2 billion people lack access to improved sanitation, undermining efforts to protect public health. By 2025, estimates suggest that 2.8 billion people will be living in either water-scarce or water-stressed regions of the world. Ensuring the safety and availability of water for drinking, sanitation, agriculture and industry is a top priority for future agricultural development efforts.

There are two different types of water scarcity to consider: physical and economic. Physical water scarcity occurs when there is not enough water to meet all demands. Arid regions of the world are most affected by this type of scarcity. In particular, agriculture in U.S. states such as Arizona, New Mexico, Colorado, Utah and Nevada are all affected by physical water scarcity. Internationally, areas in the Middle East are most affected by physical water scarcity. Economic water scarcity, on the other hand, is a condition caused by a lack of investment in water or a lack of human capacity to satisfy the demand for water in areas where water is already abundant. Many times this is an issue with not having the infrastructure built to make use of the available water supply. Sub-Saharan Africa is affected by economic water scarcity.

Averting this looming global water crisis requires meeting two great challenges: improving water use efficiency to ensure that the quantity of water reserves remain adequate and reducing pollution and other threats to water quality to ensure that the water supplies continue to be usable.

Education and Training

In order for farmers to implement innovations from scientific and technological research, they must have access to the information. In the U.S., farmers have access to information on the latest technology through an expansive network of colleges, universities, public institutions, membership organizations, government agencies and private industry. Rural isolation is one of the challenges facing many developing countries. For example, in Sub-Saharan Africa, low to no access to roads and modern communication technologies makes it difficult for new information to flow into the area.

Rural extension is one way to meet the immediate needs of farmers and other rural people as they change their production and livelihood systems. In the U.S., the cooperative extension service is responsible for providing citizens with information from the state and federal levels related to national problems. They also relay needs related to agriculture, the environment, human health and well being, and community development. In many developing countries, this kind of system is not available, yet information flow is critical to improving economic conditions – especially in agriculture.

Development efforts need to encourage extension and education services to:

- Provide advice to farmers about problems or opportunities in agriculture.
- Facilitate development of organizations where farmers can come together to learn.
- Develop links with research programs.
- Ensure that farmers understand how to use new technologies in a responsible manner.
- Address public interest issues in rural areas.

Sustainable Agricultural Practices

Agriculture is a natural resource-based industry. According to USAID, of the 11 percent of the world's land surface that is suitable for agriculture, 38 percent has become degraded by poor natural resource management practices. Good stewardship of the available land through conservation techniques focused on protecting soil, air, water and animal health quality is necessary to maintain agricultural productivity. In the U.S., producers and ranchers embrace practices such as renewable agricultural products, precision agriculture and natural pest control practices to protect our nation's soil, water, air and wildlife. Doing so ensures continued economic growth, protection of local biodiversity and maintenance of vital resources. Similar measures focused on sustainability in the long term should be an important consideration when planning international

development efforts. These practices will help reduce the risks in developing countries of complex problems, such as climate change and water scarcity, which is particularly important since agriculture constitutes approximately 70 percent of water consumption in the developing world.

In the past, many developing countries have met the need for increased productivity by expanding the area on which they are able to plant and grow livestock. This is typically done through a method called "slash and burn," which has led to problems such as deforestation, wildlife displacement and the reduction of valuable biodiversity. The Green Revolution in Asia was an example of another way to increase food production; however, it was unique in that it promoted increasing productivity on the available land rather than putting more land into production. For instance, they doubled cereal production between 1970 and 1995, yet the total land area cultivated with cereals increased by only 4 percent (World Bank, 2008). The FAO estimates that by 2030, an additional 121 million hectares (300 million acres) will be needed for global agriculture. This number represents an area that is larger than the amount of U.S. land currently devoted to the production of our nation's four largest crops: corn, soybeans, hay and wheat. Increasing productivity on the land currently in production is a far more sustainable route.

Infrastructure Development

The Oxford English Dictionary defines infrastructure as the basic physical and organizational structures needed for the operation of a society or enterprise, or the services and facilities necessary for an economy to function. Think of infrastructure as a set of systems. One issue related to infrastructure and agriculture deals with ensuring that producers are able to access systems that allow them to move their product from the farm gate to the consumer's plate. U.S. farmers are able to do this because they have access to systems to transport, store, distribute and market their products; information and technologies necessary to make wise choices about production; and the credit and capital needed to secure the inputs necessary for production.

In developing countries, rural producers are often isolated from any organized system for marketing or distributing their products. Issues such as poor road systems, lack of access to information on pricing and other factors can hinder rural farmers' efforts to become competitive in the global marketplace. To develop markets, efforts must promote infrastructure development supported by fair and equitable access to those systems. For example, to produce products, farmers in developed and developing countries must be able to access and pay for inputs, such as seed, water, fertilizer, etc. However, inputs come at a price. In developing nations, many farmers do not have access to the capital needed to purchase these important inputs. In some cases, government policies subsidize the purchase of inputs. Generally, this act can create problems because it does not create the added benefits of building the economy through developing input industries. *The Man Who Fed the World* highlights the vital role the development of a fertilizer industry played in India. Another way governments can support producers in developing countries is by ensuring credit for the purchase of inputs. Through credit, producers are able to participate in the developing agricultural economy, and private input industries are able to develop. The result is development of the economy.

Module III References and Additional Resources

Agricultural Markets and Free Trade Practices

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(Tip: On the World Food Summit site, click Documents on the left menu and then Technical Background Documents. Then locate Volume 3, document number 12 in the list provided.)

USAID, Agricultural Markets and Trade Web page: www.usaid.gov/our_work/agriculture/ag_markets_trade.htm

USDA, Foreign Agriculture Service Web page: www.fas.usda.gov/

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USAID, Water Productivity and Efficiency Web page: www.usaid.gov/our_work/cross-cutting_programs/water/water_productivity_efficiency.html

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Education and Training

Association for International Agricultural and Extension Education Web page: www.aiaee.org/

FAO, Educating Rural People Web page: http://www.fao.org/sd/erp/

USAID, Rural Extension and Advisory Services Web page: www.usaid.gov/our_work/agriculture/extension_services.htm

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World Bank. *World Development Report.* 2008 ‹go.worldbank.org/ZJIAOSUFU0›.

Sustainable Agricultural Practices

FAO, SD Dimensions Web page: www.fao.org/SD/

USAID, Sustainable Agriculture Web page: www.usaid.gov/our_work/agriculture/sustainable_ag.htm

USDA, Alternative Farming Systems Information Center Web page: afsic.nal.usda.gov

World Bank. *World Development Report.* 2008 ‹go.worldbank.org/ZJIAOSUFU0›.

Infrastructure Development

FAO. World Food Summit, Technical Background Document, *Food for Consumers: Marketing, Processing and Distribution, vol. 2, ch. 8.* 1996 ‹www.fao.org/WFS/index_en.htm›.
(Tip: On the World Food Summit site, click Documents on the left menu and then Technical Background Documents. Then locate Volume 2, document number 8 in the list provided.)

USAID, Agricultural Markets and Trade Web page: www.usaid.gov/our_work/agriculture/ag_markets_trade.htm

USDA, Rural and Community Development Web page: www.rurdev.usda.gov/

World Bank. *World Development Report.* 2008 ‹go.worldbank.org/ZJIAOSUFU0›.

Other

American Farm Bureau Federation. *Making American Agriculture Productive and Profitable.* Washington, D.C. 2005.

Cliff Notes

The Man Who Fed the World

Norman Ernest Borlaug (born March 25, 1914) is an American agronomist, humanitarian and Nobel laureate and has been called the Father of the Green Revolution. *The Man Who Fed the World* by Leon Hesser is an authorized biography of Borlaug and his work. Chapters with an asterisk (*) next to the title are required reading for the lesson.

Chapter 1 – Growing Up on an Iowa Farm

Borlaug was born in 1914 near the village of Saude, Iowa. Norman's parents, who were children of Norwegian immigrants, farmed in North Eastern Iowa. This chapter highlights Norman's early experiences on the family farm and identifies how they were influential in developing his outlook and work ethic.

Chapter 2 – A Budding Scientist at the University of Minnesota

Borlaug completed his undergraduate and graduate studies at the University of Minnesota. His studies there laid the groundwork for his life's work as a scientist. This chapter discusses how he began his career in forestry and plant pathology. Borlaug's time at the University of Minnesota ended with the completion of his master's degree in 1940 and later with a doctorate in general plant pathology.

*Chapter 3 – The Rockefeller Foundation Offers Borlaug a Challenge**

This chapter describes the beginning of the United States' first foreign agricultural assistance program: the Mexican Government-Rockefeller Foundation Cooperative Agricultural Program. Henry A. Wallace, former U.S. Secretary of Agriculture, and Vice-President-to-President Franklin D. Roosevelt had a vision for reducing hunger and poverty through focused agricultural research and technology diffusion in the developing world. Inspired by Wallace's vision, the Rockefeller Foundation formed a team of agricultural scientists – including Borlaug – to take up the challenge in Mexico. At the time, Mexico was still struggling from the effects of a major land distribution program that created a class of small-scale farmers: the campesinos. This new class of farmers lacked the knowledge, skills, capital and technology to make their small farms productive. The vision for the program was to conduct focused agricultural research, training and extension efforts with regard to corn and wheat in an effort to identify new technologies and practices that could make agriculture a viable industry. George Harrar, the original director of the Mexican Government-Rockefeller Foundation Cooperative Agriculture project, aptly noted high hopes for this program to lead to a "bloodless" revolution – one that offered the possibility of doubling food production through a transformation of technology.

*Chapter 4 – Borlaug Builds a Revolutionary Wheat Breeding Program**

This chapter describes the key innovations that provided the foundation for significant yield increases in wheat. After arriving in 1944, Borlaug led the wheat-breeding program. Through application of the scientific process, he created hybrid varieties of wheat that were resistant to a devastating disease called "wheat rust." Next, he developed a process called "shuttle breeding" that doubled the growing season and ultimately adapted the seeds to a variety of growing climates. Finally, he developed a hybrid seed that grew into a plant with a shorter stalk. Doing so allowed the plants to withstand applications of fertilizer, irrigation and more extreme weather conditions. Borlaug's achievements with wheat in Mexico led to self-sufficiency in cereal production by 1956. In particular, the achievements were directly responsible for a doubling of yields between 1961 and 1969 (a process that should have taken several more than eight years). Just as important as increased yields, Borlaug's wheat-breeding program became an internationally recognized training ground for a network of agricultural scientists to conduct research, education and technology dissemination around the globe.

*Chapter 5 – Rockefeller's Mexico Program Goes International**

This chapter describes how the original program extended beyond Mexico. The FAO of the United Nations partnered with the Rockefeller Foundation to explore ways to expand the program into other areas with pervasive hunger and poverty, such as Pakistan and India. After success with the training program, the Rockefeller and Ford Foundations eventually collaborated with Mexico's Ministry of Agriculture to start the International Center for Maize and Wheat Improvement (CIMMYT). This center was unique for its time in that it was an independent international training program focused on conducting targeted agricultural research in an effort to train young scientists from around the globe to solve the growing world crisis with food production.

Chapter 6 – Famine is Averted in India*

In the 1960s, growing concern existed in countries such as India and Pakistan regarding whether food production could keep pace with population growth. Short-term solutions, such as food aid, were proving ineffective. Growing popular concern about the ability of the Earth to feed its people led some to the writings of Thomas Malthus (1766–1834), a famous British scholar who proposed that unchecked population growth would eventually lead to famine, followed by widespread mortality. Books such as *The Population Bomb* by Paul Ehrlich and William and Paul Paddock's book *Famine 1975!: America's Decision: Who Will Survive*? reinvigorated Malthusian thought and painted a grim picture. This chapter discusses how Borlaug and his cutting-edge agricultural technology and research program in Mexico were transferred to India in an effort to avert an impending famine. The author draws attention to several keys to effective agricultural development efforts. In particular, the author highlights the role of government in making policies that promote market development, credit, infrastructure development and fair prices for producers. Many of these items are some of the fundamental policies needed to make agriculture productive and profitable in developing and developed nations alike. Adoption of the technology supported with education, training and government policies eventually led India to self-sufficiency with cereal production by 1974.

Chapter 7 – Father of the Green Revolution*

This chapter again highlights the pressure population growth puts on achieving food security. During the 1960s, Pakistan struggled with rapid population growth, rural poverty, civil unrest, natural disaster and tense relations with neighboring India. All of these issues created an environment of food insecurity and a growing reliance on food aid from programs, such as the U.S. Food for Peace program. Successes in Mexico and India were proving that development of the agricultural economy through research, education and technology could provide a longer-term solution to the food security problem. In this chapter, the author again points to key factors that influence the success of an agricultural development effort. In particular, the author highlights the key role of infrastructure – or means for ensuring the movement, storage and security of people and products in a nation. Additionally, the chapter re-emphasizes the important role economic policies play in making agriculture productive and profitable. The chapter concludes with the now famous quote by William S. Gaud, then director of USAID, where the term "Green Revolution" was actually coined. The term originally referred to the dramatic wheat harvests that had been achieved from 1966 to 1968 in India and Pakistan. Today, the Green Revolution refers to efforts to stimulate growth and change in developing nations through the application of agricultural technology, research and practices.

Chapter 8 – Margaret Copes with Loneliness

Borlaug met his wife Margaret Gibson Borlaug during his time at the University of Minnesota. Together, they had two children, Jeanie and William (Bill) Borlaug. Margaret and the children lived in Mexico with Borlaug during his time as a researcher there. This chapter discusses Borlaug's family life.

Chapter 9 – The Birth of a Global Network of Research and Training*

Science and technology play a central role in the development of agriculture worldwide. This chapter describes the development of the CGIAR. The mission of this network of research and training groups is to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy and environment. The international centers were developed to supplement national agricultural research, production and training programs. They are a link in the worldwide network of organizations that are trying to combat food insecurity and sustainability of natural resource use. Other critical organizations include the FAO of the United Nations, the World Bank and the U.S. Agency for International Development.

Chapter 10 – The Nobel Peace Prize

In 1970, Borlaug was awarded a Nobel Peace Prize for his scientific and humanitarian efforts to reduce world hunger and modernize agriculture in the developing world. During the 20th century, Borlaug was the only person to have been awarded the Peace Prize for work on food production. This chapter provides an overview of the Nobel Prize and Borlaug's experiences with receiving it.

Chapter 11 – Launching the World Food Prize

Borlaug established the World Food Prize Foundation to inspire and recognize exceptional achievement in assuring adequate food and nutrition for all. There is no Nobel Prize for agricultural advancements or food production. As such, Borlaug felt there was a need for such an award to bring attention to the noble mission of feeding the world. This chapter tells the story of how Borlaug fulfilled this mission and launched the World Food Prize in 1986.

*Chapter 12 – Borlaug in China**

This chapter provides a short case study for students to examine some of the key factors associated with making agriculture productive and profitable. Borlaug describes China as a success story with respect to increasing productivity on the same amount of land. In the 1970s, China began planting Borlaug's high-yielding Mexican wheat seed. Borlaug first visited China in 1974 and found that they had embraced the idea of conducting research to adapt the varieties to their growing conditions. From the late 1960s through the 1980s, China experienced impressive increases in yield and production of cereals, such as wheat, rice, maize and millet. Borlaug attributes this success in achieving productivity and profitability to several factors:

- Focus on science and research
- Acceptance of modern agricultural technologies, such as fertilizers, to maximize production on available land
- Government policies that liberalized crop production and opened grain marketing systems, placing production responsibility on the farmers

All of the factors resulted in greater crop yields, a significant improvement in farmers' incomes and a dramatic decrease in rural poverty. At the end of the chapter, the author briefly discusses one of the "new frontiers" for development in China's rural economy: biotechnology. This chapter illustrates several of the factors that are important for supporting agricultural development efforts.

*Chapter 13 – Borlaug and Jimmy Carter Join Hands for Africa**

This chapter provides a look at development efforts and challenges in Africa where development is still an ongoing effort. Improving food security in Africa is a current example of international agricultural development efforts. As discussed in the chapter, a lack of infrastructure in Sub-Saharan Africa creates severe rural isolation. Rapid population growth, ongoing environmental degradation, disease, weak markets, little access to research and information, instable water supplies, protectionist government policies that keep food prices artificially low and extreme poverty further complicate efforts to ensure food security. Borlaug has been working with President Jimmy Carter and the Nippon Foundation of Japan to bring about a "Green Revolution" in several developing African nations. The strategy involves getting small-scale commercial agriculture moving and then building infrastructure to open this agriculture to new markets. Additionally, Borlaug highlights the role that new high-yielding technology may play in this water-scarce environment. This chapter provides an example to illustrate the complexity of agricultural development.

*Chapter 14 – Feeding 10 Billion People**

This chapter provides insights from Borlaug regarding the challenges and opportunities with regard to food security in a world with 10 billion people. On page 171, Borlaug is quoted as saying, "Despite a more than tripling in the world food supply over a period of three decades, the Green Revolution in cereal production has not solved the problem of poverty and chronic under-nutrition afflicting hundreds of millions of people around the world." As discussed throughout the cliff notes, increasing productivity is only one part of solving the world's food security problem. Reducing or eradicating poverty is the key to solving the problem. Improving the economic well-being of nations through building the agricultural industry is one approach to solving this issue. Advancements in science and technology, extension and education efforts, government policies that promote free trade, access to markets and embracing sustainable practices, such as biotechnology, are all factors that promote the development of a productive and profitable agricultural industry.

Chapter 15 – Distinguished Professor

After retiring from his directorship of the international wheat program at CIMMYT, Borlaug became a professor. This chapter outlines his experiences in teaching at the University of Minnesota, Cornell University and Texas A&M University. This chapter also provides insights into Dr. Borlaug's experiences and achievements as he enlivened college campuses with his passions for agriculture and feeding a hungry planet.

Chapter 16 – Norman Borlaug's Legacy

Borlaug's selfless service to the advancement of science and agriculture around the world is still strong. A number of foundations, programs and centers around the nation are dedicated in his name. This chapter provides a guide to some of the various ways Borlaug's legacy as a "Hero of Hunger" is memorialized.

Chapter 17 – Reflections of a Humble Hero of Hunger

This chapter was developed from a living history interview conducted by Hesser with Borlaug. In this chapter, Borlaug reflects on his achievements, key events that shaped his passion for solving the food security problem around the globe and insights on influential individuals in his life.

Epilogue

In 1999, a new strain of wheat rust called UG99 emerged in Uganda. Borlaug's initial research focused on fighting the devastating disease. This chapter discusses Borlaug's involvement in addressing the new strain of wheat rust. It also provides an editorial from Borlaug about the fact that decreased funding for international agricultural research in the 1990s may leave nations, especially developing nations, susceptible to such issues. This chapter calls for increased attention to the role of scientific research necessary to keep agriculture productive and profitable.

Additional Resources on Norman Borlaug's Life and Legacy

Wikipedia. Norman Borlaug Article. 2009 ‹en.wikipedia.org/wiki/Norman_Borlaug›.

World Food Prize Foundation, The World Food Prize Web page: www.worldfoodprize.org/

Nobel Peace Prize 1970 Web page: nobelprize.org/nobel_prizes/peace/laureates/1970/index.html

The Nobel Prize Organization Web page: www.nobelprize.org

Hesser, Leon. *The Man Who Fed the World*. 2009.

Additional Teaching Notes

Additional Teaching Notes

The American Farm Bureau Foundation for Agriculture
is building awareness, understanding, and a positive public perception of agriculture through education.

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