



B I O N E E R S

FOOD & FARMING

STUDY GUIDE I



C H A P T E R I

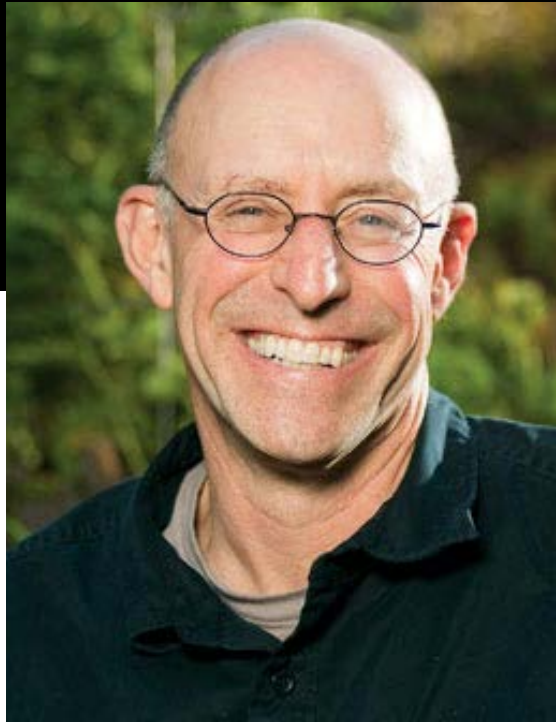
INTRODUCTION



S E C T I O N I



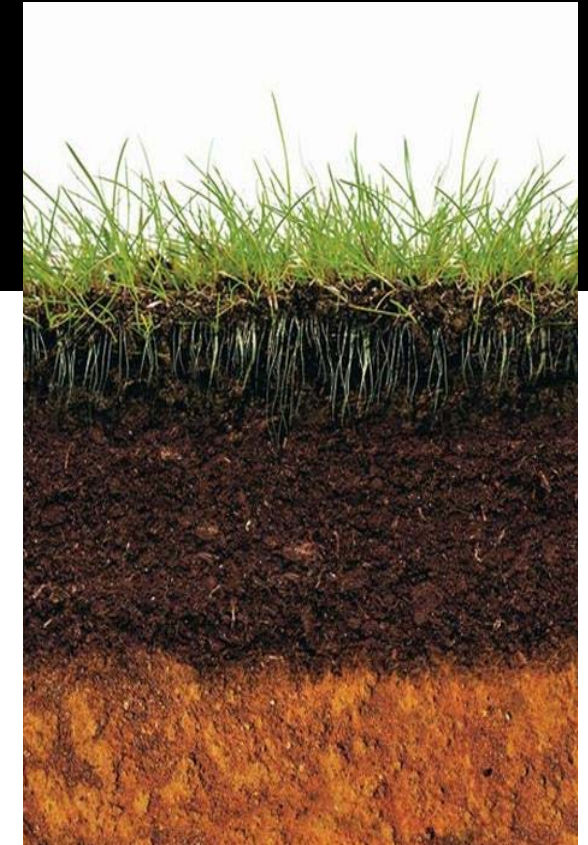
THE BIONEERS



MICHAEL POLLAN



FRED KIRSCHENMANN



Role: Author & Global Food System Advocate

Video: Beyond the Barcode

Topics: politics, food economies, and farmers markets

Role: Author & Sustainable Agriculture Expert

Video: Planting the Future

Topic: transforming the current system of agriculture

S E C T I O N 2



TOPIC OVERVIEW



Millennia ago, humans ceased to rely solely on hunting and gathering and turned to agriculture. This seemingly small transition from one food supply to include another changed the course of human history. By cultivating crops and raising livestock, people no longer had to move according to their food sources and began to settle. Villages, cities, and, eventually, civilizations arose in areas of high fertility where crop yields were able to sustain large populations.

The changing landscape of agriculture over the years has also led to technological developments ranging from basic ploughs and winnowing fans to modern-day tractors and harvesters. Farm technologies continue to advance in response to economic needs and Earth's increasing population. Advancements such as fertilizers, pesticides, and herbicides as well as high quantities of fossil fuel emissions from various other agricultural activities have greatly affected the very earth humans rely upon for nourishment.

Agriculture transformed the world, but mankind has changed agriculture to the point where it is no longer sustainable. If the human race is to continue, an ecological balance needs to be found in farming practices worldwide that will produce the necessary food without destroying the environment and, with it, mankind. As Chief Seattle once said, "Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect."¹

S E C T I O N 3



INTRODUCTION





FOOD AND FARMING

When someone says ‘food,’ what thoughts come to mind? Some of you will imagine a multi-textured and multi-colored salad. Others will conjure up a juicy steak with steamed broccoli and hot rolls. Still others will relive treasured holiday menus such as turkey, potatoes, corn, and apple pie. Or, perhaps, you will think of yesterday’s lunch or whatever you’re hungry for right now. Say ‘food’ and most people think of just that — food.

However, say the word ‘food’ to an often-unknown group that is fighting a vitally important behind-the-scenes ongoing battle and quite different pictures will spring to their minds. They envision exciting scenarios that include earthworms, crop and animal rotation, the Farm Bill, Farmers’ Markets, wildlife, natural pesticides, Jersey cows and CLA, root-shoot ratio, less fossil fuel usage, food security, and feeding the world. In short, they are likely to start thinking of all the players, changes, politics, and economics involved in transforming agriculture in order to help heal our home and feed mankind.

For most people, food fills our bellies. For a select group, food and its production fill their thoughts. They also fuel their dreams and bring hope to our world. Transforming agriculture is a big challenge with many layers. Each layer needs to be addressed from many angles before the desired goal is achieved. This, in turn, requires a wide variety of approaches by an assortment of intelligent, caring, and determined people.

In this video, Michael Pollan stresses farming local, buying local, and voting local. Explaining the intricacies of grass farming, reasons truly organic food is NOT FedExed across the country, and the value of a Non-Zero Sum approach guides us to not only a better understanding of the need for organic and local farming, but also the incredible benefits it brings to our community, our health, and our world. But what can we do to create and protect an environment that is local-farmer friendly? Use your votes — political votes as well as your ‘fork vote.’

Unite Pollan’s system to help advance the transformation of agriculture with Fred Kirschenmann’s and we are definitely closer to a successful battle. In this particular video, Kirschenmann reminds us of seven challenges we must overcome — not by flexing our muscles, but by anticipating what’s coming and being prepared. To this end, he presents three different farms owned by people willing and eager to change their strategies. From imitating successful rice farming methods of ancestors to focusing more on quality and healthy results, they have come to realize that nature gives us everything we need to feed ourselves if we are willing to listen and learn.

It takes strong-spirited people who understand the challenges of agriculture and the food system, the farming economy, and politics to steer others toward growing a greener world. They strive to bring about a world in which food is healthy, an acre of land yields a variety of commodities rather than just one crop, farmers work with nature, and a healthy Earth provides food for a larger population than ever before.

If the planet turns toward a greener world, we have an elite group — with members like Michael Pollan and Fred Kirschenmann — to thank.



C H A P T E R 2

MICHAEL POLLAN

SECTION I



BIONEER: MICHAEL POLLAN



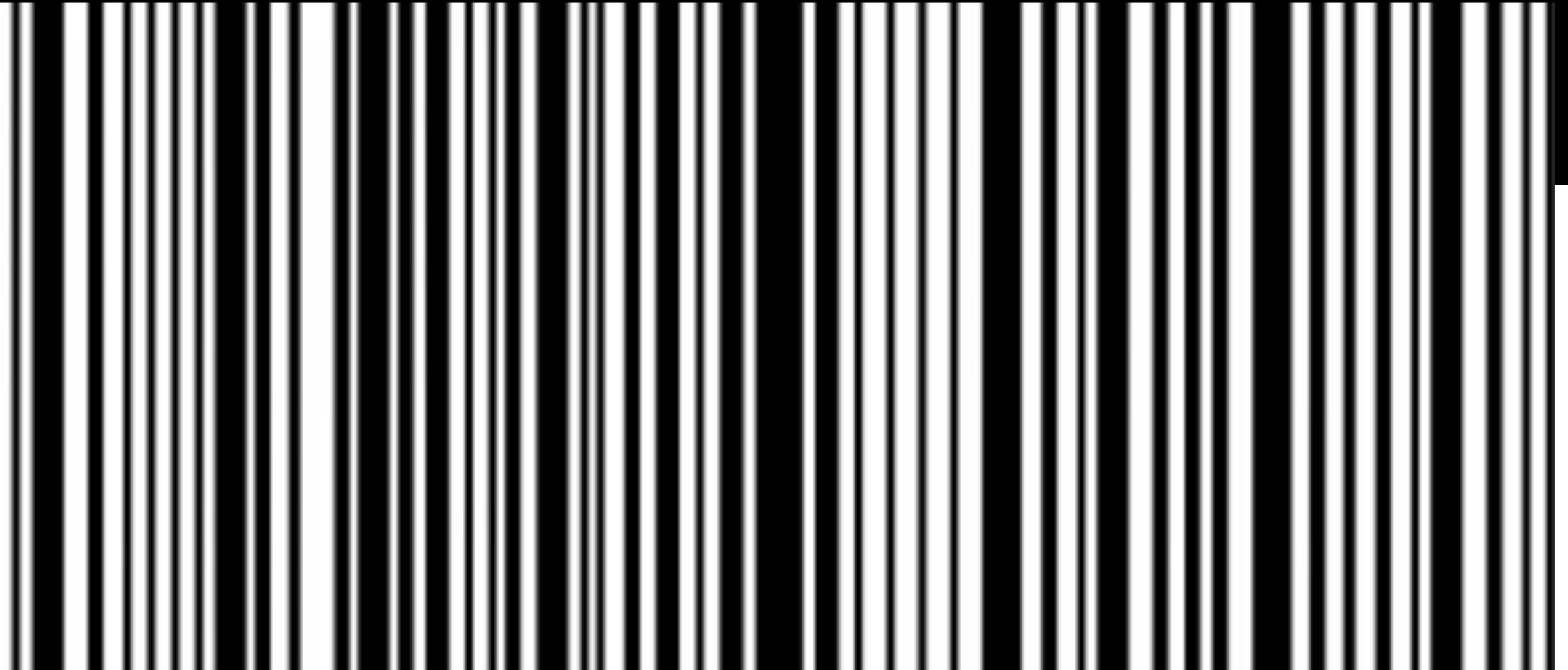
AUTHOR & GLOBAL FOOD SYSTEM ADVOCATE

Michael Pollan is perhaps the foremost critic of the American and global food system and advocate for transforming that system. A contributing writer to *The New York Times Magazine* since 1987 and the author of such bestselling, highly influential works as *The Omnivore's Dilemma*, *The Botany of Desire*, and *Food Rules: An Eater's Manual*, he was featured in the documentary films *The Botany of Desire* and the Oscar-nominated *Food, Inc.*

S E C T I O N 2



VIDEO: BEYOND THE BARCODE



MICHAEL POLLAN



VIDEO: BEYOND THE BARCODE

Movie 2.1 Michael Pollan: Beyond the Barcode



MICHAEL POLLAN

Description:

Local food economies are our best hope for checking the drift toward the total global economy. Food is where these economies begin. A revolt is underway across this country – a revolt of the small producers and consumers. Some of the most important politics today are happening at the farmers market.

Time Duration:

23:43

Michael Pollan encourages us to put our faith in relationship rather than technology and regulation. The emerging local food economy is a dynamic edge of urban/rural interface. CSAs and farmers markets – opportunities to be in direct contact with farmers who provide local, seasonal food picked at its nutritional peak – are the fastest growing sectors in the food system. In contrast, the highly centralized industrial food system, which uses 17 percent of all fossil fuels, is a significant cause of obesity and diabetes, and is increasingly susceptible to food safety risks.

S E C T I O N 3



FACTS & STATISTICS



BEYOND THE BARCODE



BEYOND THE BARCODE

Stated Fact or Statistic	Update, More Information, and/or Source
Year of Speech	2006
Joel Salatin's Polyface Farms	According to the Polyface website, "Polyface, Inc. is a family owned, multi-generational, pasture-based, beyond organic, local-market farm and informational outreach in Virginia's Shenandoah Valley" that produces beef, pork, poultry, rabbits, and forestry products. ²
Stonyfield Organic Yogurt	The Stonyfield Organic's SourceMap shows the origin of many Stonyfield ingredients, such as organic vanilla from Madagascar, black cherries from Chile, and chocolate from cocoa from Peru and the Dominican Republic. ³
Agriculture during the Soviet Union	The economic policy of War Communism, which allowed the state to confiscate any surplus of grain from farmers, and later collectivization of individuals' farms both greatly impacted the Soviet Union's food system. With national food shortages, collective farms, and farmers having little motivation to over-produce, food production and hunger became an issue for the Soviet Union. Farmers using small, but allowed, private plots and selling at farmers markets filled a need. In the early 1980s, only ~3% of farmland was private, but it yielded more than 25% of food in the Soviet Union. ⁴
The U.S. food system "is consuming 17% of our fossil fuel."	Pollan was likely referencing a 1994 study by Pimentel and Giampietro that stated agriculture accounts for 17% of U.S. energy use. A more recent study in 2000 by Heller and Keoleian states food production and distribution account for 10% of the U.S.'s annual energy use. ⁵
Food in the U.S. is moved an average of 1,500 miles and "supermarket organic food is moved even further."	A study in 2001 by Rich Pirog et al at the Leopold Center for Sustainable Agriculture found food being transported by truck to Chicago traveled an average of 1,518 miles. As seen with Stonyfield Organic ingredients, organic food can travel much farther. ⁶
Local tulips from Whole Foods in Seattle are shipped from California.	According to the Whole Foods website, tulips are sourced from various farms including Sun Valley Group in California and Fresh Tulips USA in Virginia, which (as of 2010) imports bulbs from the Netherlands, France, and Chile. ⁷
Projections for California stated that by the "end of this century, there will be no more food production in the Central Valley."	According to a 2009 study from the California Climate Change Center by Lee, De Gryze, and Six, "climate change will decrease crop yields (in the Central Valley) in the long-term, unless one slows climate change and/or adapts new management practices and improved cultivars." With more than 200 products, California's Central Valley is one of the U.S.'s most productive agricultural tracts. If drought and climate change decrease crop yield as expected, the need to import crops will likely increase. ⁸
Produce from Mexico	According to the USDA, the U.S. had \$4.05 billion in fresh vegetable imports and \$2.86 billion in fresh fruit imports from Mexico in 2012. ⁹
The <i>E. coli</i> in the 2006 outbreak was "a mutation from industrial feed lot agriculture."	The FDA and California's Department of Health Services did not definitively state the cause of the outbreak, but the contaminated spinach originated in one field with several environmental risk factors and was all processed and packaged at a single plant in San Juan Bautista, CA. The multi-state outbreak resulted in 205 confirmed illnesses and three deaths. ¹⁰
Farmers' Markets CSAs is the fastest growing sector of the food system.	According to the NRDC, around 50 CSAs existed in the U.S. in 1990. By 2007, that number reached more than 1,000. The National Conference of State Legislatures stated there were only 1,755 farmers' markets in the U.S. in 1994, but the number grew to 7,864 in 2012. ¹¹
Farm Bill explanation	Legislation concerning national agriculture, nutrition, conservation, and forestry policy is passed approximately every five years. Several sources offer information regarding the 2014 Farm Bill, including the USDA and the U.S. Senate Committee on Agriculture, Nutrition, & Forestry. ¹²

S E C T I O N 4



VIDEO GUIDE



MICHAEL POLLAN: BEYOND THE BARCODE



V I D E O G U I D E



BEYOND THE BARCODE

- Beginning: Thanks
- Joel Salatin (critic of organic agriculture): ~1:10
- “FedEx meat across the country”: ~2:00
- “Our Relationship to Nature” & Grass Farming: ~2:50
- Root-shoot Ratio & the Production of Soil: ~3:30
- Joel Salatin’s Farm Production: ~5:00
- “Zero Sum Model”: ~5:50
- “Non-Zero Sum Way”: ~6:20
- Politics at Farmers Markets & Healthy Soils: ~7:00
- Wendell Berry’s “Total Economy”: ~7:40
- “Zero Sum Food Economy”: ~8:05
- Industrialization of Organic Food: ~9:00
- Local Food Economies & Reasons to Buy Local: ~9:40
- The “Globalizers of Food’s” Stance: ~12:00
- Importance of Local Food Economies to National Security & Public Health: ~13:00
- Fossil Fuels in the Food System: ~13:35
- Food Sovereignty: ~14:35
- Centralized Food System: ~15:15
- Public Health and the Food System: ~16:00
- Increased Farm Regulation & Industrialization: ~17:25
- “Faith in Relationships”: ~18:10
- Farmers Markets & Underground Economies: ~18:40
- Two Types of Votes: ~19:25
- The Farm Bill: ~20:40
- Call to Action: ~22:30

SECTION 5



DISCUSSION GUIDE



GENERAL QUESTIONS

Refer to specific points, questions, and issues highlighted in the video



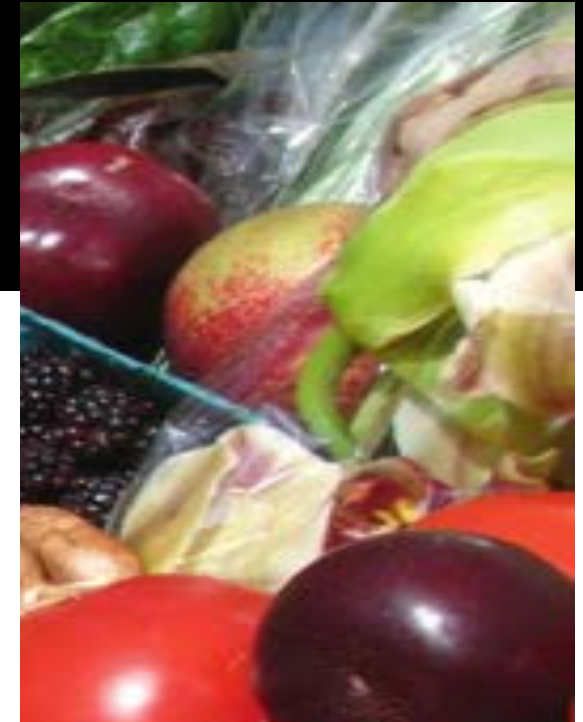
INSIGHT TOPICS

Topics that touch on current issues for discussion that cross academic disciplines



CRITICAL THINKING

Questions that encourage students to think beyond the page and the video to address issues and find creative solutions



PAPER STARTERS

Topics that could be posed for a class discussion or as a thesis for an individual paper or group report



GENERAL QUESTIONS

1. Joel Salatin is known for what type of farming method? Briefly describe his agricultural style.
2. Outline the importance of the “root-shoot ratio” in the creation of soil. How is this a reciprocal relationship with grazing livestock?
3. Explain zero sum food economy as Pollan presented in the video.
4. According to Pollan, how is food “going the way of clothing and of consumer electronics?”
5. Summarize Pollan’s discussion on how food is related to both national security and public health.
6. According to Pollan, how can people “vote with forks?”



INSIGHT TOPICS

1. Pollan states there is a *non-zero* sum way to engage with the natural world. Explain his statement and support it by giving an example.
2. Detail why Pollan feels it is important to “buy local.”
3. Pollan says, “It’s an underground economy.” To what is he referring? Explain his statement.
4. According to Pollan, list several ways a consumer can act as a “co-creator” or “builder of food chains.”
5. Why does Pollan declare the “Farm Bill is really a Food Bill?” Include in your answer how the Farm Bill affects food on both the local and national levels.



CRITICAL THINKING QUESTIONS

1. Who is credited with the quote, “I don’t believe it is organic or sustainable to FedEx meat across the country.” Explain what the author means. Specify why “organic” is included in this statement.
2. Explain in depth what Pollan means by “politics being transacted in Farmers’ Markets” and why he views it in a positive way.
3. “We are in the age of organic feed lots, organic factory farms. These are words that were never meant to be attached to one another.” Why do you think Pollan feels these words do not belong together? Do you agree or disagree? Support your view.
4. “I say we put our faith not in technology or regulation, but in relationships.” Do you agree or disagree? Why or why not?
5. Pollan states two ways to vote on food policy. Outline each type. Do you believe both can be used to bring about changes in legislation? Is one more effective than the other? Defend your answer.
6. List several ways individuals can take action to both spread awareness of the Farm Bill’s importance and to influence its policy.



CONVERSATION & PAPER STARTERS

1. Outline what constitutes a local food economy. Identify at least three pros and cons of “buying local.”
2. Clarify and discuss the “zero sum attitude” Pollan presents in the video. Detail several pros and cons of a zero sum farming system.
3. Present an in-depth description of the progression from healthy soil to a healthy economy.
4. Discuss how local food has progressed into a political movement. Would it be accurate to call this a “protest?”



C H A P T E R 3

FRED KIRSCHENMANN

S E C T I O N I



BIONEER: FRED KIRSCHENMANN



AUTHOR & SUSTAINABLE AGRICULTURE EXPERT

Dr. Fred Kirschenmann is a distinguished fellow at the Leopold Center for Sustainable Agriculture, based in Ames, Iowa. He is also President of Stone Barns Center for Food and Agriculture in Pontico Hills, New York. Fred manages a 2,600-acre certified organic farm in south central North Dakota and is a professor in the ISU Department of Religion and Philosophy. He is the author of *Cultivating an Ecological Conscience: Essays from a Farmer Philosopher*.

S E C T I O N 2



VIDEO: PLANTING THE FUTURE



FRED KIRSCHENMANN



VIDEO: PLANTING THE FUTURE

Movie 3.1 Fred Kirschenmann: Planting the Future



FRED KIRSCHENMANN

Description:

“Modern agriculture, which uses only the simplest biotic responses, can be transformed into an alternative system of agriculture, which I would call postmodern agriculture, in which the use of complete biotic interactions becomes the key technology.”

Time Duration:
22:21

Because agriculture is perhaps the single most environmentally destructive human activity, transforming our food and farming systems is central to restoring both the environment and human health. Fred Kirschenmann has been at the forefront of identifying the challenges to agriculture and the course needed to build a more adaptive and resilient food system. His bird’s-eye view has informed a new ecological farming model that is steadily gaining traction, one local watershed at a time.

S E C T I O N 3



FACTS & STATISTICS



PLANTING THE FUTURE



PLANTING THE FUTURE

Stated Fact or Statistic	Update, More Information, and/or Source
Year of Speech	2003
The U.S. spends "more per calorie of food than 95% of the rest of the world's population, but nevertheless because we spend less of our disposable income on food than any other people in the world, we are told we have cheap food. Never mind the fact that we have more disposable income than anybody else in the world."	According to the USDA, "U.S. consumers, businesses, and government entities spent \$1.4 trillion on food and beverages in grocery stores and other retailers and on away-from-home meals and snacks." ¹³
Farmers in Iowa have increased productivity, but have been unable to retain the value of their production. & Farmers all over the world are going broke and not able to recoup the cost of production.	Even though farm productivity has generally increased due to advances and technological improvements, the USDA forecasts 2015 net farm income to fall by 32% compared to 2014's forecast. ¹⁴
"The United Nations now predicts a global population of about 9.3 billion people by the year 2050."	Updated figures from a 2013 United Nations report suggest a global population of ~9.6 billion by the year 2050. ¹⁵
"Almost half of the world's people now live on less than \$2 a day."	Even with global efforts to alleviate hunger, updated numbers by the World Bank in 2011 stated 2.2 billion people (out of a then-world population ~7 billion) lived on less than (U.S.) \$2 a day. ¹⁶
Fertilizers and pesticides are almost all based on fossil fuels.	As reported by Richard Manning in "The Oil We Eat" as cited in Sustainable Table's "Fossil Fuel and Energy Use," the production of fertilizers from atmospheric nitrogen and natural gas requires a significant amount of energy. The production and distribution of fertilizers uses an average of 5.5 gallons of fossil fuels per acre. ¹⁷
"Twenty-five years ago, farmers in Iowa didn't have to worry that much about excess nitrates, but now there's an 8,200 square mile hypoxic zone in the Gulf of Mexico."	Due to management practices and variations in weather and oceanographic conditions, the size of the Gulf of Mexico's 'dead zone' differs. A 2015 study by NOAA and the USGS estimate the hypoxic zone is approximately the size of Connecticut, or 5,483 square miles. ¹⁸
"Seventy percent of the nutrients flowing down the Mississippi River come off of farmlands."	The same study by NOAA and the USGS estimates 104,000 metric tons of nitrate and 19,300 metric tons of phosphorus from the Mississippi and Atchafalaya rivers entered the Gulf of Mexico in May 2015. Another report states the USGS estimate that agricultural sources are responsible for more than 70% of the hypoxic zone's N and P, as opposed to the 9-12% from urban sources. ¹⁹



PLANTING THE FUTURE

Stated Fact or Statistic	Update, More Information, and/or Source
A group of scientists at Iowa State University have done some computer modeling to see how climate change will effect Iowa: "Iowa will probably see a 21% increase in precipitation, and most of that precipitation will come in the form of more violent storms instead of gentle rains. Therefore we should expect that by the year 2040, we will see a 51% increase in surface runoff."	"Climate Change Impacts on Iowa," a similar report in 2010 for Iowa's Governor and General Assembly, supports Kirschenmann's statement that increased and more intense rainfall in Iowa has aggravated issues with soil erosion. As stated in the report, "Iowa's average erosion rate is estimated to be 5 tons per acre per year. Best science indicates soil renewal rates are closer to 0.5 tons per acre per year." ²⁰
Thirty-five new diseases have emerged in the past thirty years. This past summer (2002), a group of scientists got together to try to figure out why this is happening and they identified 13 causes, and almost all of those causes were related to ecological impact."	In 2003, a panel of U.S. researchers for the Institute of Medicine analyzed the probable causes of the increase of infectious diseases and found several factors including climate, weather, and changing ecosystems. A report from the University of Hawaii stated "human changes to urban and rural landscapes and ecosystems" play a large role in the emergence of diseases. ²¹
Ecologists from Japan who raised the "central question" about future agriculture	Kirschenmann is referencing the book <i>Structure and Function in Agroecosystems Design and Management</i> edited by Masae Shiyomi and Hiroshi Koizumi in 2001 and published by CRC Press. ²²
Takao Furuno in Japan	Furuno was recognized as a Social Entrepreneur of the Year 2001 by the Schwab Foundation. In 2007, Kyushu University awarded him a Ph.D. for "Comparative Research on Traditional Asian Paddy-Duck Farming and on Rice-Duck Farming." ²³
Francis Thicke in Iowa	In 2009, Francis and Susan Thicke received the Spencer Award for Sustainable Agriculture administered by the Leopold Center for Sustainable Agriculture of Iowa State University. At that point, their farm consisted of 236 acres divided into 60 paddocks with 80 grass-fed Jersey cows from which Radiance Dairy produced milk, yogurt, and cheese on-site. ²⁴
article from Michael Pollan that speaks of turning "a solar powered ruminant into a fossil fuel machine"	Kirschenmann was likely referencing Michael Pollan's 2002 article "Power Steer" from <i>The New York Times Magazine</i> . ²⁵

S E C T I O N 4



VIDEO GUIDE



FRED KIRSCHENMANN: PLANTING THE FUTURE



PLANTING THE FUTURE

- Beginning: Thanks & Intro
- Reasons to Transform Agriculture: ~0:30 (Table @ 0:43)
- "...The rest of the story": ~1:30 (Table @ 1:50)
- How to Transform Agriculture: ~2:00
- Diamond's *Guns, Germs, and Steel* & Societies: ~2:40
- A Lesson in Cultural Transformations: ~3:35
- Farm Economy in Iowa: ~4:10 (Table)
- The 7 Challenges: ~4:50 (Table)
- Increased Global Population: ~5:40
- Poverty: ~6:10
- Depletion of Fossil Fuels: ~6:30
- Food Security & Human Rights: ~7:20
- Environmental Degradation: ~8:00
- Climate Change, Computer Modeling, and Soil Erosion: ~8:40
- Infectious Diseases & Causes: ~10:00
- Summary of Challenges: ~10:35 (Table @ 10:44)
- The Future of Agriculture: ~11:20 (Table @ 11:44)
- Takao Furuno's Farm & Ducks: ~12:20
- Furuno's Fish: ~14:05
- *Azolla*: ~15:00
- Furuno's Products: ~16:00
- Equivalents to Furuno's System: ~17:00
- Kuntz Farms in Iowa: ~17:45 (Table @ 17:48)
- Tame vs. Wild: ~18:40
- Thicke's Dairy Farm: ~19:15
- "A Metaphor for Agriculture": ~21:20

SECTION 5



DISCUSSION GUIDE



GENERAL QUESTIONS

Refer to specific points, questions, and issues highlighted in the video



INSIGHT TOPICS

Topics that touch on current issues for discussion that cross academic disciplines



CRITICAL THINKING

Questions that encourage students to think beyond the page and the video to address issues and find creative solutions



PAPER STARTERS

Topics that could be posed for a class discussion or as a thesis for an individual paper or group report



GENERAL QUESTIONS

1. List several ways the depletion of fossil fuels is a concern for agriculture worldwide.
2. Summarize how environmental degradation is a “side effect” of modern agriculture?
3. Explain the steps Takao Furuno took to increase yield and produce a variety of commodities on the same acreage as his original rice paddies.
4. Why did Takao Furuno choose to use a cross between wild and tame ducks?
5. Kirschenmann mentioned Kuntz Farms in Iowa. Name the crops discussed and describe why this style can be considered better or more productive than other modern forms of farming?
6. Describe the hypoxic zone in the Gulf of Mexico. Explain why it exists and what damage it causes.



INSIGHT TOPICS

1. Kirschenmann suggests it is necessary to increase agricultural “productivity on a dispersed basis throughout the world.” In your own words, explain what he means by this statement. Do you agree with this proposal? Why or why not?
2. How can an increased awareness of food security (and insecurity) help alleviate global food concerns?
3. Kirschenmann stated, “Twenty-five years ago farmers in Iowa didn’t have to worry that much about excess nitrates.” Why is this a consideration today? What are the results of an increase of nitrates in soil?
4. One possible outcome of climate change in Iowa is a 51% increase in surface runoff. How will this affect both agriculture and food supply?



CRITICAL THINKING QUESTIONS

1. Kirschenmann referenced Jared Diamond's book *Guns, Germs, and Steel* to explain why some societies flourish while others perish. Summarize this statement and reasoning. Do you agree or disagree? Support your answer.
2. Kirschenmann declared, "Agriculture will change in the next two decades." Why and how is agriculture going to change? Include several scenarios in your answer.
3. Referring to Takao Furuno's farming method, Kirschenmann believes "we all have the same rich species interactive synergistic power that's given to us by nature." Choose a crop grown in your region. Create a system of farming similar to Furuno's that could increase crop yield while still maintaining the health of the earth.
4. Studies indicate that the recent increase in new diseases is linked to human's ecological impact and agriculture. Explain this finding and list several supporting examples.
5. Weather is listed as a major cause of soil erosion. Outline a variety of ways farmers can slow, or avoid, soil loss.



DISCUSSION GUIDE



CONVERSATION & PAPER STARTERS

1. List five positive and five negative aspects of the current large-scale or industrial system of agriculture. Do you believe the “pros” outweigh the “cons?” Support your stance.
2. Name the “seven challenges” Kirschenmann mentions in the video. Even though all seven are connected, arrange them in the order in which you would address them. Discuss your reasoning.
3. Referencing the summary of seven issues the world’s food system is facing, Kirschenmann believes that “modern industrial agriculture is not designed to meet the challenge.” Devise a strategy that could help the world “meet the challenge.”
4. What overall lessons can be drawn from the following farming models: Takao Furuno, Kuntz Farms, and Francis Thicke? Support your responses using examples.



C H A P T E R 4

IN-DEPTH INQUIRY

S E C T I O N I



DISCUSSION GUIDE



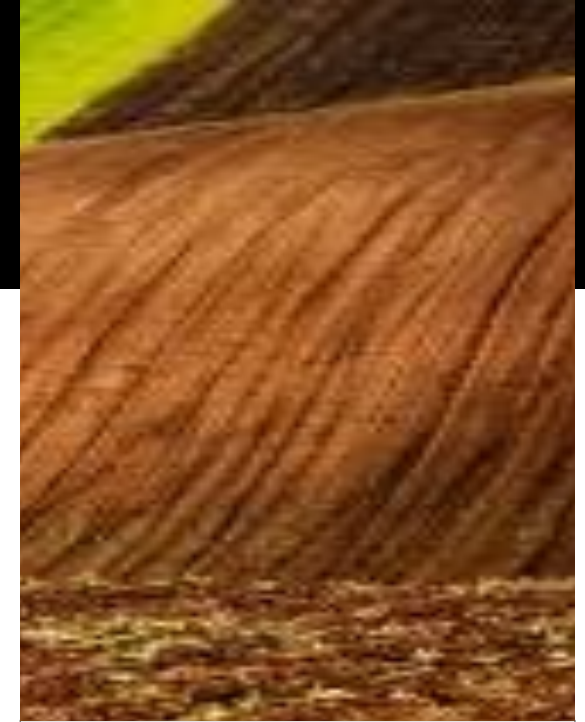
INSIGHT TOPICS

Topics that touch on current issues for discussion that cross academic disciplines



CRITICAL THINKING

Questions that encourage students to think beyond the page and the video to address issues and find creative solutions



PAPER STARTERS

Topics that could be posed for a class discussion or as a thesis for an individual paper or group report



D I S C U S S I O N G U I D E



INSIGHT TOPICS

1. Write your own definitions of “organic” and “sustainable” as they pertain to agriculture.
2. List and describe 3-5 ways agriculture is dependent on fossil fuels.
3. Outline several of the most pressing issues facing large-scale industrial farms today.



CRITICAL THINKING QUESTIONS

1. Describe what you believe the term “organic” means to Pollan and Kirschenmann. Include in your answer the use of fossil fuels in various aspects of agriculture, i.e. fertilizers and transportation.
2. Research and explain how the definition of “organic” has changed over the past century.
3. Why are many modern farmers trying to reduce their dependency on fossil fuels? Outline several sustainable practices employed today.
4. How does organic or sustainable farming differ from large-scale industrial farming practices? What are the outcomes of each style? Include both immediate and long-term effects in your answer.



CONVERSATION & PAPER STARTERS

1. Do you believe it is possible to create a large-scale, industrial organic system of farming? If yes, describe such a farm. If no, detail why such a system would not work. Fully defend your opinion.
2. Kirschenmann said, “Here is a metaphor for agriculture that we need to consider seriously: Instead of forcing nature to give us what we think we want, we ask nature what it is that it’s producing and then turn it into something valuable and delicious to eat.” In your own words, explain what he meant. Do you believe this could be a solution for some of the problems facing modern day agriculture? Why or why not? Do you believe Pollan would agree with him?
3. Both videos support that by working with nature, more product is yielded. Research and give examples other than the ones cited in the videos. Find examples in your own area or community.

Suggested Project:

Find out if your area has Farmers’ Markets or other options to “buy local.” If so, make a list of stores or organizations that offer locally-grown food. Research to see if any nearby farmers practice organic or sustainable methods similar to the models presented in the video. If so, describe their systems. Research organizations in your area that promote sustainable or organic farming. Concentrate on one or two groups and learn about their practices. Present all your findings to the class.



CHAPTER 5

STANDARDS

ALIGNING STANDARDS FOR COURSE INTEGRATION

All Bioneers' Study Guides are aligned with national educational standards. Every video and corresponding Guide includes a detailed list of the specific standards met in each subject matter.

Given that the Study Guides offer many different avenues of inquiry and teachers can focus on various aspects of the material, not all standards listed may apply to the chosen discussion topics. However, all have been included for reference and convenience.

Included in this Study Guide:

- Next Generation Science Standards
- National Geographic Standards



S E C T I O N I



SCIENCE STANDARDS



NEXT GENERATION SCIENCE STANDARDS



NEXT GENERATION SCIENCE STANDARDS

High School Life Sciences

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

[Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]



NEXT GENERATION SCIENCE STANDARDS

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

[Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*



NEXT GENERATION SCIENCE STANDARDS

High School Earth's Systems

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

[Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

S E C T I O N 2



GEOGRAPHIC STANDARDS



NATIONAL GEOGRAPHIC STANDARDS



NATIONAL GEOGRAPHIC STANDARDS

Standard 3

How to analyze the spatial organization of people, places, and environments on Earth's surface

- *Spatial Concepts*

1. The meaning and use of complex spatial concepts, such as connectivity, networks, hierarchies, to analyze and explain the spatial organization of human and physical phenomena

Therefore, the student is able to:

A. Analyze and explain the spatial organization of people, places, and environments (where things are in relation to other things) using spatial concepts, as exemplified by being able to

- Construct various forms of geographic representations (hardcopy or digital maps, graphs, tables, or charts) to explain the spatial patterns of physical and human phenomena (e.g., maps that define a major watershed, composed of smaller watersheds and the hierarchies of streams and rivers within; maps that show the transportation networks within and between population centers of varying sizes to show hierarchies of cities, towns, and villages within a region).
- Construct data tables and digital maps using US Census data to analyze and explain the variability of population density in relation to the location of transportation nodes and networks.
- Construct and use various forms of geographic representations to explain that certain coastal urban centers gained locational, connectivity, and economic prominence (e.g., New Orleans, Calcutta, Rotterdam, Singapore).



NATIONAL GEOGRAPHIC STANDARDS

- *Spatial Models*

3. Models are used to represent the structure and dynamics of spatial processes that shape human and physical systems

Therefore, the student is able to:

A. Analyze and explain the spatial features, processes, and organization of people, places, and environments using models of human and/or physical systems (e.g., urban structure, sediment transport, and spatial interaction), as exemplified by being able to

- Construct a model and explain the influence that spatial processes have on human and physical systems (e.g., urbanization and transportation; housing prices and environmental amenities such as water bodies, parks, or vistas; gardening associated with the growing season).
- Construct physical or digital models of a river valley and evaluate locations that may be suitable for different purposes (e.g., recreational sites, residential housing, resort hotels, industrial sites).
- Construct a model that shows how election strategists might determine which areas in the state should receive special attention and additional resources in advance of an election (e.g., political party membership, economic traits, past voter turnout).



NATIONAL GEOGRAPHIC STANDARDS

Standard 6

How culture and experience influence people's perceptions of places and regions

The student knows and understands:

- *The Perception of Places and Regions*

1. People can view places and regions from multiple perspectives

Therefore, the student is able to:

A. Explain how and why people view places and regions differently as a function of their ideology, race, ethnicity, language, gender, age, religion, politics, social class, and economic status, as exemplified by being able to

- Explain how and why gated communities in wealthy suburban areas may be viewed differently by people from different socioeconomic groups.
- Explain how and why senior citizens and college students may view recreational destinations in Florida differently.
- Explain how and why groups of people may view a place differently (e.g., Harney Peak, South Dakota, viewed by the Lakota Sioux or the US Forest Service; Mount Fuji viewed by Japanese citizens or foreign tourists).



NATIONAL GEOGRAPHIC STANDARDS

- Changes in the Perception of Places and Regions

2. Changing perceptions of places and regions have significant economic, political, and cultural consequences in an increasingly globalized and complex world

Therefore, the student is able to:

A. Explain the possible consequences of people's changing perceptions of places and regions in a globalized and fractured world, as exemplified by being able to

- Explain how international alliance networks are responses to changing views about places and regions (e.g., North Atlantic Treaty Organization [NATO], European Union [EU], Organization of American States [OAS]).
- Analyze the changes in the US perceptions of increasing consumer demand and consumption in emerging national economies, especially in such Asian nations as China, India, Singapore, and South Korea.
- Explain the consequences of people's changing perceptions of places due to natural and human disasters (e.g., reevaluating the use of artificial levees in New Orleans after Hurricane Katrina in 2005, decreased tourism after the eruption of Indonesia's Mount Merapi in 2010, responses to terrorist attacks on the World Trade Center in 1993 and 2001).



NATIONAL GEOGRAPHIC STANDARDS

Standard 14

How human actions modify the physical environment

- Modification of the Physical Environment

1. Human modifications of the physical environment can have significant global impacts

Therefore, the student is able to:

A. Explain the global impacts of human changes in the physical environment, as exemplified by being able to

- Explain the spatial consequences, deliberate and inadvertent, of human activities that have global implications (e.g., dispersal of plant and animal species, fungi, and disease worldwide; global petroleum production, transport, and consumption; global climate change).
- Explain how changes in human behavior can result in the introduction of aerosols into the atmosphere that have effects on a global scale (e.g., dust from Chinese agriculture and industry affecting Hawaii's weather, dust from the Saharan Africa affecting weather in Florida).
- Explain the implications of modifying the physical environment in Brazil to grow soybeans for global export (e.g., siltation, desertification, deforestation, global climate change).



NATIONAL GEOGRAPHIC STANDARDS

- The Use of Technology

2. The use of technology can have both intended and unintended impacts on the physical environment that may be positive or negative

Therefore, the student is able to:

A. Evaluate the intended and unintended impacts of using technology to modify the physical environment, as exemplified by being able to

- Evaluate how the technologies used in petroleum production and transportation have expanded the scale of the industry from local or regional to global over the last century (e.g., offshore oil drilling, oil sands, supertankers, pipelines).
- Evaluate various types of contemporary agricultural techniques (e.g., no-till farming, herbicides, pesticides, center-pivot application of chemicals, crop rotation, irrigation, increased acreage in production), and compare the positive and negative implications of using these techniques.
- Evaluate the environmental impact of road building into remote locations (e.g., rain forests in Brazil, old growth forests in Oregon, agricultural land in China, Alaskan pipeline in the Arctic).



NATIONAL GEOGRAPHIC STANDARDS

- Consequences for People and Environments

3. People can either mitigate and/or adapt to the consequences of human modifications of the physical environment

Therefore, the student is able to:

A. Describe and evaluate scenarios for mitigating and/or adapting to environmental changes caused by human modifications, as exemplified by being able to

- Compare the costs and benefits of alternative solutions for a human-caused environmental problem, such as acid rain (e.g., coal with lower sulfur content, scrubbers on smokestacks, nuclear waste disposal, use of alternative energies) or urban heat islands (e.g., green roof construction, increased public transportation, energy efficient buildings).
- Explain and evaluate the policy implications of managing upstream development in relation to downstream impacts (e.g., flooding, dam construction or removal, zoning).
- Evaluate the feasibility, costs, and benefits of green construction techniques (e.g., Leadership in Energy and Environmental Design [LEED] certification) and describe how these efforts may increase sustainability and mitigate human impact on the physical environment.



NATIONAL GEOGRAPHIC STANDARDS

Standard 15

How physical systems affect human systems

- Adaptation to the Environment

3. Societies use a variety of strategies to adapt to changes in the physical environment

Therefore, the student is able to:

A. Explain how societies adapt to reduced capacity in the physical environment, as exemplified by being able to

- Explain how societies historically adapted to reduced capacity in the physical environment (e.g., migration, limiting population growth, building aqueducts and cisterns) and predict locations where adaptation strategies might be required in the future.
- Explain how societies use technology in dealing with resource shortages amidst growing human populations (e.g., recycling used water, recycling paper products, converting to drip irrigation systems, development of new alternative energy sources).

B. Analyze the concept of “limits to growth” to explain adaptation strategies in response to the restrictions imposed on human systems by physical systems, as exemplified by being able to

- Analyze how people have adapted to physical environments that vary in carrying capacity (e.g., slash-and-burn agriculture practices, nomadic herding or hunting, importation of needed products).
- Identify world locations that have vulnerable environmental conditions (e.g., extreme temperatures, limited access to water, steep topography) and high population density and explain adaptation strategies used that address the limits to growth.



NATIONAL GEOGRAPHIC STANDARDS

Standard 16

The changes that occur in the meaning, use, distribution, and importance of resources

- Types and Meanings of Resources

1. The meaning and use of resources change over time

Therefore, the student is able to:

A. Explain the relationship between the quest for resources and the exploration, colonization, and settlement of different regions of the world, as exemplified by being able to

- Describe the Columbian exchange of plant and animal resources and explain how this exchange changed patterns of food consumption around the world.
- Identify different types of resources (e.g., precious metals, spices, animal products) that drove the 15th- to 20th-century European process of exploration and colonization in North America, Africa, and Asia, and explain how this process influenced the spatial distribution of European colonies on those continents.
- Describe and explain how the prospect of gaining access to resources in the Arctic and Antarctic regions creates competition among countries with territorial claims.



NATIONAL GEOGRAPHIC STANDARDS

B. Explain how globalization and higher standards of living affect the meaning and use of resources, as exemplified by being able to

- Explain why mass consumption associated with globalization requires enormous amounts of resources worldwide (e.g., energy to ship raw materials and finished goods worldwide, emerging consumer markets increase in demand for energy due to increased ownership and use of electrical devices).
- Explain fluctuations in world petroleum prices as a function of global changes in supply and demand (e.g., disruptions in supply due to political tensions, new suppliers such as Angola, environmental disasters such as oil leaks and spills).
- Explain how and why per-capita consumption of resources (e.g., petroleum, coal, electricity, steel, water, food) differs between developed and developing countries now and in the past.



CHAPTER 6

REFERENCES & RESOURCES



*Researched online resources for teacher reference,
further study, and supplementary and supporting
materials.*

S E C T I O N I



MICHAEL POLLAN



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S E C T I O N 2



FRED KIRSCHENMANN



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S E C T I O N 3



TOPIC



REFERENCES & RESOURCES FOR THE TOPIC FOOD AND FARMING



TOPIC: REFERENCES & RESOURCES

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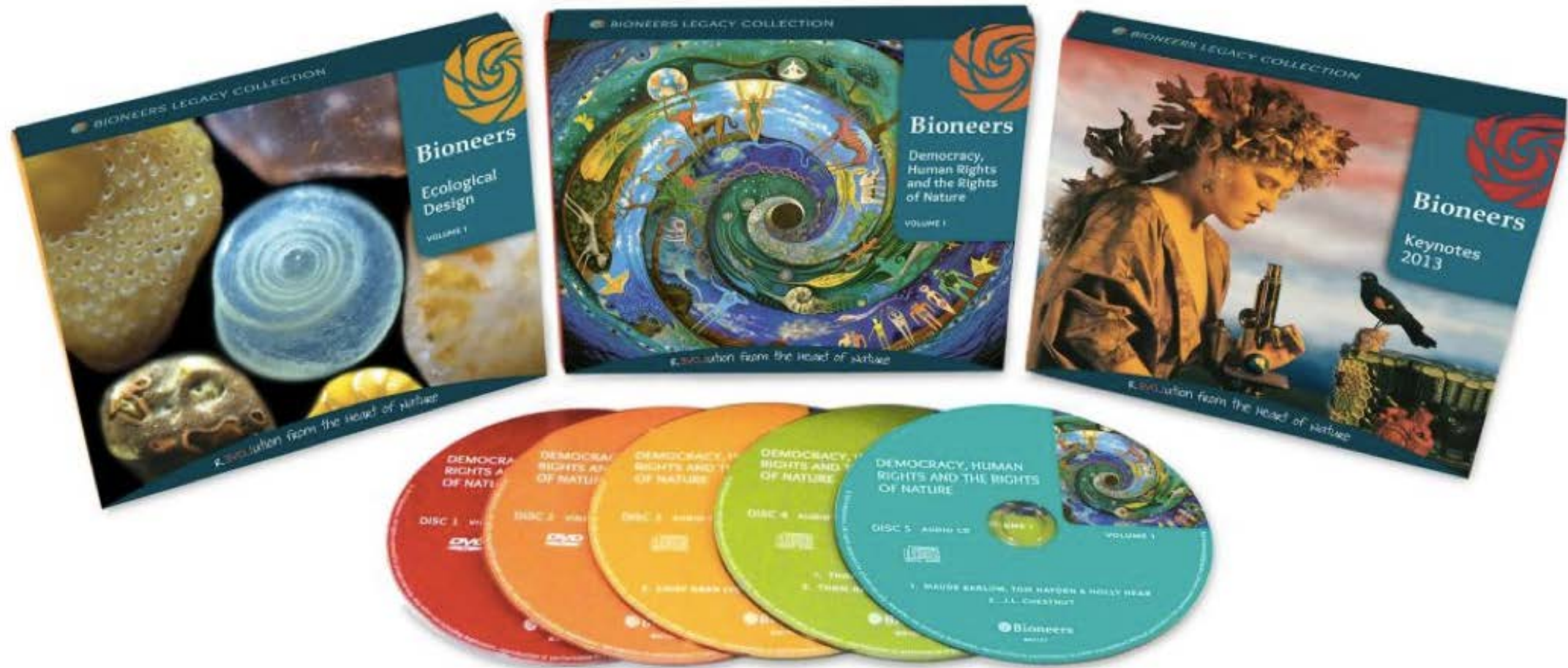
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BREADBASKET OF THE US

n., an agricultural area that provides large amounts of food, especially grain, to other areas

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CLA

n., Conjugated Linoleic Acid, a fatty acid naturally found in some foods, especially milk and meat from ruminants

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COMMUNISM

n., a system of social organization in which all economic and social activity is controlled by a totalitarian state dominated by a single and self-perpetuating political party

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COMMUNITY SUPPORTED AGRICULTURE

n., a system by which people purchase a share from a local farm and periodically receive vegetables and other agricultural products throughout the farming season

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Find Term

DAN IMHOFF

lecturer, director, and author of articles and books such as “Food Fight: The Citizen’s Guide to the Next Food and Farm Bill” and “Farming with the Wild: Enhancing Biodiversity on Farms and Ranches”

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ENVIRONMENTAL SINK

n., a reservoir that uptakes a chemical element or compound from another part of its cycle. For example, soil and trees tend to act as natural sinks for carbon.

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Find Term

FOOD SECURITY

n., an economic and social condition of ready access by all members of a household to nutritionally adequate and safe food

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Find Term

GRASS FARMING

n., the practice of basing the diet of livestock on grass, grass farms often rotate animals through pastures and use high quality grass

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HECTARE

n., a unit of surface, or land, measure equal to 100 ares, or 10,000 square meters, equivalent to 2.471 acres

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HERMAN DALY

1938-, professor at the University of Maryland and author of articles and books such as “Valuing the Earth: Economics, Ecology, Ethics” and “Beyond Growth: The Economics of Sustainable Development,” former Senior Economist in the Environment Department of the World Bank

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IRRADIATE

v., to treat by exposure to radiation, as of ultraviolet light

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JARED DIAMOND

1937-, professor of geography at the University of California, Los Angeles and author of books such as “Guns, Germs, & Steel” and “The World Until Yesterday”

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Find Term

MYCELIUM

n., the mass of hyphae that form the vegetative part of a fungus

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ORGANIC

adj., pertaining to, involving, or grown with fertilizers or pesticides of animal or vegetable origin, as distinguished from manufactured chemicals

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RUMINANT

n., any even-toed, hoofed mammal of the suborder Ruminantia, being comprised of cloven-hoofed, cud-chewing quadrupeds, and including, besides domestic cattle, bison, buffalo, deer, antelopes, giraffes, camels, and chevrotains

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SIR ALBERT HOWARD

1873-1947, English botanist, researcher, pioneer of the organic movement, and author of several books, e.g. “The Soil and Health: A Study of Organic Agriculture”

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Index

STEVEN C. BLANK

author and professor in the Agricultural and Applied Economics Department at Virginia Tech,
received his Ph.D. in Agricultural Economics

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SUBSIDY

n., a direct pecuniary aid furnished by a government to a private industrial undertaking, a charity organization, or the like

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Find Term

TECHNOCRACY

n., a theory and movement, prominent about 1932, advocating control of industrial resources, reform of financial institutions, and reorganization of the social system, based on the findings of technologists and engineers

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WENDELL BERRY

1934-, teacher, poet, and author of books such as “The Unsettling of America: Culture & Agriculture”

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ZERO SUM

adj., of or denoting a system in which the sum of the gains equals the sum of the losses

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