

# Lesson 1: Introduction to Sustainable Agriculture



## Time

90 minutes

## Activity Expectations

Students will be able to:

- Understand the core question, “How will we sustainably feed nearly 10 billion people by the year 2050?” and begin to think about the challenges and opportunities presented by this question;
- Describe the expected population growth between now and the year 2050;
- Identify agricultural products that must be provided by agriculture in order to accommodate a growing population;
- Explain what sustainable agriculture is using the sustainability barrel;
- Discover how the ripple effect can relate to sustainable agriculture and have a positive impact in our society; and
- Understand the role food waste plays in our world.

## Materials

- *Introduction to Sustainable Agriculture PowerPoint*
- [Journey 2050 Introduction video \(https://youtu.be/zYecU\\_gJdxA\)](https://youtu.be/zYecU_gJdxA)
- *Sustainability Farming Game Level 1 Demo*
- Computer or tablet device for each student
- Optional: *Student Handout 1: World Population Growth*

## Key Terms

Sustainability, Agriculture, Sustainable Agriculture, Social, Economic, Environment

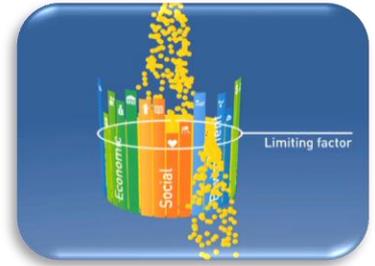
## Background Information

It is estimated that by 2050, Earth will be crowded with 2 billion more people. They’re all going to need water, homes, jobs and medicines. But most importantly, how are they all going to be fed?

This growing population will eat the equivalent of all the food grown in the last 500 years put together.<sup>1</sup> That’s approximately 60-70 percent more than we grow today<sup>2</sup> or 1 billion tons more cereal<sup>3</sup> and 50 percent<sup>4</sup> more freshwater every year.

This additional food has to be grown on less land and in a way that protects the environment and animals, while also ensuring there’s enough food for generations to come. This is called *sustainability*, and it can only be achieved by improving its three interconnected elements: economy, society and the environment.

The economic component of sustainability is about earning money—creating jobs and incomes to support the national and local community. The social element encompasses things like food, education, medical care and infrastructure, including the roads used to transport food from the farm to your plate. And finally, there are environmental needs to consider. Soil quality needs to be maintained, habitats need protection, water must be conserved, and we need to protect our atmosphere by keeping greenhouse gas emissions to a minimum.



Imagine a barrel with parts made equally from the three elements of sustainability. You can only fill this barrel to the level of its lowest piece. If the environment is the lowest piece of the barrel, it limits sustainability. This element must be improved to make the world’s sustainability better.

World leaders in the United Nations have committed to 17 Global Goals<sup>5</sup> in order to achieve extraordinary things such as: end extreme poverty, fight inequality and injustice, and fix climate change. Sustainable agriculture is key to meeting these goals and creating a stronger 2050 for our people and our planet.

The planting of a single seed creates a ripple effect that helps the farmer’s family, their community, their country and ultimately, the world. The more farmers grow and sell, the more they have to spend on seeds, machinery and fertilizer to produce even more food and fiber. Income that’s spent locally is invested in the community, providing education, medical care and infrastructure and protecting the environment. If farmers around the world start a ripple, it could improve global economies and help billions rise from poverty. Different farmers raise different crops and animals according to their local soil, climate, technology and markets. But they all have one thing in common. They love agriculture.

On our journey to the year 2050, we’re going to be spending time with farm families around the world who are growing food sustainably. First, you’ll meet the Madges. They’re a three-generation farming family from Central Alberta, Canada. Then we’ll fly across the Atlantic to meet the Oloos. They own a small farm in Kenya, East Africa. Finally, we’ll visit the Singhs, who live in India where multiple generations farm together. These families and agricultural experts will be giving you advice on what we call *best management practices*, which will allow us to grow more with less, protect the environment, build stronger communities and feed the growing population of our planet.

It’s a long journey ahead, but even the longest journey starts with a single step forward. Take it now and join us on our Journey to 2050.

## Did You Know?<sup>6</sup>

- Sustainable agriculture is critical in the global effort to eradicate hunger and poverty.
- Hunger is often caused by food waste and inequality of distribution, not scarcity.
- There are an estimated 1.4 billion<sup>7</sup> people living in extreme poverty and about 870 million people that are hungry, malnourished and food insecure (have difficulty acquiring food).
- Unfortunately, about one-third<sup>8</sup> of our current global food supply is wasted. In developed countries food is thrown out and over consumed, and in developing countries food is lost to unreliable storage and transportation.

## Interest Approach

1. Project the *Introduction to Sustainable Agriculture* PowerPoint. Begin with slide 2 and ask your students, “How much is 1 million?” Allow students to offer their answers as they begin visualizing the quantity and value of 1 million. Then ask, “If I spent \$1000 every day, how long would it take me to spend 1 million dollars?” (2.7 years, or 1,000 days)
2. Once students seem to grasp the value of 1 million, move to slide 3 and ask, “If I spend \$1,000 every day, how many days would it take to spend 1 billion dollars?” (1,000,000 days or 2,740 years)
3. Now that your students are beginning to visualize the sheer quantity of 1 billion ask, “What is the current world

population right now?" (*over 7 billion*). Follow up by asking, "Do you know what the world population is projected to be in the year 2050?" (*nearly 10 billion*).

4. Optional: If time allows, use one of the following activities to help students further visualize and understand the growth trends in world population:

- Show the [World Population](https://youtu.be/khFjdmp9sZk) video/animation (<https://youtu.be/khFjdmp9sZk>, 5:46 min)
- Show the [7 Billion: How Did We Get So Big So Fast?](https://www.youtube.com/watch?v=VcSX4ytEfcE) Video (<https://www.youtube.com/watch?v=VcSX4ytEfcE>, 2:33 min)
- Have students complete *Student Handout 1: World Population Growth*.
- Explore:
  - <http://worldpopulationhistory.org>
  - <https://ourworldindata.org/>

## Lesson Procedures

**Preparation:** Prior to class, review the *Background Information*, video clip, and PowerPoint slides (including the speaker notes) associated with the lesson.

### Activity 1: Introduction to Sustainable Agriculture

1. Journey 2050

- Slide 4: Play the [Journey 2050 Introduction video](https://youtu.be/zYecU_gJdxA) ([https://youtu.be/zYecU\\_gJdxA](https://youtu.be/zYecU_gJdxA), 3:51 min). Prepare students for the video by asking them to discover three things: 1) Why is 2050 a significant year? 2) What is the sustainability barrel? and 3) What is the ripple effect? (Background and discussion prompts are outlined in the steps below and in the PowerPoint notes.)

2. Why 2050?

- Slides 5–6: Ask students, "If it is [insert current year] right now, how many years until we reach the year 2050?" Then ask, "How old will you be in the year 2050?" Explain that scientists and world leaders have identified 2050 as a key moment in time when the world's population will be nearly 10 billion—that is over 2 billion more than today. Point out to students that they will be adults! They will have an influence on the decisions that impact everything from what is taught in schools to what they buy at the grocery store.
- Slide 7: Ask students to identify some of the resources that we will need more of in order to provide for 2 billion additional people on Earth. Brainstorm and list several items on the board. Use questioning to help students identify items such as food, clothing, shelter, fuel, jobs, medicine, etc. Remind students of all the products they get from agriculture (food, fiber, fuel, timber, medicines and by-products that are used in manufacturing or end up in items such as lipstick, paint and batteries). Explain that farmers and many other agricultural professionals are responsible for producing each of these daily necessities.
- Slide 8: Explain that in order to feed 2 billion additional people, it is predicted that farmers will need to produce 60 to 70 percent more food than we currently produce today on the same amount of land or even less.<sup>9</sup> Ask, "Will this goal of sustainable agriculture be easy to accomplish? Will the pressure on farmers increase, decrease or stay the same?" As students are thinking and offering answers, draw their attention back to the *Interest Approach* at the beginning of the lesson, picturing an additional 2 billion people that agriculture must feed. Students should conclude that farmers will have increased pressure to produce more food and fiber for a growing population.
- Before moving on, formatively assess students to ensure they understand the term *sustainability*.

3. What is the sustainability barrel?

- Slides 9–10: Tomorrow’s farmer will have to feed even more people. It is estimated that by 2050, our growing population will require the equivalent of all the food grown in the last 500 years.<sup>10</sup> That’s a lot of food! Ask, “Do farmers have limitations to how much they can produce?” As students think about the answer to this question, give an example of a corn farmer with 100 acres. Can this farmer take their same land, soil, corn seeds, water and tractors and double their crop from one year to the next simply because there is a demand for more corn? No, there are limitations if a farmer wants to produce agricultural goods in a sustainable manner.
- Slide 11: Ask students to picture a wooden barrel made up of several wooden slats. Explain that we are going to call it a *sustainability barrel*. Each wooden slat of the barrel represents a factor influencing sustainable agricultural production. Each factor can be placed into one of three challenges to sustainable agriculture—producing sustainably while maintaining economic, social and environmental systems. For example, in order to be able to grow enough food to feed the world sustainably, we have to make sure that farmers are able to earn a profit, that communities have access to education and healthcare, and that the soil stays healthy and we don’t destroy habitats.
- Slide 12: Ask students, “What are some examples of limiting factors?” (*water, available land, soil health, climate, economy, education, etc.*) Ask students to explain how each factor influences our ability to produce our food. Remind students that we must continually improve the weakest part of our sustainability, whether it is education or soil health. They all impact our ability to feed the world. A community or program is only as successful as its least developed sustainability factor.

#### 4. What is the **Ripple Effect**?

- Slide 14: Ask, “Can a single drop of water impact an entire body of water?” (*Yes, it creates a ripple.*)
- Slides 15–16: Use these slides to illustrate how sustainable practices in agriculture can create a positive ripple effect.

#### **Activity 2: Sustainability Farming Game Level 1 Demo**

1. Slides 17–18: Inform students that they are about to embark on a “Journey to 2050.” There are many challenges that lie ahead, but they will focus on tackling the following for now: plant nutrients, water, economies, geography, land use and careers. Inform students that they will be using a game to farm virtually in different parts of the world. Along the way they will learn more about where our food, fiber (clothing and shelter) and fuel comes from and how farmers can sustainably produce these items for a growing population.
2. Introduce the *Sustainability Farming Game*. Inform students that they will experience the lives of three actual farm families in Kenya, India and Canada. As they interact with each family, they should pay attention to the farming practices they choose, the technology they use and the community investments they make. Remember, agriculture is the foundation for life, and its success creates ripples locally and globally that will determine whether we meet the challenge of feeding the world.
3. Write on the board a reminder of what the sustainability barrel includes:
  - Social: food, education, infrastructure, healthcare
  - Economy: profits, income, jobs, community
  - Environment: habitats, soil health, water, greenhouse gases
4. Open the *Sustainability Farming Game* Level 1 Demo on each student’s computer or device.
5. Explain that the sustainability barrel will determine their score, and help students understand the significance of balancing the social, economic and environmental pillars of the sustainability barrel throughout the game (e.g., investments in soil health produce better crops, earning more money; investments in roads allow products and people to travel easier, improving access to markets and labor).
6. Explain to the students that it is very important that they listen to you as they will have to stop and wait every time they finish a level. Every student must start and end the game (roughly) at the same time to ensure your class time



flows smoothly.

- Note to teacher: The first level is a demonstration of the game designed to teach students how to play. Students will be in Kenya and will play one round, which will take about five minutes. The game stops after they have completed each teaching moment (such as how to plant, water and harvest).
7. Once time is up, the game will pause on the Results page. When all students have reached the Results page, instruct them to press “continue,” and help them understand what the Ripple Effects screen shows. They will then move on to the Surplus Contribution Opportunities page. Encourage them to invest in their limiting factors (there will be a red arrow under the limiting factor). If the investment matches that factor, there will be a red arrow on the left, beside the investment name. Once their score stops going up they can press “continue” and finish with the demo level.
  8. Slides 19–20: Once students have completed the game, use the following questions to help students synthesize what they have learned:
    - After growing your first crop, did you invest some of your money to purchase additional land? Why or why not?
    - What was the limiting factor in your sustainability barrel? What did this mean? (*Answers will vary*)
    - What were some of the ripple effects of your farming choices?

### **Activity 3: Do People Waste Food? (Option to teach as an independent lesson another day)**

1. Slide 21–22: It’s important for students to understand why resources are important. Take some time to help your students understand the risks of food security as we strive to feed a growing population. There are food security risks in all parts of the world, and there is one prominent threat that we all contribute to—food waste. Unfortunately, about one-third<sup>11</sup> of our current global food supply is wasted. There are an estimated 1.4 billion<sup>12</sup> people living in extreme poverty, and about 870 million<sup>13</sup> people that are hungry, malnourished and food insecure (have difficulty acquiring food). In developed countries, food is thrown out and overconsumed, and in developing countries, food is lost to unreliable storage and transportation. Hunger is often caused by food waste and inequality of distribution, not scarcity. Ask your students this question, “How often do you throw food out, and what else could you do with that uneaten food?” Discuss ways students can reduce their personal food waste, such as making or ordering only what you NEED to eat, composting, saving food for leftovers to eat later, etc. Sustainable agriculture is critical in the global effort to eradicate hunger and poverty, and reducing waste can improve the sustainability of agriculture.
2. Slide 23: Play the video clip [The Ugly Carrot](https://www.youtube.com/watch?v=EswyKGgk_Dc) ([https://www.youtube.com/watch?v=EswyKGgk\\_Dc](https://www.youtube.com/watch?v=EswyKGgk_Dc), 0:54 min). Then ask the following questions: Have you ever seen a carrot or other similarly misshaped produce item at a grocery store? If you did see this carrot (or another similarly misshaped produce item), would you buy it? Why or why not? Would you pay the same price as if it was perfectly shaped?
3. Slide 24: Ask students, “How does food waste impact sustainability and hunger?” Students will likely associate food waste with hunger and recognize the moral, economic and social implications. Provide guiding questions to help students also recognize the impact food waste has on our environment and natural resources. Ask, “Besides the food itself, what else is wasted?”
4. Slide 25 (Optional): On the board, brainstorm potential challenges that could arise when the people of a country are hungry (malnutrition and health care risks, violence and thievery, vulnerability to markets and storage, decline in education attendance, political distress/corruption, decline in infrastructure, decline in investment in technology and innovation and risk of unsustainable practices across industries). On the board, brainstorm potential challenges that could arise when a country has an overabundance of food (quality food is thrown out, obesity, increasing calorie-intake (eating more per meal), rise in Western-style diets, desire for food from other places (increased markets, infrastructure), shift to more urban population which can result in disconnect with life on the farm, consumer demands and perspectives influence food value chain (genetically modified foods, organic, free range vs barn raised animals, herbicides, pesticides, food labels, country of origin traceability, animal care, food preparation, sanitation, packaging, preservatives, etc.).
5. Optional questions for higher grades: How can governments be involved in food security? (*Governments can provide regulations, policies, education programs, low interest loans, investment in research and development, and share practices with other countries.*) What happens when there is corruption in government or a huge gap between the rich and poor?

## Wrap-Up:

1. Slide 26: Review and summarize the following key concepts:
  - Our population is growing. By 2050 it is expected that our world will grow from over 7 billion people to nearly 10 billion people.
  - Sustainable agriculture is the practice of producing our food, fiber and fuel in a way that is profitable to the farmer, supports a healthy quality of life and protects our natural resources (land, air and water).
  - Many factors can limit our ability to produce food for a growing population. These limiting factors are depicted in the sustainability barrel.
  - Using sustainable agricultural practices can improve our society through the ripple effect.
  - Over one-third of our food is wasted in both developing and developed countries.
  - Hunger is often caused by food waste and inequality of distribution, not scarcity.
  - Food waste decreases sustainability due to the inefficient use of natural resources, such as arable land, soil nutrients, water and energy.
  - Food waste can negatively affect our quality of life and create undesirable outcomes in a country.

## Enriching Activities

- Slide 29: Very cool animated video to show students why and how our population grew to reach over 7 billion today. Click here to view: <https://www.youtube.com/watch?v=VcSX4ytEfcE>
- Slide 30: The Sustainability Cookie is a quick exercise that includes a snack and a review of sustainability and food waste.
- Assign a supplemental activity for students to research the definitions of the words *sustainability*, *agriculture*, and *sustainable agriculture*.
- Utilize these 60-second supplementary videos for each of the topics below:
  - *Sustainability Barrel* (<https://youtu.be/nTAXPO-YDF8>)
  - *Best Management Practices* (<https://youtu.be/bLQ5QWN0Nlg>)
  - *Ripple Effect* (<https://youtu.be/MzF8LPlalcY>)
- As an example to illustrate growth and improvement in agriculture, explain that a North American farmer in the 1900s produced enough food for 10 people. Today's farmer feeds over 120 people. Ask students, "Why can farmers produce more food today than they could in the early 1900s?" (*increased knowledge and skills about plants and animals, technology, machinery, improved breeding and genetics, etc.*)
- As a class or part of an additional assignment, read National Geographic's [How Reducing Food Waste Could Ease Climate Change](#).
- Watch the DNews segment [Why Do We Waste \\$1 Trillion of Food A Year?](#) (<https://www.youtube.com/watch?v=zjNgr4VltAc>, 4:28 min). As a class, discuss why consumers are attracted to food meeting specific cosmetic standards and the impacts of the behavioral trend.
- Assign students a marketing project. Instruct them that they are to develop a marketing plan to decrease wasted food by marketing produce that is safe and healthy, but imperfect in size or shape. Show the video clip [Inglorious Fruits and Vegetables](#) (<https://www.youtube.com/watch?v=qQQMygivr0g>, 0:15 min) as an example.
- World leaders are working on solutions to global sustainability. The United Nations has released 17 goals that we all need to work towards. There is a free App called Global Hero that highlights each goal in 30-second mini-games. There are no in-app purchases to play the games. Learn more about each goal here: <http://www.globalgoals.org/>
- Students will understand the importance of taking action through service-learning using the WE Service Learning in Action: [Introduction to Sustainable Agriculture](#) lesson plan.

## Sources

---

<sup>1</sup> <http://www.economist.com/node/18200702>

- 
- <sup>2</sup> Sustainable Development Network Solutions (2013). Solutions for Sustainable Agriculture and Food Systems (page 3) <http://unsdsn.org/resources/publications/solutions-for-sustainable-agriculture-and-food-systems/>
- <sup>3</sup> <http://www.fao.org/mwg-internal/de5fs23hu73ds/progress?id=HXecPI0p3XpJtFbAsjLRZd3G4ZjPgUW5N3PqtZYwwio>
- <sup>4</sup> <http://waterfortheworld.net/index.php?id=12>
- <sup>5</sup> <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>
- <sup>6</sup> Sustainable Development Network Solutions (2013). Solutions for Sustainable Agriculture and Food Systems <http://unsdsn.org/mwg-internal/de5fs23hu73ds/progress?id=EHV3NQH3C4-PP-EivDwXY4i2HzjIjWty8lBnkNioco0>,
- <sup>7</sup> <http://www.un.org/en/globalissues/briefingpapers/population/vitalstats.shtml>
- <sup>8</sup> [http://www.worldfooddayusa.org/food\\_waste\\_the\\_facts](http://www.worldfooddayusa.org/food_waste_the_facts), and [http://www.un.org/waterforlifedecade/food\\_security.shtml](http://www.un.org/waterforlifedecade/food_security.shtml)
- <sup>9</sup> Sustainable Development Network Solutions (2013). Solutions for Sustainable Agriculture and Food Systems <http://unsdsn.org/mwg-internal/de5fs23hu73ds/progress?id=U-qEvmdl3Nfq5UEBFImLLeAcIX6xAu4dITzs6lGd3aw>,
- <sup>10</sup> <http://www.economist.com/node/18200702>
- <sup>11</sup> [http://www.worldfooddayusa.org/food\\_waste\\_the\\_facts](http://www.worldfooddayusa.org/food_waste_the_facts)
- <sup>12</sup> <http://www.un.org/en/globalissues/briefingpapers/population/vitalstats.shtml>
- <sup>13</sup> Sustainable Development Network Solutions (2013). Solutions for Sustainable Agriculture and Food Systems <http://unsdsn.org/mwg-internal/de5fs23hu73ds/progress?id=EHV3NQH3C4-PP-EivDwXY4i2HzjIjWty8lBnkNioco0>