

Lesson 5: Land Use

Time

30 - 45 minutes



Activity Expectations

Students will be able to:

- Recognize that arable land (ideal land for growing crops) is a limited resource;
- Identify best management practices that can be applied to every stakeholder's land-use decisions; and
- Analyze and discuss the impacts of food waste on our environment.

Materials

- Apple, knife and cutting board
- *Land Use* PowerPoint
- *Land Use video* (<https://youtu.be/RMu7NtScdhU>)

Key Terms

Currency, Population Density, Habitat, Best Management Practices, Agriculture, Stakeholder

Background Information

Land is one of our most vital resources. We build our civilizations on it. It is habitat for thousands of species and a critical part of our ecosystem. We need land for agriculture, but how much land is actually available for us to sustainably grow the food, clothing and shelter we need?

The vast majority of Earth's surface (over 70 percent) is water. This means that only 30 percent of Earth's surface is land. Only a small portion of that land, 10 percent,¹ is ideal for growing crops. However, with technology, innovation and best management practices, farmers can grow food on nearly 40 percent of the land.² For example, on land that is not ideal because it is too wet for many crops, we can grow crops like rice that thrive in wet soil. On land that is too rocky to grow crops we can raise livestock that can adjust to the landscape. If we're going to feed the world, we need to consider different ways to use Earth's land to grow more food. For example, do we convert more land to farmland for agriculture, or do we use the land we currently have and focus on increasing crop yields?

We have the ability to influence how much land is used for things like agriculture, urban development, industry development, oil and gas, mining and forestry. The choices we make with the land can bring both social and economic benefits, ensuring sustainable development.

Achieving a sustainable balance requires a great deal of thought. For example, if you want to increase your agricultural land, what are you willing to give up? Natural habitats? Industries? Homes? Recreation? You could convert natural habitats to farmland, but there will be consequences. For example, the Amazon rainforest is home to thousands of unique living things, and it plays an important role in helping regulate the Earth's atmosphere and ecosystem; these factors must be considered before converting the land to a different use. Before you decide what you're going to change, it is important to consider how one choice about land use will impact another.

To feed the world sustainably, we will need to increase how much food we can produce on a given area of land. It is estimated that one hectare of productive agricultural land, roughly the size of two soccer fields, is lost every eight seconds.³ Growing more food on the land that is available to us is only possible through the use of best management practices.

Farmers can use best management practices to help ensure they grow foods sustainably. Precise application of crop nutrients, making sure crops are watered at the best time of day, planting shelter belts or hedge trees, and replenishing soil nutrients used by plants during growth are all examples of practices that can help grow more food on less land. Sometimes best management practices are costly, but they can have a positive impact on the environment, crop yields, economic growth and society.

The implementation of best practices on farmland and in urban areas will help us move toward our goal of becoming a more sustainable civilization. For example, expanding cities upward, rather than outward, allows for more homes on less land.

Land is the source of life, but it is limited. It cannot be replaced or constructed. We need to grow more food on existing land using best management practices so that we can sustainably maximize our land resources and address other issues related to land use choices.

Did You Know?

- Over 70% of Earth is covered in water and cannot be used to grow crops.⁴
- Earth has 57 million square miles of land, but only 12 million square miles are arable (ideal conditions for growing crops).⁵
- In North America one in four calories intended for consumption are never actually eaten because the food is lost as waste (refer to Lesson 1, activity 3 for more information on food waste).⁶

Interest Approach

1. Open the *Land Use* PowerPoint.
2. Begin by reminding students how many people are currently on planet Earth (*7.6 billion in 2018*) and that expert demographers are anticipating nearly 10 billion people by the year 2050 (www.Worldometers.info).
3. Optional: Remind students what one billion looks like by asking:
 - “If I give you one million dollars and you spend \$1,000 every day when will you run out of money?” (*2.7 years*)
 - “How long would it take to spend a billion dollars if you spent \$1,000 every day?” (*2,740 years*)
 - This mental exercise will help students to understand that 10 billion is a very large number.
4. Slide 2: Ask students, “How can we feed the growing population?” Students will likely say that we need to grow/produce more food. Before you offer any additional information, conduct the following demonstration:
 - Hold up an apple and explain that it represents planet Earth. Ask, “How much of the Earth’s surface do you think is ideal for growing crops?”
 - Ask, “If you look at a globe or map, what is the main color you see?” (*Blue*) Cut the apple into four equal-sized wedges. Nearly three of these quarters represent land covered in water. Set these aside.
 - The remaining quarter represents land, which occupies roughly 30 percent of Earth’s surface. Take this piece, and cut it in half lengthwise so you have two, one-eighth sections.
 - One of these sections represents deserts, swamps, mountains and polar regions; this half of our land, or one-eighth (12.5 percent) of Earth’s surface, is not suitable for people to live or grow crops on. Set this section aside.
 - The other eighth represents land where people can live. There are some places where people can live but crops can’t be grown. Slice this section into four equal parts. Now you have four 1/32nd pieces of

apple, each representing roughly 3.1 percent of Earth's surface.

- The first section represents the areas of the world with rocky soils that are too poor for growing crops. Set this section aside.
- The next two sections represent land that is too wet or too hot for crops. Set these sections aside also.
- The fourth section represents the area of the world that is most suitable for development and agricultural cultivation. The best lands for agriculture are often desirable places to build homes and towns as well.
- Carefully remove the peel of the last 1/32nd section. This small bit of peel represents all the soil on Earth, which humans depend on for growing crops. Display slide 3 of the PowerPoint for further illustration.



5. Ask students, "Can farmers simply plant more acres of crops to feed a growing population?" (*No*) Point out that the population may increase, but the amount of arable farmland will stay the same.
6. We use our land for many different things, and we need to make smart choices to take care of the land. As a result of science and innovation, nearly 40 percent of Earth's land is used for agriculture.⁷ Raising livestock on land that is too hilly or rocky for growing crops, growing urban gardens, and planting seeds that grow in tough conditions like drought are all ways to grow more food on the same amount of land.
7. Explain that in order to feed 10 billion people, farmers will need to use best management practices, like preserving soil nutrients, improving water conservation and using arable land efficiently to grow the food, fiber, fuel and by-products that we use every day. This will need to be done in a sustainable way to minimize environmental impacts and maintain a high quality of life.

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:

- Slide 4: Play the [Land Use video](https://youtu.be/RMu7NtScdhU) (https://youtu.be/RMu7NtScdhU, 4:41 min). Prepare students for the video by asking them to discover two things: 1) Why is land a precious resource? 2) How are best management practices applied to land use choices? (Background and discussion prompts are outlined in the steps below and in the PowerPoint notes.)
- Why is land a precious resource?
 - Slide 6: Ask, "What is our land used for?" (*habitat, food, recreation, homes, industries, agriculture, etc.*) Explain that land is a precious resource. There are many things that influence how land is used and what it is used for.
- Slide 7: Display the [Worldometers](http://www.worldometers.info/world-population/#top20) (http://www.worldometers.info/world-population/#top20) website to show your class the live population statistics for the 20 largest countries in the world.
 - Optional: If time allows, challenge students to discover which of these countries has the highest and the lowest population density. (*Russia has only 9 people per km², and India has 452 people per km².*) Make it a race with a prize to see who can figure it out first. This statistic can be found on the [Worldometers](http://www.worldometers.info/world-population/#top20) website by clicking on each individual country in the list *Top 20 Largest Countries by Population*.
- Slides 8–9: Display the Population Statistics by Country Map and Agricultural Land Map, and ask students if they can see a relationship between human population and agricultural land. Students should recognize that we are building our homes and businesses in the areas that have the best climate and soil for growing crops! Historically, people have settled near water and fertile land in order to grow crops. As cities grow the urban

footprint expands into areas that are habitat and farmland. India and China have nearly 40% of the population between the two countries (As of 2018, China has 1.415 billion people + India has 1.354 billion people = 2.769 billion or 36.28% of the world share (compared to the next largest population: USA is in 3rd place with 326,766,748 people; Canada is 38th with 36,953,765)⁸. Compare China and India's population footprint to arable land.

- Optional: If time allows, here is an interactive world population density map: <http://worldpopulationhistory.org/map/1/mercator/1/0/25/> and here is a source for agricultural land uses: <https://ourworldindata.org/land-use-in-agriculture/>
- Explain that farmers have increased yields (food production) by using improved practices, science and technology. For example, plant scientists have developed plants that are resistant to insects, disease and drought; soil scientists and land managers have developed soil conservation practices; and irrigation engineers have developed systems and delivery mechanisms to minimize water use and still grow a bountiful crop. Yields have constantly gone up.
- How are best management practices applied to land use?
 - Slide 11: Ask, "How do we improve our land-use choices so that we can feed a growing world and still maintain a high quality of life and healthy environment?" We need to use best management practices (see the [Best Management Practices video](https://youtu.be/bLQ5QWN0Nig) (<https://youtu.be/bLQ5QWN0Nig>, 1:06). Best practices are simply the best way to do something. For example, in school, if you attend class, engage in the content and study, you will do well in the course. Similarly, we can also think about the best ways to use our land sustainably by preserving natural habitats, using agricultural best management practices and planning for urban growth.
 - Slide 12: Open Level 5a on each student's computer or device. Explain the following, "In this level, you will make predictions for the percentage of land used by nature, urban and agriculture in the 1900s compared to the year 2000". Next, explore best management practices that each stakeholder should employ in our journey and come up with your own ideas that each could be implemented to make better land-use choices.
 - Slides 13–16: Review slides as a class and discuss the noted best management practices.



Wrap-Up:

- Slide 17: Review and summarize the following key concepts: Three percent of the Earth (ten percent of the Earth's land) is ideal for growing crops.
- Most of our urban areas were built on ideal crop land. Our ancestors settled where they could grow food and cities grew from there.
- The quality of the soil under our homes and businesses is the real challenge in the journey. The challenge also spreads to our natural areas. Protecting the Earth's biodiversity and natural resources is vital to our survival.
- Every land use decision we make has a consequence. Best management practices are essential in our journey to sustainably feed the world while balancing social, economic and environmental needs.

Enriching Activities

- Slide 19: Watch the [Where in the World video](https://youtu.be/ZvdtHNe8zGw) (<https://youtu.be/ZvdtHNe8zGw>, 5:06). Have students play the *Journey 2050 Where in the World Geography Game*. This is a Q&A style game that has clues embedded in each question. Print or project the Land Use Map (PowerPoint slide 9) and [Country Comparison Map](#) for a quick reference. Before the game begins, ask the students to think of their favorite foods, sports, music and places to travel as well as things that they love about their country. Explore where some of their favorite things come from and how trading goods around the world allows us to enjoy those things. Make sure the students are aware that in the game, spelling counts. The game takes about 15 minutes to complete.



- Slide 20: Distribute the [Country Comparison Map](#) and have students find similarities and differences in climate, topography, culture and food production across the globe.
- Share the TedTalk by Allan Savory on desertification and cattle (<https://youtu.be/vpTHi7O66pl>, 22:19 min).

Sources

¹ <http://data.worldbank.org/indicator/AG.LND.ARBL.ZS>

² <http://data.worldbank.org/indicator/AG.LND.AGRI.ZS>

³ <http://www.tranquileye.com/clock/>

⁴ <http://water.usgs.gov/edu/earthhowmuch.html>

⁵ <http://one-simple-idea.com/Environment1.htm>

⁶ http://www.worldfooddayusa.org/food_waste_the_facts

⁷ <http://data.worldbank.org/indicator/AG.LND.AGRI.ZS>

⁸ <http://www.worldometers.info/world-population/population-by-country/>