The Regenerative Agriculture Journey

ACTIVITY BOOK

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Protect Soil, Water and Biodiversity

Hi there! I am Lucas!

I am a dairy farmer from Bedford County, PA. My great, great, great, great, great grandfather started this farm in 1812 when he immigrated from Germany. That makes the farm I live on today 210 years old!

Although he farmed in the same place I do, the way we take care of the cows and land looks very different from back then.

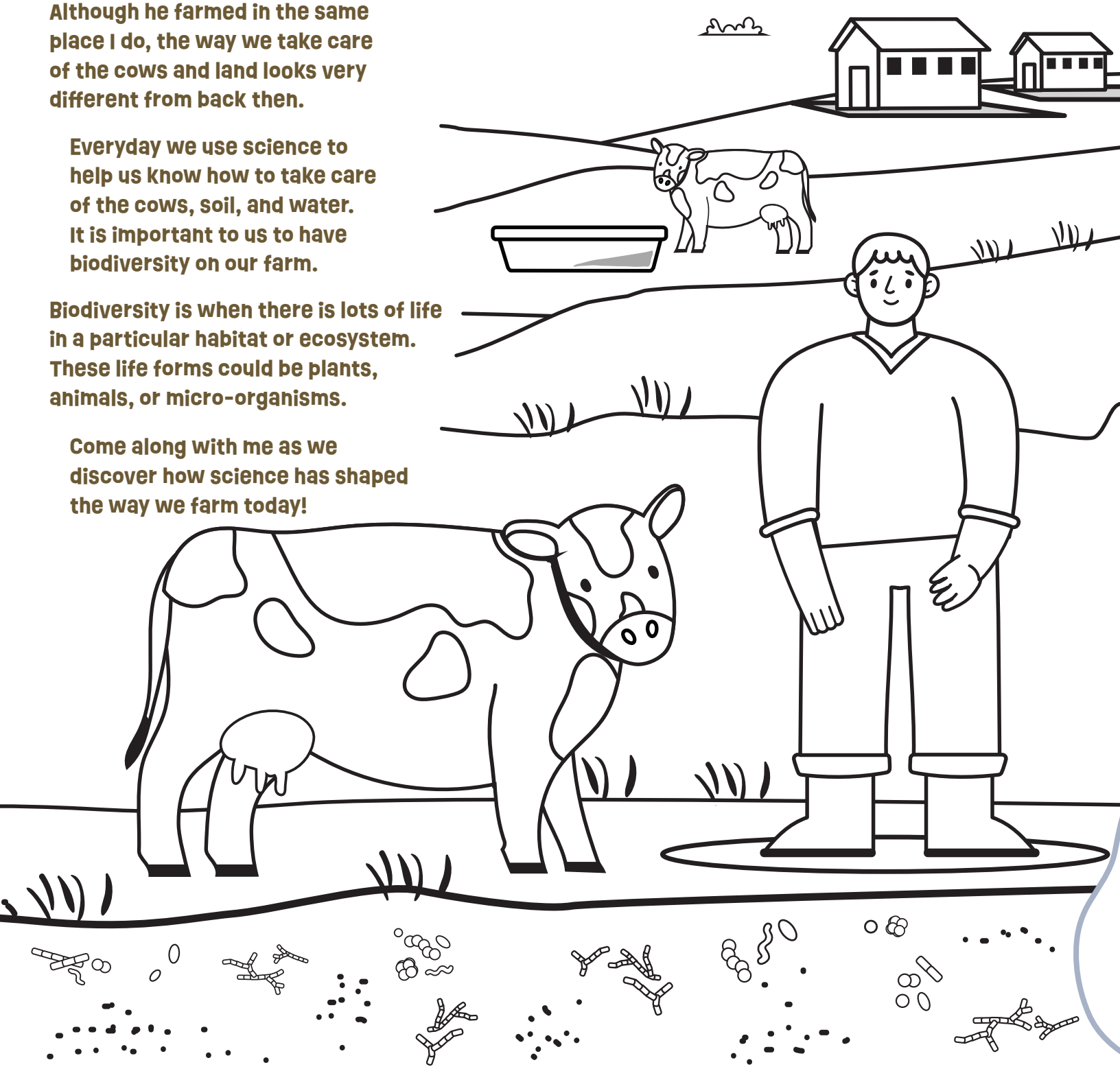
Everyday we use science to help us know how to take care of the cows, soil, and water. It is important to us to have biodiversity on our farm.

Biodiversity is when there is lots of life in a particular habitat or ecosystem. These life forms could be plants, animals, or micro-organisms.

Come along with me as we discover how science has shaped the way we farm today!

Are you an artist?

Show off your skills by coloring in Lucas' dairy farm.



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Word Scramble

FAST FACT

Did you know a thin layer of topsoil is responsible for **95% of all the food produced** for human consumption?

Unscramble the words that relate to the key soil regeneration steps. Then check your answers at the bottom:

1. __ ____ **tnilol** — the preparation of land for growing crops; land under cultivation.

2. _____ **utperas** — land covered with grass and other plants suitable for grazing animals, especially dairy cattle.

3. _____ **enarmu** — a valuable natural resource that helps put nutrients back into the soil.

4. _____ **ghmiucln** — the act of using surface mulch to conserve moisture and control weeds in a field.

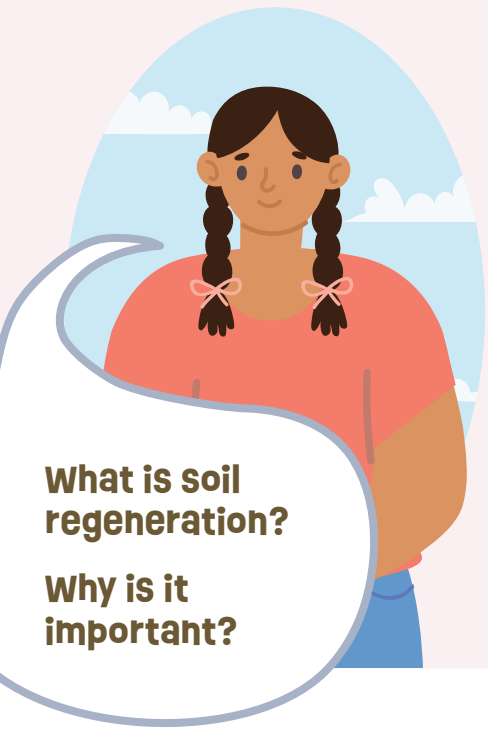
5. _____ ____ **eovcr ocpr** — a crop grown for the protection and enrichment of the soil.

6. _____ **gseial** — loose pieces of grass resulting from cutting; a field of grass grown for hay.

7. _____ **ivodsebityir** — the variety of life in the world or in a particular habitat or ecosystem.

8. _____ **pliosto** — the top layer of soil.

1. no till; 2. pasture; 3. manure; 4. mulching 5. cover crop; 6. silage; 7. biodiversity; 8. topsoil



The 5 Steps of Soil Regeneration:

Soil Regeneration is when a farmer's focus is on creating new soil and restoring soil health. Check out the five ways that we can do this!

1. Reduce soil disturbance (tillage, pesticides, herbicides)
2. Keep the soil covered as much as possible (mulching, cover crops, mowing)
3. Growing green plants throughout the year, as much as possible.
4. Have different species of plants grown throughout the year, as many as possible.
5. Have some sort of animal impact. We use cow manure to help put nutrients back into the soil (ex. Dairy cattle).

FAST FACT

Did you know that dairy farmers work everyday to restore soil quality? Healthy soil helps lower the amount of carbon in the air. Plants can withdraw carbon from the atmosphere using photosynthesis.

Why is soil restoration important?

The Underground World: Soil Microbiomes

Soil is an ecosystem or a group of living things in one setting. The world under the ground is as complex as our world above the ground. Around 25% of all living things on earth call soil their home. Wow! That's a lot. Some of them live on top of the soil, like plants or animals.

Others live right below the surface, like worms or beetles. If we pick up a handful of soil, we may not see many of these living things without a microscope. Decomposers, for instance, are types of bacteria that live in the soil. They break down organic matter, like dead leaves. Who knew so many living things call soil their home?

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Importance of Soil Restoration

Soil restoration is important since it helps protect natural resources, restore habitats for plants and animals, improve water quality, and makes the soil healthier. If we take care of the soil now, then future generations will be able to grow plants and have clean water.

Are you an artist?

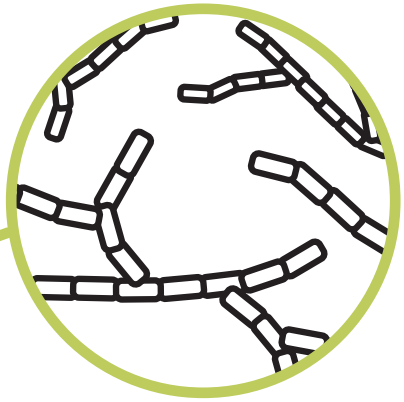
Show off your skills by coloring in the parts of the soil microbiome on this page!

microbiome — the community of microorganisms (such as bacteria, fungi, and viruses) and their combined genetic material inhabiting a particular environment.

bacteria — Bacteria are small organisms, or living things, that can be found in all natural environments. They are made of a single cell.

Most bacteria can be seen only with a microscope. Bacteria do not have most of the structures found in the cells of other organisms. Probiotics are special live bacteria and yeasts that have been studied and shown to be good for your health. Many probiotics have been shown to have gut health and immune health benefits. Some bacteria are great at making fermented foods, these bacteria are often found in yogurt. Yogurts made from cow's milk are excellent sources of live and active bacteria!

archaea — Archaea are single-celled organisms that often live in extreme places, like your gut! Like bacteria, Archaea are prokaryotic cells, which is just a fancy way to say they are the smallest type of cell around. While it might be scary to imagine microscopic organisms hanging out in your gut, these Archaea actually help you digest the food you eat.



fungi — A fungus is a simple organism, or living thing, that is neither a plant nor an animal. When there is more than one fungus, they are called fungi. Some familiar fungi are mushrooms, molds, mildews, truffles, and yeasts. There are about 50,000 known species, or types, of fungus. They are found all over the world on land or in the water. Some live on or inside plants and animals.

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Respect Animal Welfare

Help Daisy the Holstein cow get back to the barn in time for milking!
Don't forget to make sure she gets the care she needs along the way!

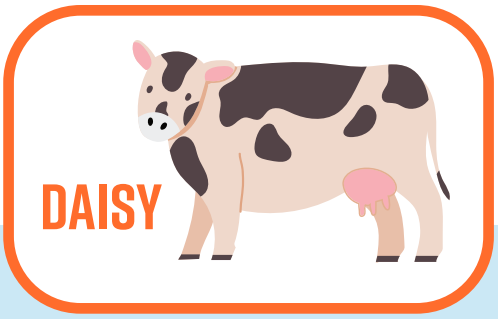
Me again!

Did you know having a healthy environment for a dairy cow will also help the soil growth and the ecosystems the cow is a part of? Check out the ways that dairy farmers like me keep our cows healthy and happy!

Animal Welfare Section:

1. Dairy farmers ensure their cows always have access to food and water.

2. Dairy farmers ensure their cows always have shelter and a comfortable resting area. Sand is used to keep the dairy cattle comfortable in the barn.



FAST FACT

Did you know dairy farmers work hard to ensure the welfare of animals? Anything from dairy cows to pollinators play a key role in a healthy ecosystem!

3. Dairy farmers ensure their cows are treated for injury or disease. Mastitis tests are used to check for infections within the udder.

4. Dairy farmers ensure cows have sufficient space, whether in a pasture, barn, or stall.

You made it back in time for milking!

Great job on making sure Daisy is well fed, has plenty of water, and is comfortable in her barn or pasture.

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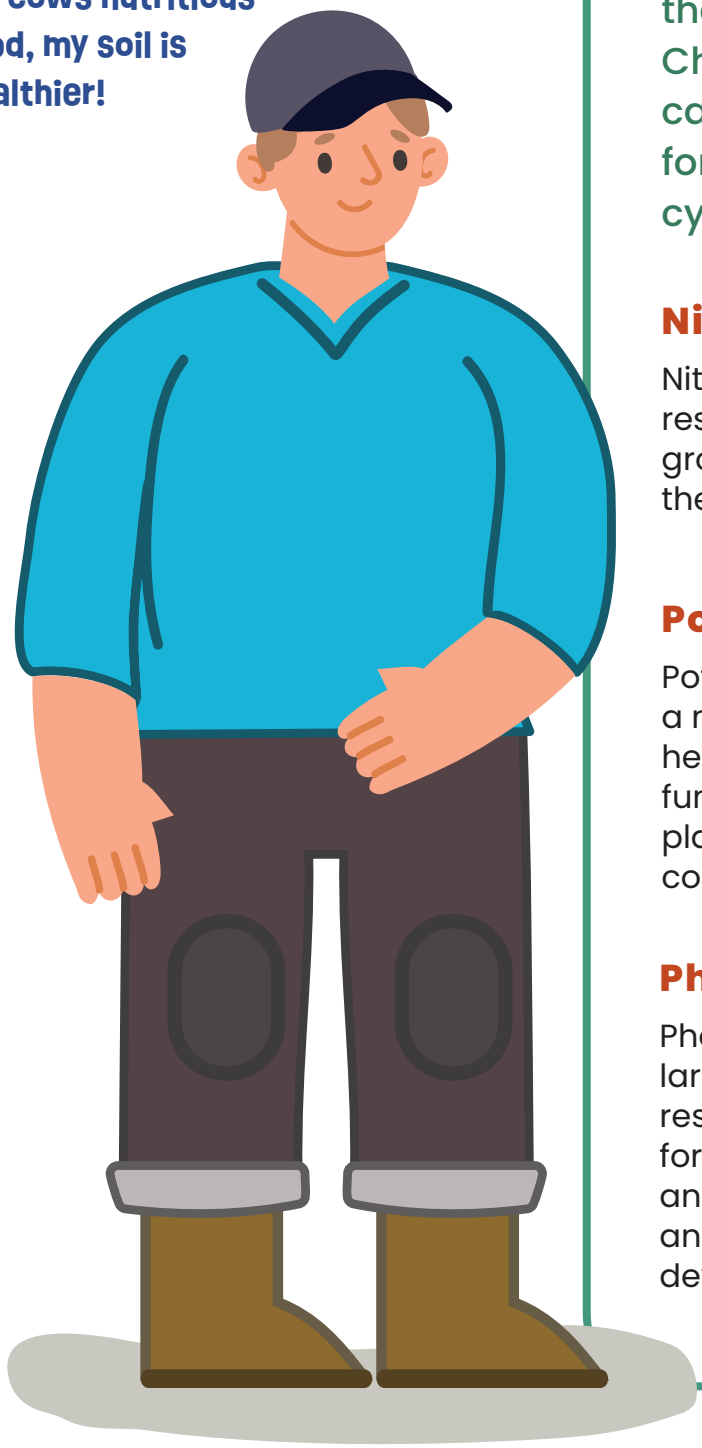
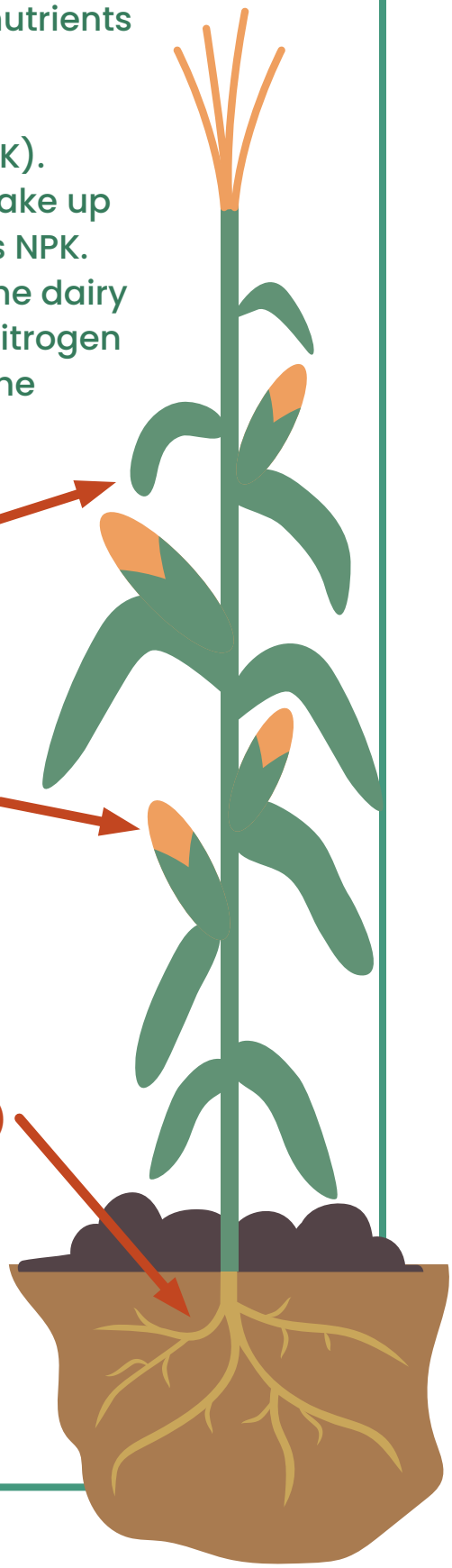
What you are probably beginning to notice is how all these parts of my job as a dairy farmer are connected to my cows and soil's health. If the cows are fed nutritious food, then the manure the cow excretes goes into the soil and gives it nutrients. Let's discover how when I feed my cows nutritious food, my soil is healthier!



Soil is a major source of nutrients needed by plants for growth. The three main nutrients are nitrogen (N), phosphorus (P) and potassium (K). Together they make up the trio known as NPK. Check out how the dairy cattle provides nitrogen for the soil with the cycle below!



Nitrogen (N)

Nitrogen is largely responsible for the growth of leaves on the plant.

Potassium (K)

Potassium is a nutrient that helps the overall functions of the plant perform correctly.

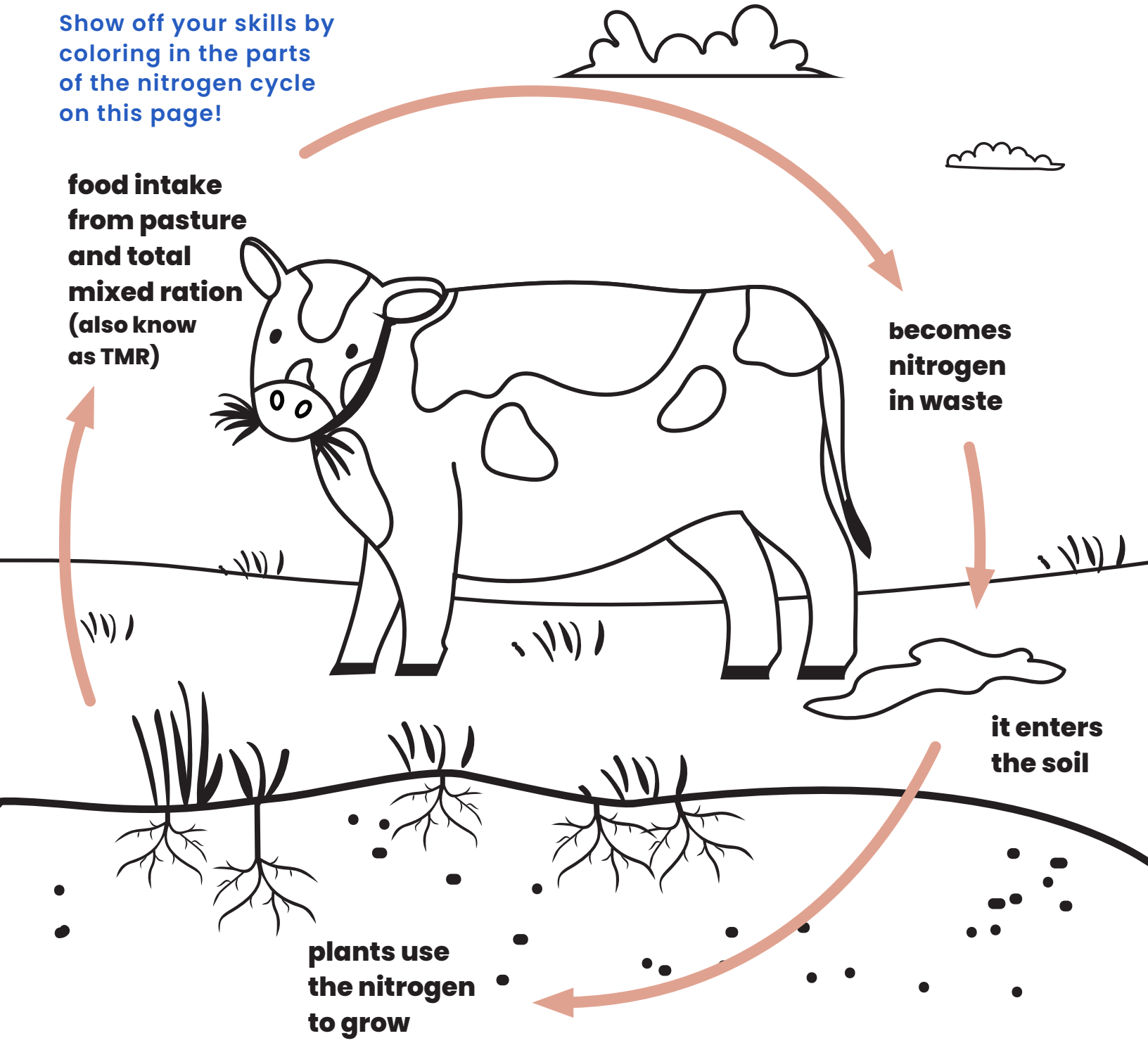
Phosphorus (P)

Phosphorus is largely responsible for root growth and flower and fruit development.

Nitrogen Cycle and Dairy Cow Ecosystem

Are you an artist?

Show off your skills by coloring in the parts of the nitrogen cycle on this page!



FAST FACT

Did you know that an estimated 33% of land worldwide is moderately to highly degraded? Soil degradation means the soil quality can't support animals and plants anymore. Dairy farmers worldwide are using regenerative soil practices to help the soil.

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Key Roles of Farmers

Farmers are innovating the future with different technologies that are used today to improve farming.

How can we do this better?

How can we feed the world and take care of our land and animals?

These are questions I ask myself everyday. New technology helps farmers answer these questions! Check out these tools that are helping farmers provide safe and affordable food.

Debunk the Code Activity

It's time for us to start looking ahead! Are you ready to learn more about new agriculture innovations? Check out the innovations that will improve the future of agriculture. Write down each underlined letter in the agricultural innovations' vocabulary words. Then unscramble them to find the mystery word!

_ _ _ _ _ _ _ _ _ _

NO-TILL F<u>A</u>RMING: A technique for growing crops or pasture without disturbing the soil through tillage.

CONSER<u>V</u>ATION <u>T</u>ILLAGE: At least 30% of plant residue is left on the field after harvest.

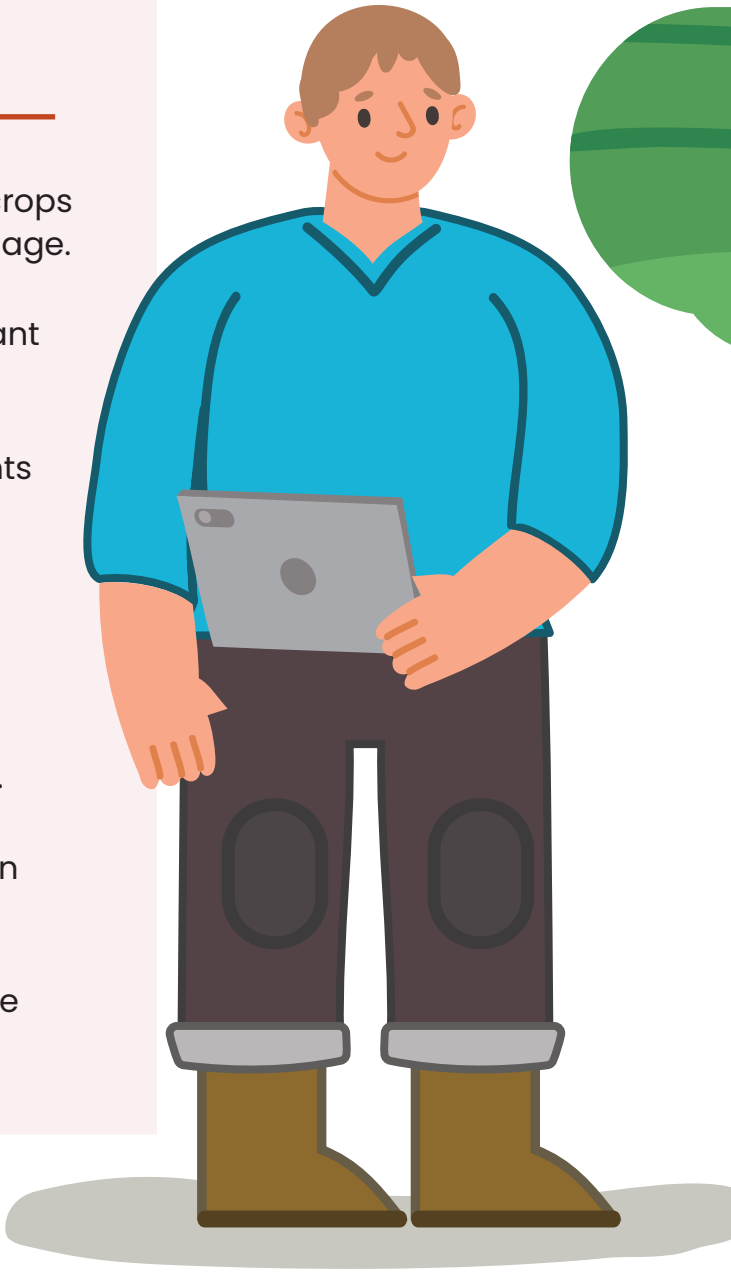
IRRIGATIO<u>N</u>: The watering of land to help plants grow.

<u>N</u>ATURAL RES<u>O</u>URCES: A natural source of wealth such as land, water, minerals, etc.

HYBR<u>I</u>DS: The result of crossing two plants or animals of different breeds, varieties, or species.

B<u>I</u>OTECHNOL<u>O</u>GY: Using technology based on biology to make lives and the planet better.

EROSIO<u>N</u>: The process in which a surface of the Earth is worn away.



Answer: innovation

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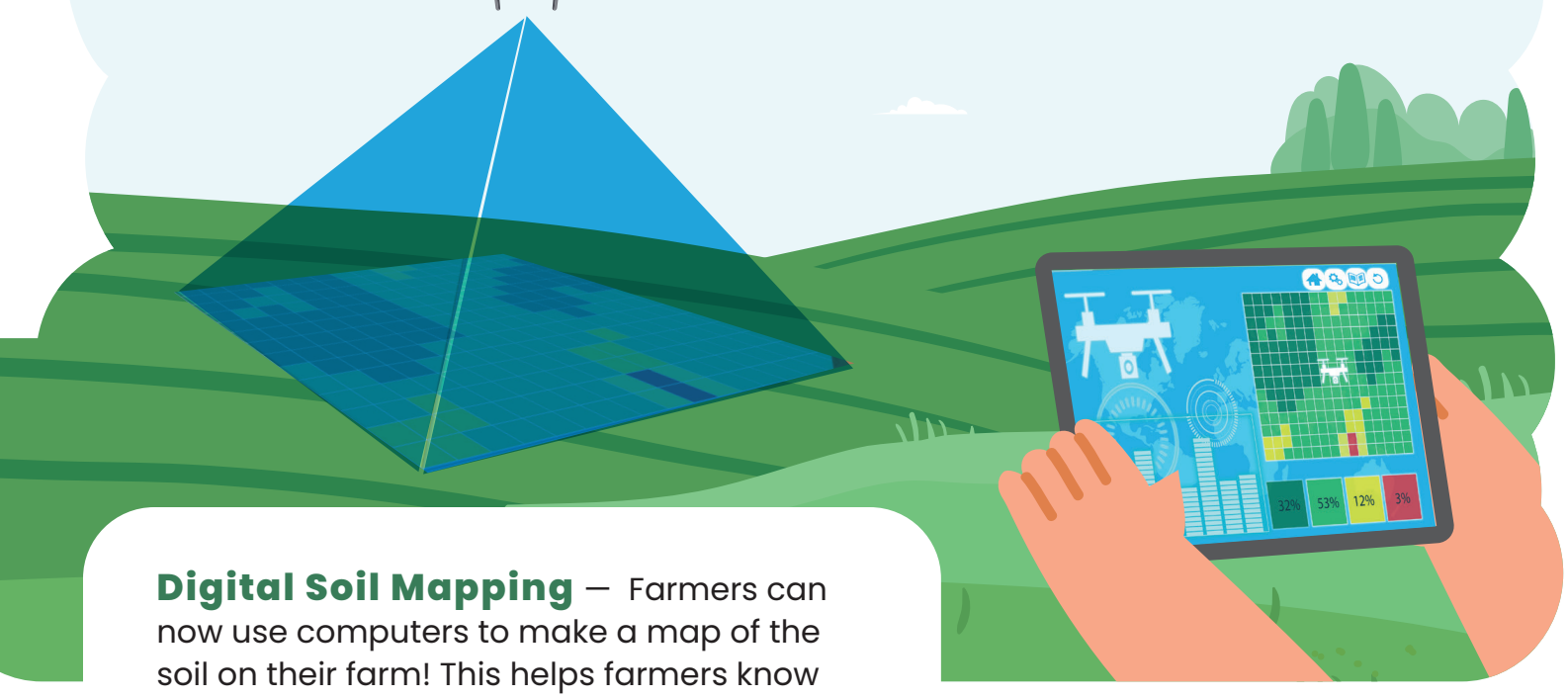
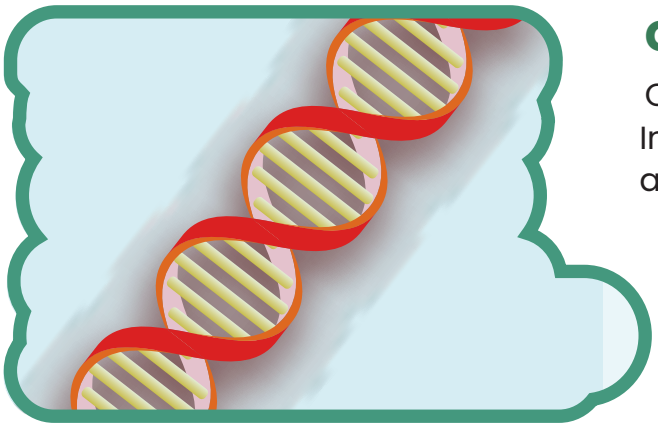
Drones — Imagine you could fly over a farm. What would you see? How could this help you? Farmers use drones to get a birds-eye view of their farm. These tiny flying robots have sensors that give the farmer helpful information about their plants and land. They can even take pictures to show how plants are growing.



Digital Soil Mapping — Farmers can now use computers to make a map of the soil on their farm! This helps farmers know important things like how much water is needed and which plants will grow best.



CRISPR

CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeat. That's a lot of words, but the science is pretty cool! This new technology helps researchers understand the genes in plants and animals. It allows them to even turn genes on and off. Researchers are working hard to find new ways to use this technology.

FAST FACT

Did you know the global population is set to pass **9 billion people by 2050?** Farmers are looking for new agricultural innovations to help meet that demand while regenerating the planet.

Generational Farming Over the Years

18th Century

Oxen and horses are used to prepare the land with wooden plows.

1854

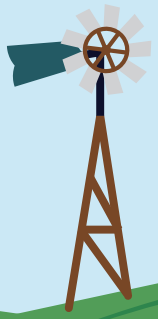
The self-governing windmill is invented.

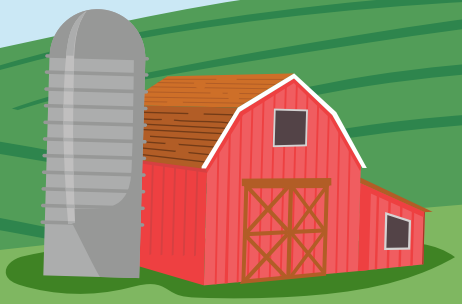
1870

The first silos are used.

1918

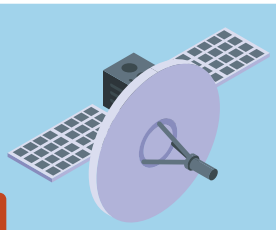
Bacteriologist Alice Evans discovered the importance of pasteurized milk.





FAST FACT

Did you know dairy farmers work hard everyday to protect soil and help animal wellbeing?



1994

Farmers begin using satellites to track and plan their farming habits.

1997

The first weed- and insect-resistant biotech crops are sold — soybeans and cotton.

2004

Agricultural robots and ag bots are tested.

2015

Federal Aviation Administration gives first permits for agricultural drones which are tiny flying robots.

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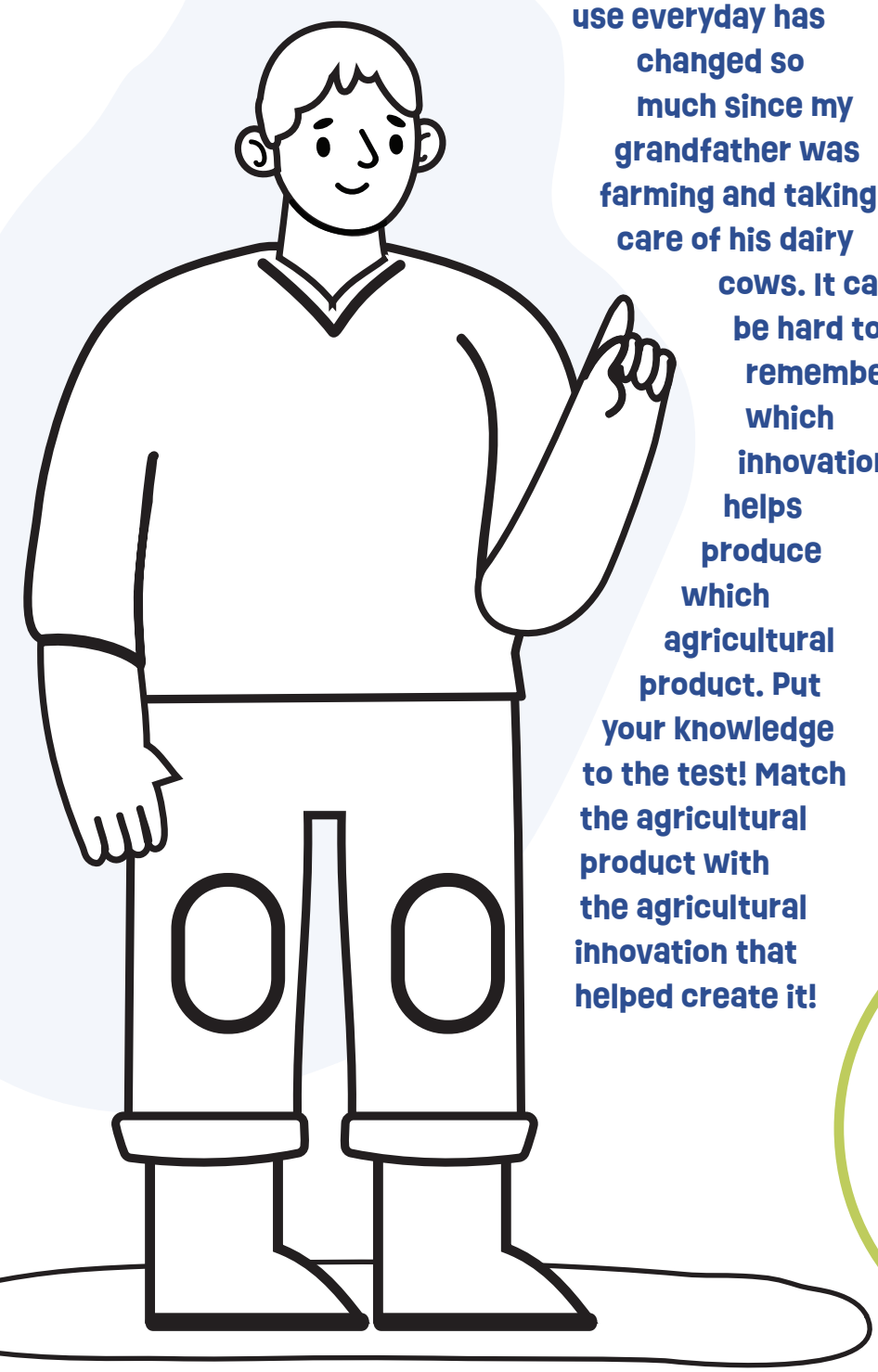
Catch the Match

Draw a line across to match the farming innovations with the correct farming commodity.



Technology that farmers use everyday has changed so much since my grandfather was farming and taking care of his dairy cows. It can be hard to remember which innovation helps produce which agricultural product. Put your knowledge to the test! Match the agricultural product with the agricultural innovation that helped create it!

yogurt

corn silage

milk

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carousel parlor

filling machine

forage harvester

A carousel parlor is like a carousel ride for dairy cows! The milking stalls are arranged in a large circle. Dairy cows walk in to a stall and the platform begins rotating slowly. By the time the carousel has gone a full lap the milking is finished!

1.Yogurt/Carousel Parlor, 2.Corn Silage/Forage Harvester, 3.Milk/Filling Machine

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