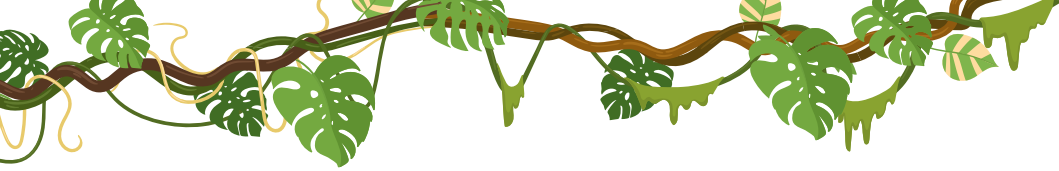


**FIRST[®]
LEGO[®]
LEAGUE**

EXPLORE

ENGINEERING NOTEBOOK





***FIRST*® LEGO® League** **Global Sponsors**

The LEGO Foundation 



Welcome

Team Name:

Think of a team
name for the
BIOGLOW™
season!



Team Members:

1.

.....

2.

.....

3.

.....

4.

.....

5.

.....

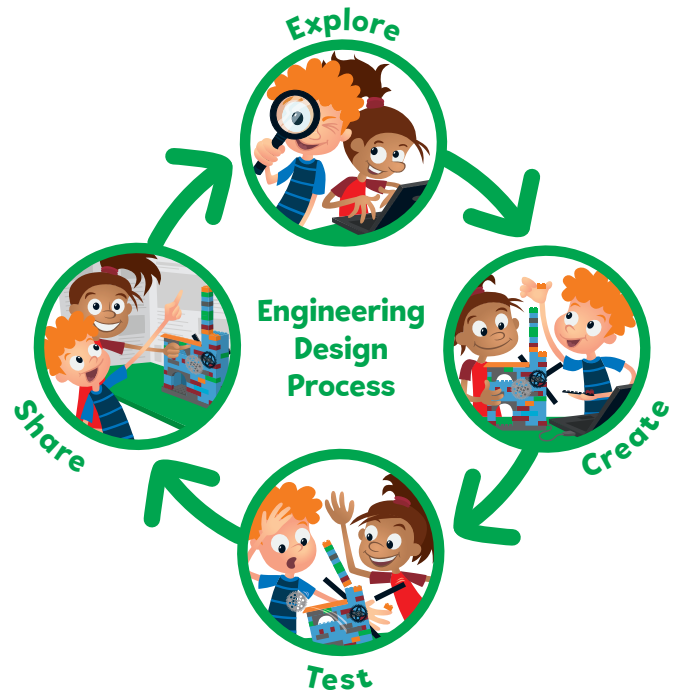
6.

.....

Earth is full of many different plants and animals. All living things work together to help our planet stay healthy. This is **biodiversity**.

This season, you will explore the rainforest, build creatures, and discover how plants and animals support healthy **ecosystems**. You'll use building, coding, and teamwork to create a treehouse and set up a research station just like scientists in the real world. Nature can give us great ideas to make the world a better place.

Use your LEGO® Education SPIKE™ Essential set to develop your coding skills, create awesome models, and share what you learned on your team poster at the festival!



Explore Story



What jobs work in the rainforest?

Learn about more jobs and technology related to rainforest biodiversity on pages 28-29.



Wildlife Biologist

A wildlife biologist studies animals in the rainforest to learn how they live and what they need to survive. They help protect animals by finding ways to keep their homes safe. They use **tools like cameras and trackers** to safely watch animals in their habitats.



Conservation Scientist

A conservation scientist helps take care of the rainforest and the animals that live there. They find ways to protect nature and fix places that have been damaged. They use **maps and computer tools** to plan how to protect nature and fix damaged areas.

Learning about the rainforest can help us take care of it. Scientists might want to know:

- What animals live there?
- What kinds of plants grow there?
- What do plants and animals need to be healthy?
- What tools or technology are needed to learn more?
- How do the animals and plants interact with each other?



Team Progress

Come back to these pages throughout your season to update your team's goals and your own and to share your progress.

START HERE!

My goals for this season are. . .

HALFWAY THERE!

So far, I have learned. . .
I want to learn more about. . .

What has been
the most surprising thing
you have learned?

What is your
favorite feature of
your team model?

I am proud of my team because we. . .
I am proud of myself because I. . .

FESTIVAL TIME!

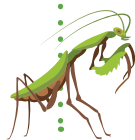


Core Values

Draw or write an example of your team using each of the *FIRST*® Core Values.

Discovery

How does your team explore new skills and ideas?



Inclusion

How does your team respect each other and embrace your differences?



Innovation

How does your team use creativity and persistence to solve problems?

Teamwork

How is your team stronger when you work together?

Impact

How does your team apply what you learn to improve your world?



Fun

How does your team celebrate and enjoy what you do?



Session 1

Your team needs:

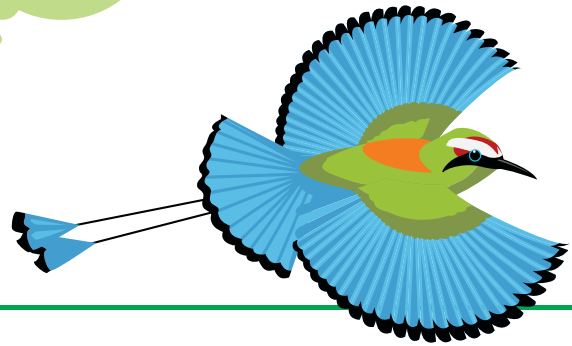
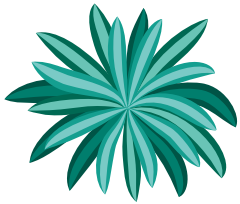


→ Activity 1 Tasks

- ☐ Look at the Explore story on page 4. Look closely at each picture and think about what the characters/animals might be thinking or doing.
- ☐ Share what you know about the rainforest and biodiversity with your team.
- ☐ Write or draw what your team shared.
- ☐ List your team goals on page 6.

What words do you know that relate to the rainforest?

What happened in the Explore story?



Rainforests have many kinds of plants and animals.



Your team needs:



Canopy Connections

→ Activity 2 Tasks

- ☐ Build the tree model from the Explore Set using Book 1 and Bags 1-3.
- ☐ Talk to your team about the different layers of the tree you built. What animals live on the forest floor? What animals live in the canopy?

→ Challenge

- ☐ Change the tree model by moving the leaves to new places.
- ☐ Draw or describe the animals you talked about with your team.

What kinds of animals live in trees?



🌿 Look at the layers of the rainforest on page 30.

🌿 Trees in the rainforest can grow tall and form a canopy.

Session 2

Your team needs:



→ Activity 1 Tasks

- ☐ Use Book 2 and Bags 4-6 to build the animals in the Explore Set.
- ☐ Talk to your team about the animals you built. Can you describe them? What makes them different from each other?
- ☐ Talk to your team about where these animals live in the rainforest.
- ☐ Label the parts of the animals below.

Tip

Many rainforest animals have colors or patterns that help them hide in plants and trees. This is called camouflage.

**Add labels to the different animal parts.
Do they have wings? Eyes? Legs? What else?**



Your team needs:



How can you change the animals you built?

Tip

Many frogs have bright colors that warn other animals to stay away.

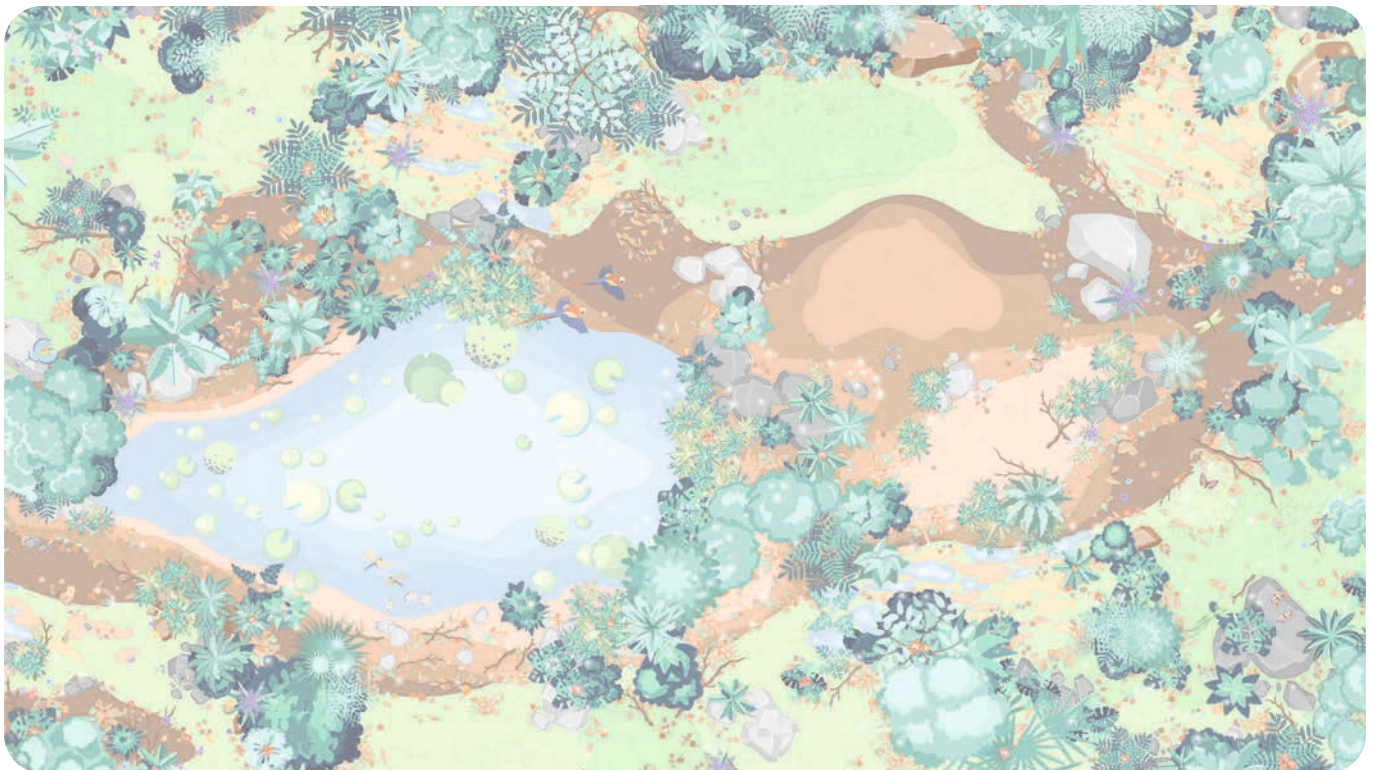
Creature Creators

→ Activity 2 Tasks

- ☐ Place the Explore mat on a flat surface.
- ☐ Look at the mat and decide with your team where each of the animals might live.
- ☐ Tell a story with your team about one of the animals.

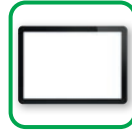
→ Challenge

- ☐ Change one of the animals you built by swapping its pieces with other animals' pieces.
- ☐ Think about where this new kind of animal would live on the mat.
- ☐ Tell a story about the new kind of animal you created. What would you call this animal? What does it like to eat? How does it move? Is it friendly to other animals?
- ☐ Label the mat to show where this animal would live.



Session 3

Your team needs:



→ Activity 1 Tasks

- ☐ Open the SPIKE app on your team's device.
- ☐ Complete Coding Lesson 1 in the *FIRST*® LEGO® League Explore Unit – **Animal Alarm**.
- ☐ Change the program so the color changes when one of the animals from the Explore Set moves in front of the sensor.
- ☐ Write your ideas below.

Write your program here:

Tip

Scientists can learn which animals live nearby by listening to their sounds.

Your team needs:



What animal sounds
could you hear in
the rainforest?

Animal Alarm

→ Activity 2 Tasks

- ☐ Try the other sound blocks for the Animal Alarm.
- ☐ Record a new animal sound using the microphone icon.
- ☐ Change the program so your new sound plays when the animal moves by the sensor.

→ Challenge

- ☐ Create a sound for each new animal you built.
- ☐ Place the Animal Alarm and the animals you built on the mat.
- ☐ Change the program so the model will play a sound when the animal is detected by the sensor.
- ☐ Tell a story about the new animal. Why does it make that sound?

Check your program here:

Session 4

Your team needs:



→ Activity 1 Tasks

- ☐ Open the SPIKE app on your team's device.
- ☐ Complete Coding Lesson 2 in the *FIRST LEGO League Explore* Unit – **Treehouse Camp**.
- ☐ Change the program so the treehouse roof can open slowly.
- ☐ Talk with your team about how this model could help a scientist in the rainforest.
- ☐ Write your ideas below.

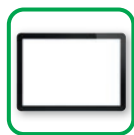


A scientist could use the treehouse to:

Tip

Some people travel to the rainforest to study animals and plants where they live.

Your team needs:



Treehouse Camp

→ Activity 2 Tasks

- ☐ Use the SPIKE Essential set to change the Treehouse Camp model so that it can blend into the rainforest.
- ☐ Place the model on the Explore Mat.

→ Challenge

- ☐ Change the program so the model will open for 5 seconds and then close for 5 seconds.
- ☐ Make the program repeat two or three times.
- ☐ Share what you built and explain how you coded the model.

Check your program here:

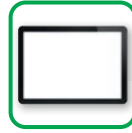


🌿 Scientists must be patient and quiet to watch animals safely.

🌿 To learn more about motors, try the Arctic Ride lesson in the SPIKE app.

Session 5

Your team needs:



→ Activity 1 Tasks

- ☐ Use the building instructions in Book 2 and Bag 7 to build the lifting platform.
Add a scientist to the platform.
- ☐ Open the SPIKE app on your team's device.
- ☐ Try the program provided in the box below to activate the lift and raise the scientist.
- ☐ Talk with your team about how this model could help a scientist in the rainforest.
- ☐ Write your ideas below.



A scientist could use this model to:

Sample Code



Tip

Discoveries made by scientists can protect the rainforest and its animals.

Your team needs:



Science Helpers

→ Activity 2 Tasks

- ☐ Find or rebuild the tree model from Session 1.
- ☐ Change the lifting platform so that it can be used in the rainforest.

→ Challenge

- ☐ Place the tree model and lifting platform on the mat.
- ☐ Add two scientists to the platform.
- ☐ Decide with your team what the scientists want to research in the tree.
- ☐ Change the program for your lifting platform so it can raise and lower the scientists safely.
- ☐ Share what you built and explain how you coded the model.

Write your program here:

Tip

Scientists often work in teams to share their knowledge and skills.

Session 6

→ Activity 1 Tasks

- ☐ Talk to your team about tools used to study the rainforest. What tools are needed for animal observation? What tools are used to document or study plants?
- ☐ Write your ideas below.
- ☐ Select a tool to build with your team.
- ☐ Use the prototyping pieces in Bag 9-13 to create a tool used in the rainforest.
- ☐ Put the tool on the mat.

Your team needs:



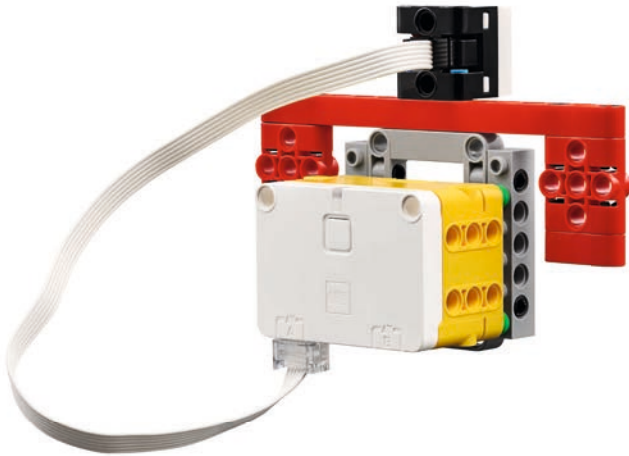
What tools do scientists use to study animals?



Tools used to study animals in the rainforest are:



Your team needs:



Research Tools

→ Activity 2 Tasks

- ☐ Use the building instructions in Book 2 and bag 8 to build the research device.
- ☐ Open the SPIKE app on your team's device.
- ☐ Try the program provided in the box below to activate the research device.
- ☐ Take turns moving the research device to different places on the mat. What does it do?

→ Challenge

- ☐ Change the program for the research device so it is activated by a different color. What does it do when used on the animals you built?
- ☐ Write your ideas below.

Write your program here:

Sample Code



🌿 Scientists use notebooks, cameras, and listening tools to learn without hurting nature.

🌿 Look at the jobs on pages 5, 28, and 29 to see what tools and technology are used to learn about the rainforest.

Session 7

Your team needs:



→ Activity 1 Tasks

- ☐ Read about the jobs on page 5, 28 and 29.
- ☐ Design a treehouse where a wildlife biologist can safely watch animals.
- ☐ Choose an animal to study. What tools does the scientist need?
- ☐ Write or draw your ideas below.
- ☐ Use the prototyping pieces to build the treehouse your team designed.



My ideas:

Tip

A research station high up in a rainforest could help people study animals and plants that live in the treetops.

Your team needs:



Tip

Nature is always changing. Scientists study biodiversity to learn about those changes and help keep rainforests and other ecosystems healthy.

Dream Treehouse

→ Activity 2 Tasks

- ☐ Talk about the tools you learned used to study animals.
- ☐ Record your ideas below.
- ☐ Use the prototyping pieces to build a tool or technology for the treehouse.

→ Challenge

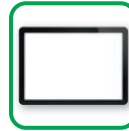
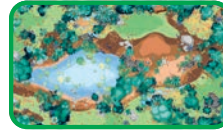
- ☐ Add a plant scientist, or botanist, to the treehouse.
- ☐ Change the treehouse so that it has tools to study plants.
- ☐ Share what you built with your team.

My ideas:



Session 8

Your team needs:



→ Activity 1 Tasks

- ☐ Talk to your team about what you have learned about biodiversity.
- ☐ Check the team model requirements on the next page.
- ☐ Draw your ideas for your team model below. Label the different parts.

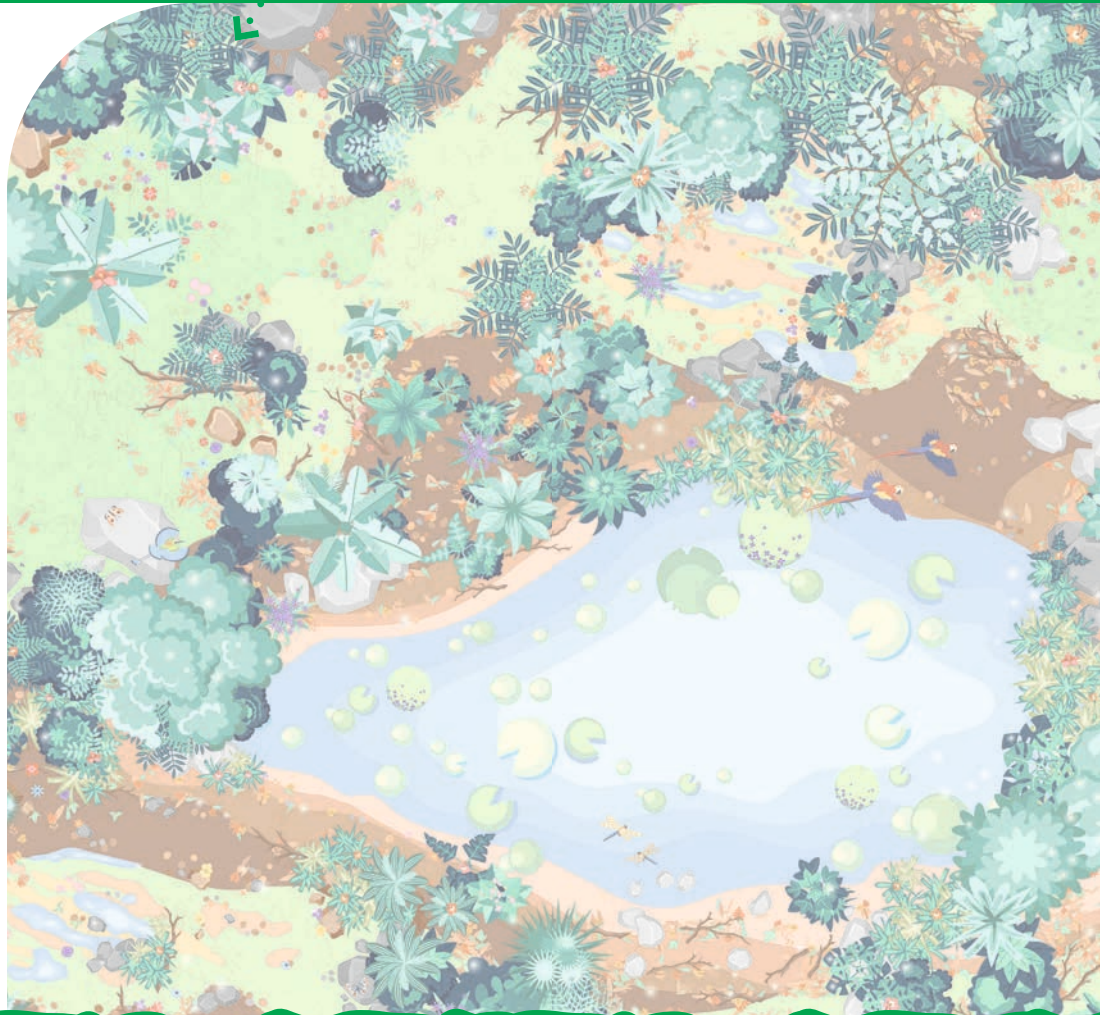
→ Activity 2 Tasks

- ☐ Create your team model together on the Explore mat.
- ☐ Talk about the different parts of your model.

Tip

It's time to build your team model! Your team model will be presented to reviewers at the festival.

Draw and label your team model:



Team Model

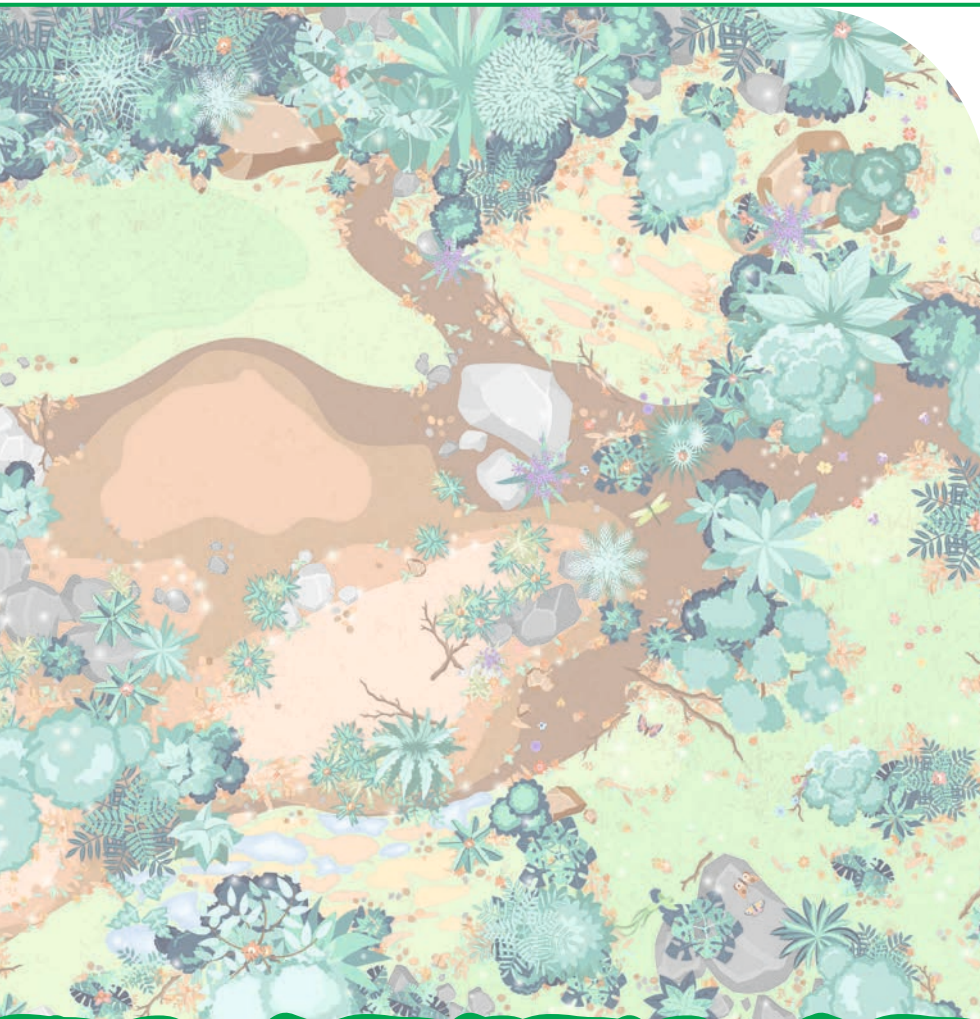
Requirements

- ☐ Include all parts of the Explore Set and mat.



- ☐ Use only LEGO® elements.

- ☐ Use SPIKE Essential to motorize any part of your model.



Feature the following on your team model:

- ☐ A plant or animal that your team designed
- ☐ A job related to the rainforest
- ☐ A tool or piece of technology used to study biodiversity

Session 9

Your team needs:



→ Activity 1 Tasks

- ☐ Talk to your team about what you will include on your team poster.
- ☐ Use the next page to write your ideas.

→ Activity 2 Tasks

- ☐ Decide how your team will create the poster and determine what supplies you will need.
- ☐ Gather your poster board and supplies.
- ☐ Create your team poster. The whole team should help create it.

Your team poster should describe your team's journey throughout the sessions.



Team Poster

Include these items on your team poster:

- ☐ How you worked together as a team
- ☐ What you learned about biodiversity
- ☐ What you built as your team model
- ☐ Anything else you want to share!



In the next session,
you will prepare for the
Explore Festival. You should
have your team model and
team poster completed.



Session 10

→ Activity Tasks

- ☐ Gather your completed team model and team poster.
- ☐ Talk about how your team will share what you learned with the reviewers.
- ☐ Complete the next page.



Sample Festival Roles



Prepare for Your Event

What I Will Share with Reviewers

- Can you describe your team model?
- Explain how your team used innovation and creativity to explore biodiversity.

- What did you learn about the season theme?
- How did you use Core Values?

- What part of your team model is motorized?
- How did you code your motorized part?

- What did you include in your team poster?
- How does the poster show your team journey?

Let's celebrate
how well your team
worked together! It is
much more fun when
everyone on the team
is included.



Jobs and Technology



Botanist

A botanist studies plants, trees, and flowers in the rainforest. They help make sure plants stay healthy so animals and people can use them. They use magnifying tools and computers to look closely at plants and record what they see.



Environmental Scientist

An environmental scientist studies air, water, soil, plants, and animals in the rainforest. They use water testing tools to check water in rivers and streams to make sure it is clean for animals. They might also use air and soil sensors to understand how nature changes and how to keep it healthy.

Exploration Questions

Look at the jobs on these pages. Pick a job, learn about it, and discuss these questions with your team.

- What are some of this job's daily tasks?
- What education or training is required?
- What makes this job exciting?
- What kind of tools or technology are used?

Jobs and Technology



Ecologist

An ecologist studies how plants, animals, and the environment work together in the rainforest. They look for patterns to know what happens when one plant or animal is missing. They use charts and data tools to study how living things depend on each other.



Forestry Technician

A forestry technician helps care for rainforest trees and plants. They help plant new trees to replace ones that were cut down or damaged by storms. They use measuring tools and GPS devices to check tree growth and track how a forest grows or decreases in size.

Other Jobs Related to Biodiversity

- Zoologist
- Park Ranger
- Entomologist
- Wildlife Photographer



The Layers of the Rainforest

Emergent Layer

This is where the tallest trees reach way up into the sky! Birds and some monkeys live here.



Canopy Layer

This layer is like a big green roof made of trees. Many animals, like sloths and parrots, live here.



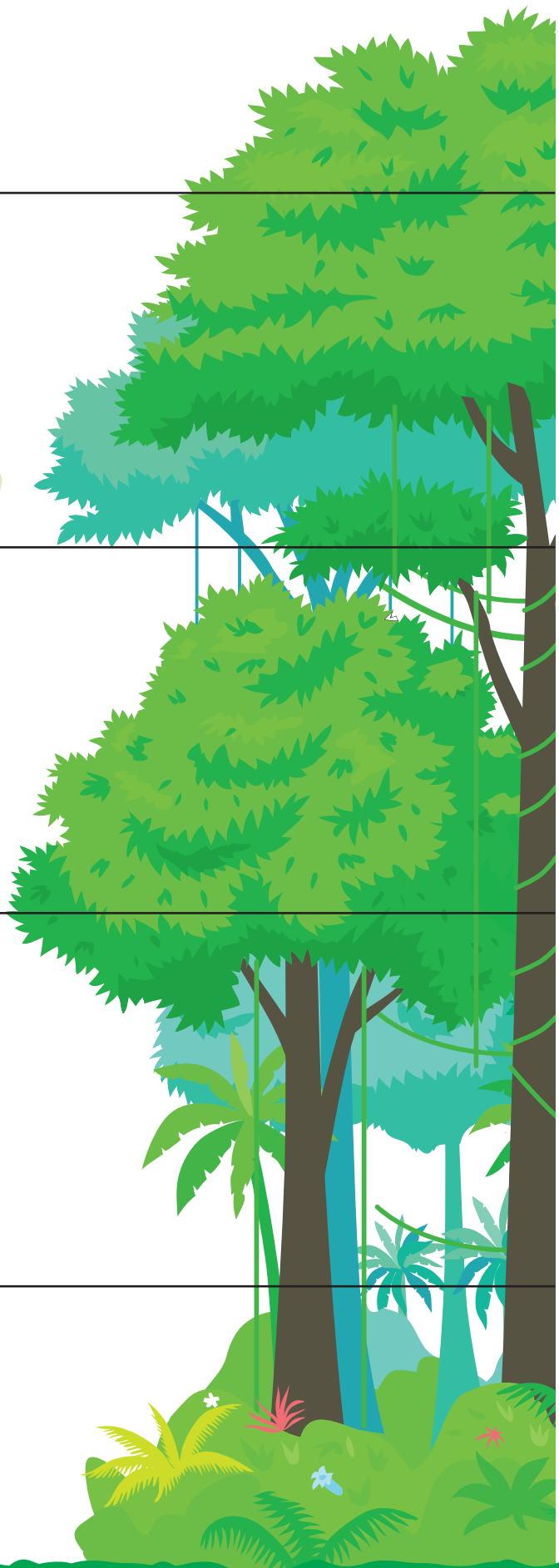
Understory Layer

It's darker and cooler under the shade of the canopy. Snakes, frogs, and jaguars hide here.

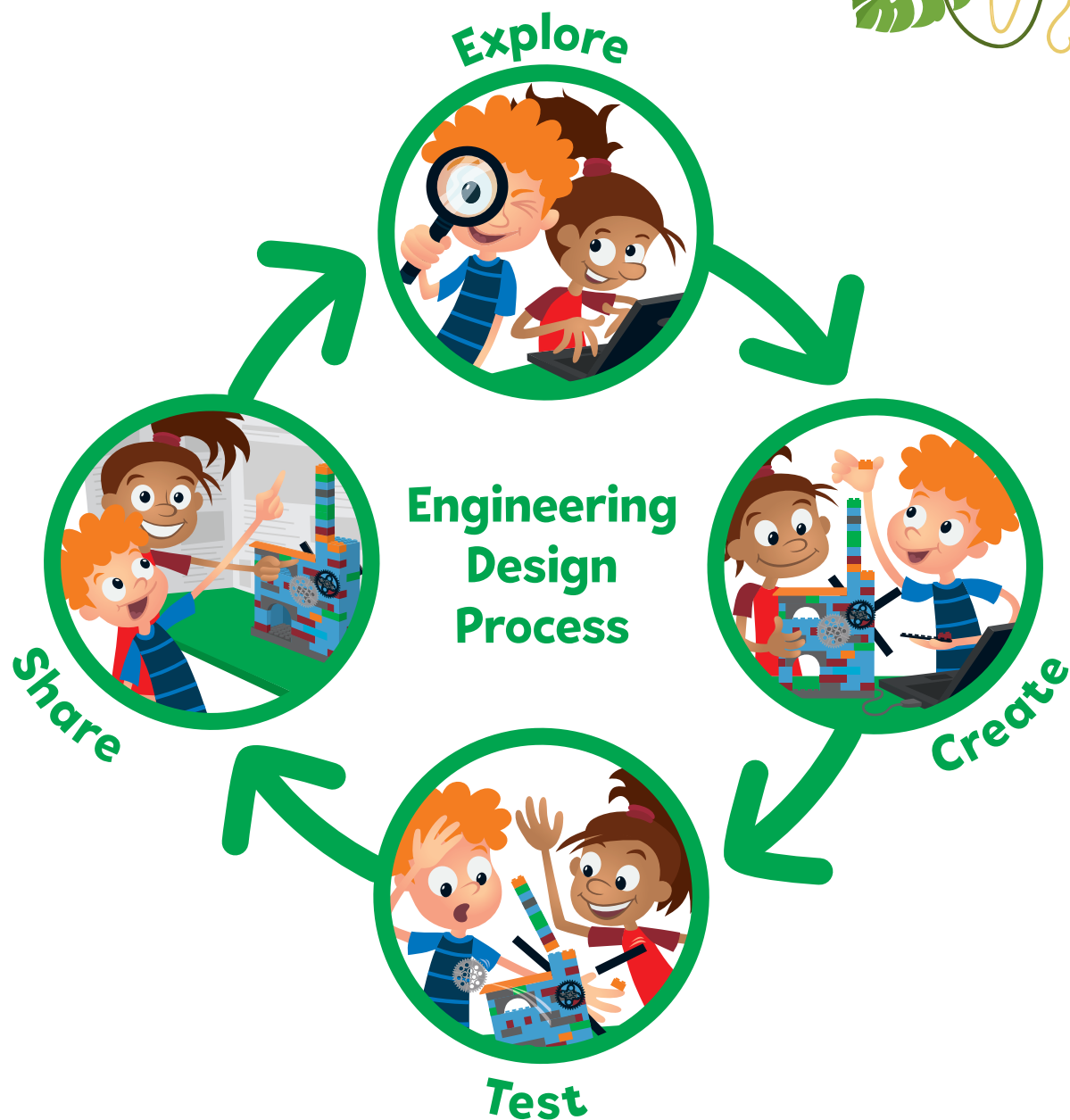


Forest Floor

The ground of the rainforest is usually very dark and damp. Big animals like tigers and elephants could live here. Plants on the forest floor grow slowly without much sunlight.







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