This Investigation Guide aims to present some suggestions for activities to promote science education during the A/B-weeks. These activities can be integrated into the A-week lessons if teachers choose, or children can simply use them on their own during B-weeks. Below are suggestions for integrating activities Prior, During and After student investigations.

STAGES	DESCRIPTION
Entry	Engage your students into the topic by gathering their initial ideas on the topic and asking guiding questions.
Extension	Depending on students' ideas, possible guiding questions are included.
Further	Depending on students' ideas, possible next investigations are included.
General	Include something fun and memorable to trigger students' interest in the topic.

→ Relation between stage and level of difficulty: **Entry** should be used as an initiation to the topic; **Extension** as a way to consolidate with a question that links the topic to content; and **Further** implies a deepening of content and ideas for students to pursue through further investigations.

PRIOR STAGE: PREPARATION IN THE CLASS

STEP 1 – WHOLE GROUP BRAINSTORMING		
INTRODUCING THE TOPIC		
Stages	**Description**	**Suggestions**
Entry	Engage your students into the topic of trees by gathering their initial ideas on the topic and asking guiding questions.	• Trees: Where have you seen trees? Are trees everywhere? How would you describe a tree? • Leaves: What do you know about tree leaves? Do all trees have leaves? • Forests: Have you ever been in the forest? How would you describe the forest? Can you describe how it looks? How it sounds? How it smells?
Extension	Depending on students' ideas, it is possible to add an extension question.	• Trees: Are they always brown and green? What are trees used for? How are trees similar and different? • Leaves: Do only trees have leave? • Forests: What is special about the forest? Do all forests look the same? How might they be different?
Further	Ask questions that can serve to further guide discussion, depending on students' ideas.	• Trees: Did you know trees can communicate to each other in a forest? • Leaves: What purposes do you think leaves have?

		• Forests: How can you tell the difference between a forest and a plantation (like farming)?
General	Include something fun and memorable to trigger interest in the topic.	• Trees: What words come to mind when you think about trees? How do trees make you feel?

STEP 2 – VISITING A TREE

EXPLORING TO THE TOPIC

If possible, take the children outside to look at a tree.

If the tree allows social distancing, the students can take paper and pencil and make observations and drawings or get down under the tree and outline the branches and leaves and shadows. Back in the classroom, they can show their work and compare.

STEP 3 – INTRODUCE THE WEEK B ACTIVITIES

Explain to children that the topic of trees will be the focus of scientific investigations that they will be doing independently during week B, and clarify the particular expectations for completion within the weekly plan. Be sure to let children know if there will be the opportunity for follow-up activities and discussion when they return to the school in the next week A so that there can be group connections made after the investigations have been completed individually.

→ If you want to have an interesting experiment to show to children in the classroom, you can use the "Leaf skeleton" activity. One suggestion is to start the experiment at the end of one week A, leave it for at least one B week and conclude during the second week A.

USEFUL RESOURCES FOR THE PREPARATION STEPS

USEFUL LINKS

Connections can be made to forest habitats that are near the school, and photos can be used to make comparisons and observations. Science.lu has numerous further extensions for discovering trees, for example:

- Investigations with Mr.Science about whether young or old forests produce more oxygen: https://science.lu/de/natur-wald/welcher-wald-produziert-mehr-sauerstoff-ein-junger-oder-ein-alter-wald
- Die Sendung mit der Maus has a series on Baumschulen: https://www.wdrmaus.de/filme/sachgeschichten/baumschule_teil1.php5

TREES/LEAVES INVESTIGATION: WEEK PLAN

TASKS AND EXPERIMENTS							
ACTIVITY	**TIMING**	**TYPE**	**MON**	**TUES**	**WEDN**	**THUR**	**FRI**
TREE JOURNAL	**EVERYDAY** **10-20 minutes**	**Observation and data collection**					
IDENTIFYING TREES	**3 DAYS** **(approx. 15 min. each)** **1 DAY** **(approx. 40 minutes)**	**Observation and classification**					
LEAF BREATH	**1 DAY** **SET: approx. 5 min.** **OBSERV: 12h later**	**Experiment**					
WATER LEAF	**3-5 DAYS** **5-10 minutes**	**Experiment**					
BARK	**EVERYDAY** **5-10 minutes**	**Observation**					

ANY OTHER IDEAS?

AFTER STAGE: SUGGESTIONS FOR WHEN CHILDREN COME BACK TO SCHOOL

STEP 1 – WHOLE GROUP BRAINSTORMING	
CONCLUSIONS ON THE TOPIC	
WHAT TO DO	**HOW TO DO IT**
Share tree presentations	Each child presents their tree to the class, focusing on the unique aspects that make their tree special and new things that they observed which they had not thought about before. This can be enhanced with photos and videos that can be projected. These can be sent via email prior in order to project them in the classroom during discussion.
Create leaf rubbings	Connect to the leaf rubbing component of the tree journal while also integrating art and science. Students can bring leaves to school and use leaf rubbings to document the shape and forum of leaves. An extension is to do a similar activity with aluminum foil and gently using the side of a pencil, creating a leaf-relief.
Exchange creative writing pieces	If your students made tree journals that included creative writing pieces, ask students to share by reading aloud. Encourage discussion and ensure understanding that a tree is a resource for many different living beings.
Brainstorm creative uses for trees	People have been using trees for a variety of purposes for centuries, including bark, leaves, branches, trunk, and roots. Assign children one of these parts of a tree and challenge them to invent a creative use.

USEFUL RESOURCES
USEFUL LINKS
The following tools are also provided to students for guiding their tree investigations: ● Centre de Jeunesse Hollenfels offers a PDF dichotomous key for local trees and shrubs: https://hollenfels.snj.lu/sites/default/files/publications/Bestimmungsschlussel_Hollenfels_13.06._petit.pdf ● Baumkunde is a Baumschule in Germany that offers an online identification tool for trees: https://www.baumkunde.de/baumbestimmung/
POSSIBLE EXTENSION TOPICS
Connections can be made to forest habitats that are near the school, and photos can be used to make comparisons and observations. Science.lu has numerous further extensions for discovering trees, for example: ● Sacred trees through history ● Mistletoe in Luxembourg's trees and druids ● Research the history behind why scientific names are in Latin

LEAF SKELETONS

You will need:
Leaves (different types)
Glass plate
Water
Paintbrush (small)

What to do:

1. Clean the leaves passing them through water;
2. Place the leaves in a glass plate;
3. Change the water every two days for two weeks (teacher's task);
4. On the 15th day:
   a. drain the leaves and put some water back on the plate;
   b. rub gently your finger on the leaf in order to take off the "green";
   c. use the paintbrush to help clear the skeleton.

TIPS:

- If you want faster results, on the day you have to change the water, take each leaf out of the plate, change the water and gently place each leaf back in. "Massage" leaf by passing your fingers over it as you submerge the leaf.
- If you want the leaf skeleton to dry faster, leave it on the sun for a few minutes.

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LEAF SKELETONS

BEFORE THE INVESTIGATION

Write down your prediction.	Draw your diagram showing what you expect as results.

LEAF SKELETONS

AFTER THE INVESTIGATION

Write down your observations.	Use a skeleton and a crayon to make a print by placing the skeleton under this sheet.

TREE JOURNAL

You will need:	Pen, pencil, markers Tree observation grid	A tree of your choice

What to do: The goal for this activity is to create a guide to this tree by documenting various characteristics that make your tree unique, and also those that help identify the type of tree.

TIPS:

- Choose a tree that you can observe every day for this week, ideally at the same time. This should be a tree that you can walk up to and touch, but if this is not possible, you can also choose a tree that you can observe from afar.
- Create a new page for your tree journal each day, in which you focus on a different aspect of the tree. The tree observation grid will help you.
- Document your observations about what makes your tree special in writing, drawing, photos, and any other creative way you can think of!

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TREE JOURNAL

Day 1: Get to know your tree today!

Walk all the way around it if you can, looking up and down and all around it. Introduce your tree in this first journal entry by describing its shape. Note things you observe, such as: does it have leaves or needles? Is it tall or small in comparison to things around it? Draw a picture of your tree, focusing especially on the overall form, and if possible, include a photo.

My tree...

Drawing of my tree

TREE JOURNAL

Day 2: Have a closer look at the bark of the tree, what do you notice?
Is it all the same color, or do you notice any differences? Touch the bark, how does it feel? Is it all the same, or do you notice differences in the bark? Add a page to your tree journal that includes a description of the bark, a sketch, and a photo if possible.

The bark of my tree...

Drawing of the bark

TREE JOURNAL

Day 3: Examine the leaves of your tree today.

Look closely at the leaves on your tree and describe the leaves. Some questions that can help your descriptions include: What shape are the leaves? How are they attached to the tree? Are there only leaves or also blossoms on your tree? If you can, take a leaf from the tree and look very closely (this can be either one from the tree or one that is on the ground). Are there patterns in the leaves? Do you see lines in the leaf? Do you notice any specific details about the leaf, for example, does it have bumps or hairs or holes? Trace the leaf in your journal if you can and use the outline to make a sketch of the leaf. Enhance the journal entry with a photo and / or a leaf rubbing! To make a leaf rubbing, place the leaf under the paper, and slowly rub the paper with a crayon held sidewise. The rubbing should reveal the shape and texture of the leaf.

Make the sketch of the leaf on one part of the paper. Rub the leaf on the other part!

TREE JOURNAL

Day 4: Looking for roots and shoots.

Today you are going to have a close look to your tree's body and to the roots that keep it attached to the soil. What are they like? Are there any shoots? In which ways are they similar? In which ways are they different? Can you see your tree's roots? How do the roots compare to other trees around it? What else do you see? Describe what you have observed about your tree and make a drawing of what you have described.

As well as leaves, my tree has...

Drawing of

TREE JOURNAL

Day 5: Close your tree journal with a creative writing piece.

In this piece you will write about this past week from the perspective of the tree, or you can take the perspective of another living being that is connected to the tree (for example, a bird using it for food and shelter, or a human using it for leisure or building purposes). Write about the interactions with other living things and Include in your narrative the trees' needs and other noticeable characteristics, and be as creative as you can!

IDENTIFYING TREES

Now that you have spent some time getting to know your tree, it's time to give it a name! In fact, your tree will hopefully have **three names** by the end of this activity. Did you know that plant and animal species all have scientific names in Latin? This is because Latin used to be the most common language spoken by scientists, and the tradition of scientific names being in Latin has continued. These are combined with names that are in different languages as well, and today you will try discover both the Latin and German names for your tree. And once you have done that, you will also create a unique name for your tree!

You will need:
Your tree journal
Pen, pencil, crayon
Access to one of the below dichotomous keys

What to do:
Your challenge is to see if you can discover the Latin name of your tree, as well as the commonly used German name. How can you do that?

TIPS:

- Use the data you have collected about your tree to try to identify the species, including its shape, leaves, bark, and any flowers or buds. There are several types of guides that can help:
  - Centre de Jeunesse Hollenfels offers a PDF dichotomous key for local trees and shrubs: https://hollenfels.snj.lu/sites/default/files/publications/Bestimmungsschlussel_Hollenfels_13.06._petit.pdf
  - Baumkunde is a Baumschule in Germany that offers an online identification tool for trees: https://www.baumkunde.de/baumbestimmung/
- Once you have possibly identified your tree and discovered the Latin and German names for it, it is time to give the tree a name that captures its uniqueness! Use the descriptions you have documented in your journal, and reflect upon what makes your tree special. Try to think of a creative name that "fits" your tree well!

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LEAF BREATH

You will need:	Leaf	Rock
	Water	Pen, pencil, crayon
	Bowl and glass	Straw

What to do:

You may have heard the saying that trees are important because they produce oxygen. One of the contributions of trees is that they convert carbon dioxide to oxygen, in a complex process called photosynthesis. Plants also breathe, and in this process they do exactly the opposite, meaning they absorb oxygen and produce carbon dioxide. Have you ever wondered how this works? Although you cannot hear them breathing, nor can you see them photosynthesizing, you can carry out an experiment to try to observe the gas exchange!

TIPS:

- If you can reach one, take a leaf from your tree one morning. (Do not take one from the ground, because this investigation works best with "active" leaves, meaning leaves that are on a tree). If you can't take a leaf from your own tree, choose a leaf that is similar in size and shape.
- Fill a large bowl with lukewarm water, and place the leaf in the bottom of the bowl with a rock on top, to keep the leaf from floating up.
- Leave the bowl undisturbed for at least 4 hours, ideally in a sunny spot inside, and then look closely at the leaf, do you notice anything different? You might be able to see that there are small bubbles on the edges of the leaf, and possibly also on the edges of the bowl. What do you think they are?
- Now, place a straw inside a glass and blow through it. Does anything similar happen? Compare the results.
- Document both investigations with a drawing and describe your observations.

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LEAF BREATH

In the first experiment...	*In the second experiment...*

My best explanation for what happened is...

LEAF BREATH

Investigation #1	*Investigation #2*

HOW DOES WATER MOVE THROUGH A LEAF?

You will need:

- Leaves
- Water
- Red or blue food coloring
- A glass
- Pen, pencil, crayon

What to do: You are going to investigate how water moves through the leaves. To better see the movement of the water, you will add food coloring to it.

TIPS:

- Collect a few leaves, and be sure the ends are cut cleanly.
- Put the leaf in a glass, so that its stem is down and in a few centimeters of water.
- Add red or blue food coloring to the water.
- Document the investigation with a photo or a drawing, and place the glass where it can be undisturbed.
- Check back every day and document any changes you see.

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HOW DOES WATER MOVE THROUGH A LEAF?

OBSERVATION GRID

Date & Day	Observations	Drawing

TREE BARK PRINT 1

You will need: Paper OR investigation sheets (attached)
Crayons OR oil pastels
Trees

What to do:

1. Get 5 sheets of paper read.
2. Make sure you choose dark color crayon(s) – you can use the same color or choose 5 different colors.
3. Choose trees near your home or ask an adult to accompany you to a walk on your street or to the park – each day you will choose a different tree.
4. Look closely at the tree's bark, choose the part you want to make a print from, place the paper and start the bark rubbing.

TIPS:

- If you want to take multiple investigations on trees, try to choose big tall old ones.

BEFORE THE INVESTIGATION

→ What do you expect to find through this investigation?

TREE BARK PRINT 1

KEEP A RECORD OF YOUR INVESTIGATION – _____ to _____

DAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
CHECK	☐	☐	☐	☐	☐
DESCRIPTION (What features do you see?)					
NAME (Do you know what the tree is called?)					
LOCATION (Think of a way to document the tree location)					
ECOSYSTEM (What do you see linked to the tree? Birds, insects, other plants?)					

TREE BARK PRINT 2

You will need: Investigation sheet (attached)
Foil
Trees

What to do:

1. Get a piece of aluminum foil from the kitchen.
2. Choose trees near your home or ask an adult to accompany you to a walk on your street or to the park – each day you will choose a different tree.
3. Look closely to the tree's bark, choose the part you want to make a print from, place the foil and gently put pressure so the foil keeps the barks' impressions.

TIPS:

- If you want to take multiple investigations on trees, try to choose big tall old ones.

BEFORE THE INVESTIGATION

→ What do you expect to find through this investigation?

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