AUSTRALIAN DATA SCIENCE
EDUCATION INSTITUTE

What's so great about a tree?

Trees are vital to our survival. They supply us with oxygen, they make shade, they're habitat for birds, animals, and insects, and they even take carbon out of the atmosphere for us. We really need trees, but sometimes the need for trees clashes with the need for more houses, more parking spaces, or new shops. Sometimes people even object to trees because they make a mess - they drop leaves, or they house possums who then scatter their droppings everywhere.

In this project you're going to count trees and calculate how much carbon they store, comparing different ways of counting the trees, and looking at whole neighbourhoods.

Year levels

Year 3 and 4

Curriculum Areas

CURRICULUM AREA	STRAND	SUB-STRAND
Science	Science Understanding	Biological Sciences Earth and Space
	Science Inquiry Skills	Questioning and predicting Planning and Conducting Recording and processing Analysing and evaluating Communicating
Mathematics	Number and Algebra	Number and Place Value
	Measurement and Geometry	Using units of measurement Location and transformation
	Statistics and Probability	Data representation and interpretation
Humanities: Geography	Geographical Concepts and Skills	Data and Information
	Geographical Knowledge	Diversity and significance of places and environments
English	Reading and Viewing	Interpreting, analysing, evaluating

	Writing Speaking and Listening	Creating texts Interacting with others
Digital Technologies	Data and information	
General Capabilities	Critical and Creative Thinking	Organise and process information

Resources

- https://www.abc.net.au/btn/classroom/tree-day/10526148 tree planting - BTN
- https://www.abc.net.au/btn/classroom/carbon-reports/10540946 Contains video, activities, questions and teacher notes BTN
- https://www.abc.net.au/btn/classroom/carbon-ad/10534236 Carbon tax -advertising BTN
- https://www.abc.net.au/btn/classroom/carbon-target/10526022 Carbon targets set by the Federal Government - BTN
- https://schoolsweek.co.uk/ten-things-schools-can-do-to-address-the-climate-crisis/ MARCH 2019 article on ways schools can address climate change
- (TEACHER RESOURCE FOR READING /GETTING SCHOOL INVOLVED) -https://news.curtin.edu.au/stories/low-carbon-schools-empowering-tomorrows-sustainability-champions/

Equipment needed

- Computers with internet access & Google Maps
- Notepads & pens
- Tape measures
- School sitemap

Success Criteria

In this unit the student will improve their data literacy and data analysis skills by :
Knowing:
- What data is and how it is collected
- That data can help tell a story about the world around us and help us solve problems

Doing:
- Collecting data
- Applying basic mathematical skills to make sense of data
- Sharing the data story with others in different ways.

Understanding:
- How to check your data for possible errors
- The role carbon plays in climate change and how much carbon is stored by one tree

Introduction

Watch the videos on Carbon and Trees
https://www.abc.net.au/tv/carboncops/about.htm
https://www.abc.net.au/btn/classroom/tree-day/10526148 tree planting - BTN

Step 1

- Make a map of your school - you could do this by printing out a zoomed in section of Google Maps - and label the buildings and other parts of the school.
- In groups of 3 or 4, walk around your school and count the trees on the school grounds as accurately as possible. Note each tree on the map.
- Write the final tallies for each group on the board and compare them. Are they all the same?
- As a class, brainstorm the reasons why your tallies might be different and come up with a list of all the ways you can think of that you might have counted differently.

Step 2

One of the ways your tallies might have differed is the way you defined a tree. Are there places where some groups called a plant a shrub, and others a tree?

- As a class, come up with a definition of “tree”, and a definition of “shrub”.
- How easy will this definition be to use when you are counting the trees around the grounds? If, for example, you used height, is the height something you can easily measure, or are you going to have to estimate? Try to refine your definitions so that you can easily apply them when you are counting trees.

Step 3

Trees store carbon, which is one of the reasons when we chop them down and burn them, or make woodchips or paper from them, we also have an impact on the atmosphere. Check out the tree & shrub carbon calculator here:

https://www.northsydney.nsw.gov.au/carbon/carbon.html

Pay careful attention to the information you need about each tree and shrub in order to calculate the carbon it stores.

- Create a table that will help you store all of the information you need for each tree and shrub. Make sure you include a description of the tree's location and a space for a photo.

Example of Tree information table

Description of tree	Location	Photo/Image of tree
It is much bigger than the classroom building. It is near the walkway where students hang their school bags. The trees leaves drop in the Autumn.	The tree is located in front of the grade 2 / 3 classroom.	

Step 4

- In your groups, count the trees around your school again, this time using your tree & shrub definitions.
    - NOTE: Depending on how big your school is, and how many trees there are, you might need to divide the school up into areas and have groups do different areas. It's important that you have at least two groups count each area though, so if your school is too big, just do one section of the grounds, instead of the whole school.
- Collect the information you need for each tree for the calculator at the same time. Fill out a table entry for each tree and shrub.
- Take a photo of each tree and shrub
- You might need to print some pictures of each type of tree, to help you identify them. This is often a problem with data collection, especially of plants or animals - actually knowing what the different types look like, and making sure you have labelled them correctly!
- When you get back to the classroom, print the photos and stick them in the table next to the details, OR enter all of the details into a spreadsheet and insert the photos next to the details for that plant. How can you be sure you have matched the photos to the plants correctly?

Step 5

- Get together with another group in your class, and compare your data. Do you have the same measurements for all of the trees? How can you be sure you are comparing the same trees? Where you have different measurements, write the difference on the board (eg if one group measured the circumference of a tree to be 80cm and another 78, write 2cm).
- How accurately are your trees places on the map? Does your map look exactly the same as all of the other groups? Why/why not?
- How big are the differences that you found? Make a note of the 3 largest differences, we'll use those in the next step.
- Put together a class list of all of the trees, their type, and their size. If there are big differences in measurements, consider which measurement you think is most likely to be accurate. One approach is to choose a value in the middle of all of the different measurements, to create a kind of rough average. If you know about averages already, calculate the average for these trees.

Example of Class list of trees

Group / Person	**Tree type**	**Tree size**	**Tree measurement differences / notes**	**Averages**

Step 6

- Put each of the trees into the carbon calculator at https://www.northsydney.nsw.gov.au/carbon/carbon.html and put the carbon stored by each tree into your table.
    - Whoops - we didn't leave a space for carbon storage in the table! This is another problem you often encounter in data science - finding that you have more data than you expected when you began the project. This is why it's always useful to leave extra space if you're recording on paper, or to use a spreadsheet on a computer, so that you can easily add another column.
- For the trees with the largest differences in class measurements, put the smallest and largest values into the calculator. How much difference does it make to the resulting value? What about if you change the type of tree? How much difference does that make to your results?

Step 7

- Add up the total carbon stored by the trees and shrubs in your school.
- **Advanced**: Using your school's electricity bills, calculate the carbon footprint of your school's electricity use for one year. You might like to use this calculator, bearing in mind it calculates Carbon Dioxide by the tonne, and your earlier calculations will be in kg of Carbon.
    - One ton of carbon equals 44/12 = 11/3 = 3.67 tons of carbon dioxide, so to convert your CO2 into tonnes of Carbon, divide your CO2 result by 3.67.
    - 1 tonne is 1000kg, so you will need to multiply by 1000 to get kgs of carbon that you can compare to your tree result.

  https://cncf.com.au/carbon-calculator/

Step 8

- What is the ratio of carbon generated by the electricity used by your school in one year to the carbon stored in the trees on the grounds? How many trees would be required to store the full amount of carbon your school used over the last year?
    - Note that this is a tricky question, because it depends on the type of trees, and the size of the trees. Growing trees absorb more carbon, but mature trees have more carbon stored. Data Science questions are often complicated like this!
- Assuming the amount of electricity generated by your school stays the same every year, how many mature trees would be needed each year to match the amount of carbon generated by the school's electricity used over your entire time at the school?

Step 9

- Make a visualisation of the number of trees needed to store the carbon generated by your school's electricity usage over one year.
- Write a report that describes what you found out about trees, carbon, and your school's energy use, and present it as a speech or a video to your class or family and friends.

Curriculum Links (Australian Curriculum)

Curriculum Area: Strand: Sub-strands	Level 3	Level 4
Science: Science Understanding: • Biological sciences	• Different living things have different life cycles and depend on each other and the environment to survive.	
Science: Science understanding • Earth and space	• Earth surface changes over time as a result of natural processes and human activity	
Science: Science Inquiry Skills: • Questioning and Predicting	• With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge	
Science: Science Inquiry Skills: • Planning and Conducting	• Suggest ways to plan and conduct investigations to find answers to questions including consideration of the elements of fair tests. • Safely use appropriate materials, tools, equipment and technologies.	
Science: Science Inquiry Skills: • Recording and Processing	• Use formal measurements in the collection and recording of observations • Use a range of methods including tables and column graphs to represent data and to identify patterns and trends.	
Science: Science Inquiry Skills: • Analysing and evaluating	• Compare results with predictions, suggesting possible reasons for findings. • Reflect on an investigation, including whether a test was fair or not.	
Science: Science Inquiry Skills: • Communicating	• Represent and communicate observation ideas and findings to show patterns and relationships using formal and informal scientific language	
Mathematics: Number and Algebra • Number and Place value	• Recognise, model and order numbers to at least 10,000 • Recognise and explain the connection between addition and subtraction.	• Recognise, represent and order numbers to at least tens of thousands • Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems
Mathematics: Measurement and Geometry • Using units of measurement	• Measure, order and compare objects using familiar metric units of length, mass and capacity	• Use scaled instruments to measure and compare lengths, masses, capacities and temperatures
Mathematics: Measurement and Geometry • Location and transformation	• Create and interpret simple grid maps to show position and pathways	• Use simple scales, legends and directions to interpret information contained in basic maps

Mathematics: Statistics and Probability ● Data representation and interpretation	● Identify questions or issues for categorical variables. Identify data sources and plan methods of data collection and recording ● Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies ● Interpret and compare data displays	● Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values ● Evaluate the effectiveness of different displays in illustrating data features including variability
Geography Geographical Concepts and Skills ● Data and information	● Collect and record relevant geographical data and information from the field and other sources ● Represent data and the location of places and their characteristics by constructing tables and simple graphs and maps of appropriate scale that conform to cartographic conventions of border, scale, legend, title and north point.	
Geography Geographical Knowledge ● Diversity and significance of places and environments	● Main climates of the world and the similarities and differences between the climates of different places	
English <u>Reading and Viewing:</u> Interpreting, analysing, evaluating <u>Writing</u>: Creating texts <u>Speaking and Listening:</u> Interacting with others	● Use comprehension strategies to build literal and inferred meaning and begin to evaluate texts by drawing on a growing knowledge of context, text structures and language features. ● Plan, draft and publish imaginative informative and persuasive texts demonstrating increasing control over text structures and language features and selecting print and multimodal elements appropriate to the audience and purpose ● Plan and deliver short presentations, providing some key details in logical sequence, using appropriate tone, pace, pitch and volume	● Use comprehension strategies to build literal and inferred meaning to expand content knowledge, integrating and linking ideas and analysing and evaluating texts ● Plan, draft and publish imaginative, informative and persuasive texts containing key information and supporting details for a widening range of audiences, demonstrating increasing control over text structures and language features ● Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular audiences and purposes such as informative, persuasive and imaginative, including multimodal

		elements
Technologies Digital Technologies • Data and Information	• Recognise different types of data and explore how the same data can be represented in different ways • Collect, access and present different types of data using simple software to create information and solve problems	
Capabilities Critical and Creative Thinking • Reasoning	• Distinguish between main and peripheral ideas in own and others information and points of view. • Investigate why and when the consequences of a point of view should be considered. • Explore distinctions when organising and sorting information and ideas from a range of sources.	