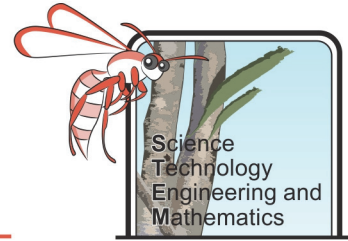


## Human Impacts on Earth's Surface – Teacher Resource

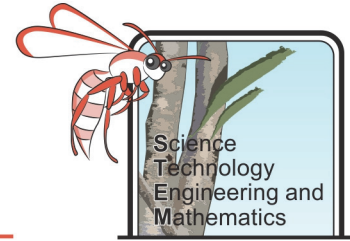


### Intended Use of Resources

This project has been designed so that teachers from different STEM areas can pick and choose sections relevant to their subject area to work on. All activities in this package do not need to be completed to get value from the package – each activity can be completed as a stand-alone or can be approached, as a team, as a larger project. The package has potential to be extended into a much longer project to include curriculum points from different STEM subjects.

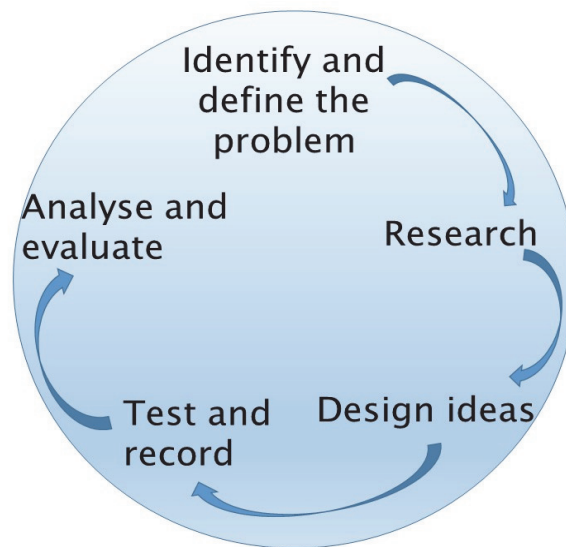
There are three **student workbooks - Open, Guided and Scaffolded**, that go along side this resource; all have the same suggestions for activities, however they have been written and edited to provide differentiated learning options to support good teaching practice. Teachers may pick and choose which versions they give which students and may wish to edit them further to address their learning needs. Due to the differentiation of the workbooks, the **Open** activities will enable more syllabus links to be addressed, which is why each activity has its own syllabus links key. However, if you wish to give a truly open-ended investigation then you could just give the students the challenge and background information section of the Student Workbook.

The Woodside Australia STEM Project aims to be accessible and supportive for teachers and students, please contact us if you have questions, require assistance or would like to arrange an incursion or a professional development workshop - [www.wasp.edu.au](http://www.wasp.edu.au)



### The Challenge

Humans have evolved over time. Humans have learnt to make tools, farm and produce goods in ways that other animals haven't. Your challenge is to investigate how human activities change the surface of the Earth.



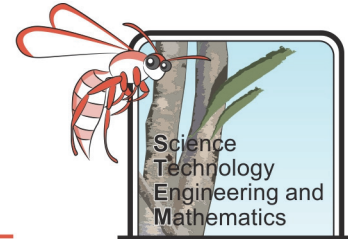
### Background Information

Humans need food to survive. As our global population grows more quickly than ever before, so too does the demand for food. Most of our food comes from large farms with crops or livestock, such as sheep and cows. This has led to large scale removal of vegetation to clear areas for farmland, such as jungles, woodlands and bushland which changes much of the surface of the Earth.

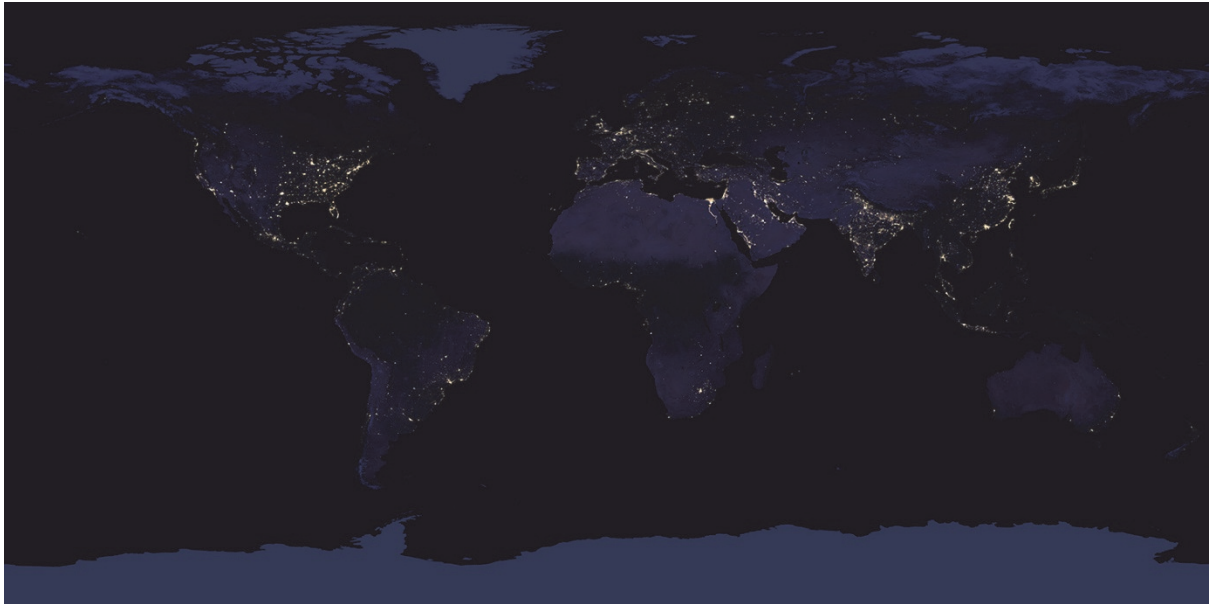
Many of us also live in a 'consumer culture' in which we are told that we need lots of things. In this modern world we use a lot of technology, such as phones, computers and tablets. To build these devices we first need the raw materials, such as minerals, metals and oil, which are extracted from the Earth by mining. This involves removing rocks and materials from the Earth. Mining can greatly impact the surface features of the Earth. With that said, mining companies are now more environmentally aware and will rehabilitate an area once they have finished, by replanting vegetation.

If we look at satellite pictures of the Earth by night, like the one below, we can see where there are cities as they are lit up. Buildings and infrastructure (roads, railways etc) have stamped their mark on the Earth's surface. Where once there were trees and plants, there

## Human Impacts on Earth's Surface – Teacher Resource

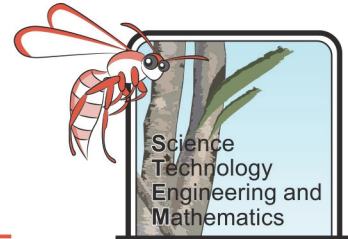


are now towns. Even hillsides are often flattened to make way for buildings and roads.



*[Figure 1. Satellite picture of Earth by night \(NASA, 2016\)](#)*

## Human Impacts on Earth's Surface – Teacher Resource



### Activities

This booklet contains extra information on each activity, including syllabus links the overall activity objective, suggestions for recommended equipment or alternative ways to run investigations as well as useful resources and website links. Please note that any reference websites provided in the entirety of our resource documents were current at the time of publication. Please advise if links are no longer accessible.

The syllabus links have been colour coded – please see the colour key below:

Covered in Scaffolded, Guided and Open student workbook
Covered in Guided and Open Student workbook
Covered in Open student workbook

#### List of activities

[Background Research](#)

[Walking away the Earth](#)

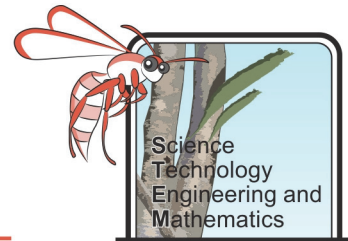
[Adding to the Earth](#)

[Keeping it Together](#)

[Earth from Above](#)

[Contour Ploughing](#)

## Human Impacts on Earth's Surface – Teacher Resource



### Background Research

#### Objective

In this activity, students will gain more understanding about what erosion is. They will research different ways in which human activities can cause erosion and some ways to prevent erosion. In the Open booklet, they will research the rate at which soil is created and eroded and discuss if soil is a renewable resource.

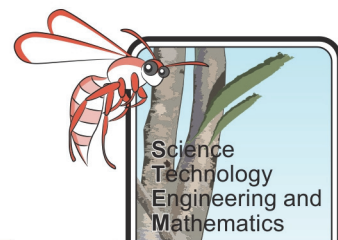
In the Scaffolded and Guided booklet, students are given suggested websites to use. In the Open booklet, students are asked to reference any sources they use for research.

Subject area	Australian syllabus links
Science	ACSSU075 Earth's surface changes over time as a result of natural processes and human activity  ACSHE062 Science knowledge helps people to understand the effect of their actions

#### Useful website:

- Kids science website with some print outs you can use in class  
<https://kidskonnnect.com/science/erosion/>

## Human Impacts on Earth's Surface – Teacher Resource



### Walking away the Earth

#### Objective

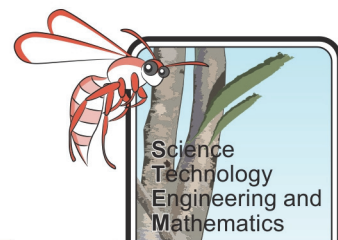
In this activity, students will investigate how animals (humans) can cause erosion of soils just from walking over it. Students using the Open booklet will design their own experiment to investigate this.

This activity focuses on investigation skills and data collection, management, and analysis. Students can use Excel or similar software to create a table and draw a graph of their results.

For this investigation it is better if you have a whole class take part or get the students to take multiple steps to show most variation.

Subject area	Australian syllabus links
Science	<p>ACSSU075 Earth's surface changes over time as a result of natural processes and human activity</p> <p>ACSSU076 Forces can be exerted by one object on another through direct contact or from a distance</p> <p>ACSHE061 Science involves making predictions and describing patterns and relationships</p> <p>AC SIS064 With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge</p> <p>AC SIS065 With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment</p> <p>AC SIS066 Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately</p> <p>AC SIS068 Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends</p> <p>AC SIS216 Compare results with predictions, suggesting possible reasons for findings</p>

## Human Impacts on Earth's Surface – Teacher Resource

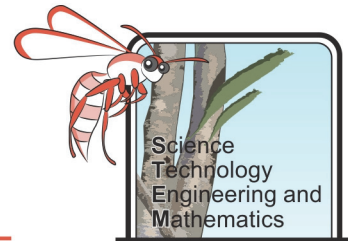


	<p>ACSIS069 Reflect on investigations, including whether a test was fair or not</p> <p>ACSIS071 Represent and communicate observations, ideas and findings using formal and informal representations</p>
<b>Technologies</b>	<p>WATPPS21 Define a sequence of steps to design a solution for a given task</p> <p>WATPPS22 Identify and choose the appropriate resources from a given set</p> <p>WATPPS23 Develop and communicate design ideas and decisions using annotated drawings and appropriate technical terms</p> <p>WATPPS24 Select, and safely use, appropriate components and equipment to make solutions</p> <p>WATPPS26 Work independently, or collaboratively when required, to plan, safely create and communicate ideas and information for solutions.</p> <p>ACTDIP009 Collect and present different types of data for a specific purpose using software</p>
<b>Mathematics</b>	<p>ACMMG084 Use scaled instruments to measure and compare lengths, masses, capacities and temperatures</p> <p>ACMSP096 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</p>

### Useful website:

- More activities and explanations about causes of erosion  
<https://www.wasp.edu.au/mod/page/view.php?id=451>
- Free online PD on the Year 4 Earth and Space topic (available Jan 2021)  
<https://waspteacher.edu.au/>
- Video and explanation of fair testing  
<https://education.abc.net.au/home#!/media/1390357/fair-test>

## Human Impacts on Earth's Surface – Teacher Resource



### Adding to the Earth

#### Objective

Students will investigate how the materials we use, and dispose of, can change the Earth's surface. They will look at how materials decompose (or don't) over a timescale.

This activity focuses on investigation skills. Students with the Open booklet will plan their own investigation. Guided students will improve a method and focus on fair testing about how to collect, present and analyse results. Scaffolded students will follow a method to safely investigate. All students will evaluate their experiment.

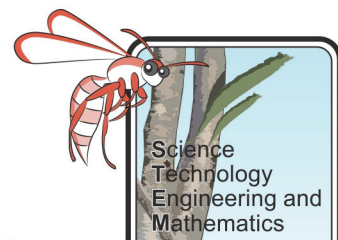
Students will consider what will happen in areas, like landfill sites, where large accumulations of non- biodegradable waste is placed.

Subject area	Australian syllabus links
Science	<p>ACSSU075 Earth's surface changes over time as a result of natural processes and human activity</p> <p>ACSHE061 Science involves making predictions and describing patterns and relationships</p> <p>ACSSU074 Natural and processed materials have a range of physical properties that can influence their use</p> <p>ACSHE062 Science knowledge helps people to understand the effect of their actions</p> <p>AC SIS064 With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge</p> <p>AC SIS065 With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment</p> <p>AC SIS066 Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately</p> <p>AC SIS068 Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends</p> <p>AC SIS216 Compare results with predictions, suggesting possible reasons for findings</p>

*An initiative supported by Woodside and ESWA*



## Human Impacts on Earth's Surface – Teacher Resource

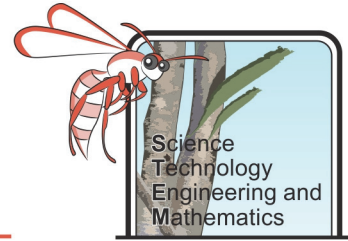


	<p>ACSIS069 Reflect on investigations, including whether a test was fair or not</p> <p>ACSIS071 Represent and communicate observations, ideas and findings using formal and informal representations</p>
<b>Technologies</b>	<p>WATPPS21 Define a sequence of steps to design a solution for a given task</p> <p>WATPPS22 Identify and choose the appropriate resources from a given set</p> <p>WATPPS23 Develop and communicate design ideas and decisions using annotated drawings and appropriate technical terms</p> <p>WATPPS24 Select, and safely use, appropriate components and equipment to make solutions</p> <p>WATPPS26 Work independently, or collaboratively when required, to plan, safely create and communicate ideas and information for solutions.</p> <p>ACTDIP009 Collect and present different types of data for a specific purpose using software</p>
<b>Mathematics</b>	<p>ACMSP096 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</p>

### Useful websites:

- ABC News article on what happens to our waste  
<https://www.abc.net.au/news/2020-09-06/wa-confronts-recycling-crisis-as-china-bans-contaminated-waste/12629488>
- YouTube Video – How San Francisco is Becoming a Zero Waste City  
<https://www.youtube.com/watch?v=Cg3OA1s8-SI>
- 25 Educational resources to help kids with the war on waste  
<https://education.abc.net.au/newsandarticles/blog/-/b/2535555/25-educational-resources-to-help-kids-with-the-war-on-waste>

## Human Impacts on Earth's Surface – Teacher Resource



### Keeping it Together

#### Objective

Students carry out an investigation to find out to what extent plant roots help hold soil together and prevent erosion. They then discuss their findings in relation to why deforestation and land clearing could add to erosion and change the Earth's surface.

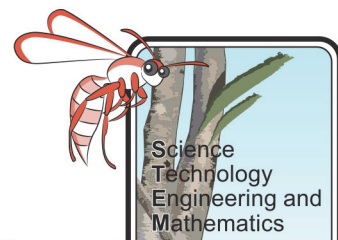
For the Scaffolded and Guided students, they are given a list of equipment and a method. The Open students must design their own investigation, this includes coming up with their own equipment list. All students will evaluate their investigation.

Scaffolded students discuss observations and collect qualitative data, whereas the Guided and Open students collect and compare quantitative data through creation of graphs and data displays.

Students may want to come with a rating scale (1 – 5) of how easy it was to pull out a weed as this will give them more quantitative data. They can also discuss how reliable using such a scale is. They will generally find that the harder the weed is to pull up the more soil it will have held in its roots. However, they may not be the longest roots; some plants have lots of short roots which will hold lots of soil together. Another extension they could do would be to weigh the roots once they were free from soil and look for a relationship between the weight of the soil held in the roots and the weight of the roots.

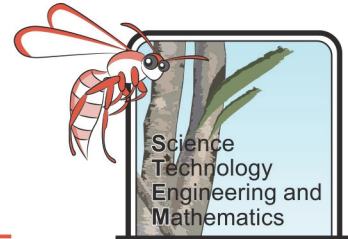
Subject area	Australian syllabus links
Science	<p>ACSSU075 Earth's surface changes over time as a result of natural processes and human activity</p> <p>ACSHE061 Science involves making predictions and describing patterns and relationships</p> <p>ACSHE062 Science knowledge helps people to understand the effect of their actions</p> <p>ACCU076 Forces can be exerted by one object on another through direct contact or from a distance</p> <p>AC SIS064 With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge</p> <p>AC SIS065 With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment</p>

## Human Impacts on Earth's Surface – Teacher Resource



	<p><b>AC SIS066</b> Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately</p> <p><b>AC SIS068</b> Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends</p> <p><b>AC SIS216</b> Compare results with predictions, suggesting possible reasons for findings</p> <p><b>AC SIS069</b> Reflect on investigations, including whether a test was fair or not</p> <p><b>AC SIS071</b> Represent and communicate observations, ideas and findings using formal and informal representations</p>
<b>Technologies</b>	<p><b>WATPPS21</b> Define a sequence of steps to design a solution for a given task</p> <p><b>WATPPS22</b> Identify and choose the appropriate resources from a given set</p> <p><b>WATPPS23</b> Develop and communicate design ideas and decisions using annotated drawings and appropriate technical terms</p> <p><b>WATPPS24</b> Select, and safely use, appropriate components and equipment to make solutions</p> <p><b>WATPPS26</b> Work independently, or collaboratively when required, to plan, safely create and communicate ideas and information for solutions.</p> <p><b>ACTDIP009</b> Collect and present different types of data for a specific purpose using software</p>
<b>Mathematics</b>	<p><b>ACMSP096</b> 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</p> <p><b>ACMMG084</b> Use scaled instruments to measure and compare lengths, masses, capacities and temperatures</p> <p><b>ACMMG290</b> Compare objects using familiar metric units of area and volume</p>

## Human Impacts on Earth's Surface – Teacher Resource

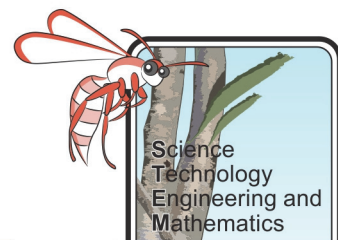


	<p>ACMSP095 Select and trial methods for data collection, including survey questions and recording sheets</p> <p>ACMSP097 Evaluate the effectiveness of different displays in illustrating data features including variability</p>
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### Useful websites:

- AusEarthEd video: preventing erosion  
<https://www.youtube.com/watch?v=WreJRM6wSf0&t=4s>
- Further activities and information on erosion  
<https://www.wasp.edu.au/mod/page/view.php?id=451>
- A simple diagram which shows the difference between quantitative and qualitative data  
<https://www.mymarketresearchmethods.com/data-types-in-statistics/examples-of-quantitative-vs-qualitative-data-min/>

## Human Impacts on Earth's Surface – Teacher Resource



### Earth from Above

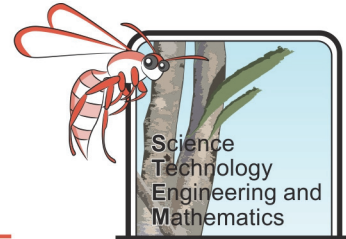
#### Objective

Students use Google Maps to find evidence of civilisation and compare the extent of different human practices (mining, farming and building infrastructure). Students take screenshots and use the measurement tool to gather information about different practice types. Students compare the data and discuss the impact of different types of human practices. They use their findings to create a presentation.

As an extension activity, students may want to look at historical maps of cities and compare them to Google Maps images. You can also go into street view and look at how areas have changed (although this might not be very much).

Subject area	Australian syllabus links
Science	<p><a href="#">ACSSU075</a> Earth's surface changes over time as a result of natural processes and human activity</p> <p><a href="#">ACSHE061</a> Science involves making predictions and describing patterns and relationships</p> <p><a href="#">ACSHE062</a> Science knowledge helps people to understand the effect of their actions</p> <p><a href="#">AC SIS064</a> With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge</p> <p><a href="#">AC SIS066</a> Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately</p> <p><a href="#">AC SIS068</a> Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends</p> <p><a href="#">AC SIS071</a> Represent and communicate observations, ideas and findings using formal and informal representations</p>
Technologies	<p><a href="#">WATPPS26</a> Work independently, or collaboratively when required, to plan, safely create and communicate ideas and information for solutions.</p> <p><a href="#">ACTDIP009</a> Collect and present different types of data for a specific purpose using software</p>

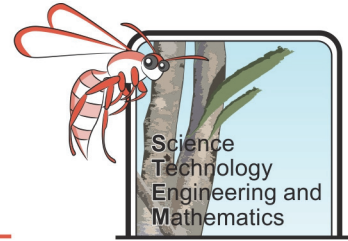
## Human Impacts on Earth's Surface – Teacher Resource



	<p>ACTDIP009 Collect and present different types of data for a specific purpose using software</p>
<b>Mathematics</b>	<p>ACMSP096 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</p> <p>ACMMG084 Use scaled instruments to measure and compare lengths, masses, capacities and temperatures</p> <p>ACMMG290 Compare objects using familiar metric units of area and volume</p> <p>ACMSP095 Select and trial methods for data collection, including survey questions and recording sheets</p>

### Useful websites

- Article on the hidden costs of renewable energy in relation to the impact of mining  
[https://theconversation.com/renewable-energy-can-save-the-natural-world-but-if-were-not-careful-it-will-also-hurt-it-145166?utm\\_medium=email&utm\\_campaign=The%20Weekend%20Conversation%20-%201722516642&utm\\_content=The%20Weekend%20Conversation%20-%201722516642+CID\\_da29689b5a9fe716c45386b1c8bcc79f&utm\\_source=campaign\\_monitor&utm\\_term=Renewable%20energy%20can%20save%20the%20natural%20world%20%20but%20if%20were%20not%20careful%20it%20will%20also%20hurt%20it](https://theconversation.com/renewable-energy-can-save-the-natural-world-but-if-were-not-careful-it-will-also-hurt-it-145166?utm_medium=email&utm_campaign=The%20Weekend%20Conversation%20-%201722516642&utm_content=The%20Weekend%20Conversation%20-%201722516642+CID_da29689b5a9fe716c45386b1c8bcc79f&utm_source=campaign_monitor&utm_term=Renewable%20energy%20can%20save%20the%20natural%20world%20%20but%20if%20were%20not%20careful%20it%20will%20also%20hurt%20it)
- The argument for increasing population densities in cities  
<https://www.citymetric.com/fabric/increasing-population-density-solution-land-squeeze-successful-cities-4092>



## Contour Ploughing

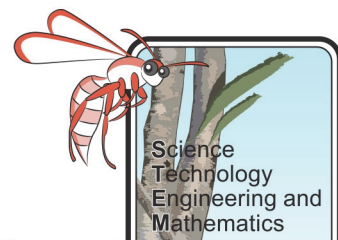
### Objective

In this activity students investigate if different ploughing methods affect erosion rates. This enables student to discuss whether farmers could improve their practices to reduce erosion, which would in turn benefit their land as the soil would not be lost so quickly.

For the Scaffolded and Guided students, they are given a list of equipment and a method. The Guided students are asked to improve the method they are given. They should consider how they will get data from the investigation – for example they should consider if it is important that each side of the hill being ploughed has the same number of beads on it. They may also like to think if there is any way they can collect sand that falls down the hillside and weigh it, to compare which side lost the most sand. Perhaps they could draw around the base of their sandcastle before ploughing and then redraw after ploughing, to determine which side increased the most. The Open students must design their own investigation this includes coming up with their own equipment list, again they should be encouraged to consider what data they will collect to enable them to answer the investigation question. All students will evaluate their investigation and consider how it could be improved and extended.

Subject area	Australian syllabus links
Science	<p>ACSSU075 Earth's surface changes over time as a result of natural processes and human activity</p> <p>ACSHE061 Science involves making predictions and describing patterns and relationships</p> <p>ACSHE062 Science knowledge helps people to understand the effect of their actions</p> <p>ACSHE062 Science knowledge helps people to understand the effect of their actions</p> <p>ACCU076 Forces can be exerted by one object on another through direct contact or from a distance</p> <p>AC SIS064 With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge</p> <p>AC SIS065 With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment</p>

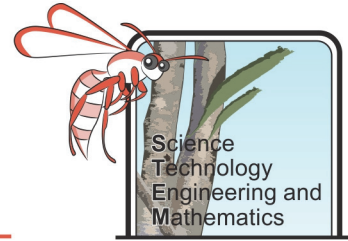
## Human Impacts on Earth's Surface – Teacher Resource



	<p>ACSIS066 Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately</p> <p>ACSIS068 Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends</p> <p>ACSIS216 Compare results with predictions, suggesting possible reasons for findings</p> <p>ACSIS069 Reflect on investigations, including whether a test was fair or not</p> <p>ACSIS071 Represent and communicate observations, ideas and findings using formal and informal representations</p>
<b>Technologies</b>	<p>WATPPS21 Define a sequence of steps to design a solution for a given task</p> <p>WATPPS22 Identify and choose the appropriate resources from a given set</p> <p>WATPPS23 Develop and communicate design ideas and decisions using annotated drawings and appropriate technical terms</p> <p>WATPPS24 Select, and safely use, appropriate components and equipment to make solutions</p> <p>WATPPS26 Work independently, or collaboratively when required, to plan, safely create and communicate ideas and information for solutions.</p> <p>ACTDIP009 Collect and present different types of data for a specific purpose using software</p>
<b>Mathematics</b>	<p>ACMSP096 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</p> <p>ACMMG084 Use scaled instruments to measure and compare lengths, masses, capacities and temperatures</p> <p>ACMMG290 Compare objects using familiar metric units of area and volume</p>



## Human Impacts on Earth's Surface – Teacher Resource



	<p>ACMSP095 Select and trial methods for data collection, including survey questions and recording sheets</p> <p>ACMMG087 Compare the areas of regular and irregular shapes by informal means</p>
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### Useful websites

- Article on fair testing and how to reduce errors  
<https://ausearthed.blogspot.com/2020/05/fair-dinkum-science.html>
- This website discusses the history of farming, the 1930s section discusses the introduction of contour ploughing.  
[https://livinghistoryfarm.org/farminginthe30s/crops\\_11.html#:~:text=Contour%20ploughing%20was%20a%20method,and%20helps%20save%20precious%20topsoil.](https://livinghistoryfarm.org/farminginthe30s/crops_11.html#:~:text=Contour%20ploughing%20was%20a%20method,and%20helps%20save%20precious%20topsoil.)
- Downloadable presentation about soils and farming practices to maintain healthy soil (good for teacher background information, a bit high level for students)  
<http://images.pcmac.org/SiSFiles/Schools/GA/VidaliaCity/VidaliaHigh/Uploads/Presentations/Ch. 9 Soil and Agriculture.pptx>