

Lesson 3: Sustainability

Narrative

During the team's time in the rainforest, they have been able to meet some of the people in the local villages and are starting to understand some of the issues that the locals face. As the team has spent time compiling data about Log Inc, the local people are starting to trust them. The environmentalists are therefore not surprised when the elders of a local village come to ask for their help. The elders want the team to explain and present some alternatives to logging which would also bring wealth into their village.

Problems

Main problem

Together, a number of villages occupy about 300 000 hectares of rainforest land. Some of the villagers are keen to sell their land to loggers as this generates a large profit for them. The team must present a case that convinces them to preserve as much rainforest as possible. The presentation will need to include some options with details of how each option would affect the villagers' finances in the short, medium and long term.

Supplementary or homework problems (optional)

The team needs a better idea what Log Inc's building and compound look like, ready for their UN report, and surveillance needs to increase.

- 1 Sketches of the building have been emailed through by the advance party. The team at base camp must now draw the building's plan, side and front views.
- 2 Two of the team have paced the perimeter and have texted the information that it is L-shaped and 1 kilometre long. The team at base camp must draw a possible scale plan of the compound.
- 3 Nine of the team will observe the gates of the compound for 3 days. Everyone in the group will do one shift with each other person, so that each pairing is different and skills are shared. All the shifts will be of equal length. The team must work out the length of a shift.

Skills required

In this lesson or in the homework pupils will:

- identify the necessary information to solve a mathematical problem
- break a problem into smaller parts and structure problems that need several steps
- try out and compare mathematical representations
- develop a reasoned case or argument and present or communicate it
- draw conclusions of their own and give an explanation of their reasoning
- check results, considering whether they are reasonable
- draw simple plans and elevations and make scale drawings
- solve problems involving the perimeter and area of 2D shapes
- structure problems that need several steps.

Rainforest resources

- 3.1 Video clip: (40 seconds) The team has been approached by local villagers who have asked for their help, so they have arrived at the village ready to offer their expertise
- 3.2 A4 resource sheet of the main problem (print one per pair or group)
- 3.3 Slide showing success criteria
- 3.4 Optional A4 resource sheet of supplementary or homework problems (print as many copies as needed, depending on your plans for using the problems)
- 3.5 A4 peer review sheet (print one per pair or group)
- 3.6 Video clip: (50 seconds) The Log Inc alarm sounds – the team has been detected! They must escape before they get caught!
- 3.7 Slides reminding pupils how to draw front, side and plan views of 3D objects (optional)

Other resources

Squared and plain paper for the optional supplementary or homework problems.

Main activity

Introduce the next stage of the mission. Play **Resource 3.1**, a 40-second video clip of the team at a local village, ready to help the indigenous people.

Give out **Resource 3.2**, the main problem, one per pair or group. Read it through together to make sure that everyone understands the information. Explain that the task is to prepare a short report for the villagers explaining what you advise them to do and why, and then to present the key ideas, either on a poster that can be displayed in the centre of the village, or in a presentation that you can show to the villagers.

Show **Resource 3.3**, a slide of the success criteria for the task.

Ask the groups to spend 5 minutes thinking about how they are going to tackle the problem and to make a plan. Then take some feedback, asking questions like:

- ▶ How are you going to present your findings?
- ▶ How are you going to organise your report?
- ▶ What do you think will be important to include?
- ▶ Would it be useful to include a spreadsheet or a graph?
- ▶ Would it be useful to put some results in a table?

Allocate time for groups to complete the task, stressing that it is important to present a *mathematical* case to the villagers.

If pupils have considered the report to the UN for homework after lesson 2, include a discussion of comparisons between the two reports (to the villagers and the UN), drawing out points about tailoring the report to the needs of the audience.

Differentiation

To make the main problem easier it would be possible to limit the options available to pupils. For example, you could ask them to consider only the **logging** and **sustainable** options.

You could also add an optional extension that more able pupils could explore, e.g. farming **soy** on deforested land produces a profit of around \$300–\$600 per hectare each year. For reference, you may wish to make use of more complex data from the Internet, e.g. on assets.panda.org/downloads/wnf_amazonerapport_def.pdf

Groups that finish ahead of time could assist another group or, if time allows, you could ask them to try one of the supplementary problems on **Resource 3.4**. The supplementary problems vary in difficulty. The second is the easiest and the third is the hardest. Squared paper is needed for the first two supplementary problems.

Review

Bring the whole class together to present their findings to each other.

This activity would lend itself to peer review. As an option, pupils could use the **Resource 3.5**, a peer review sheet, to record their assessments. Any notes could be made on an extra sheet of plain paper.

To round off, show **Resource 3.6**, a 50-second video clip. The alarm sounds – the team has been detected and must escape before they get caught!

Optional homework

Ask pupils to do a remaining problem from **Resource 3.4**. They will need a ruler and squared paper. If they need a reminder on how to draw front, side and plan views of simple 3D objects, use one or more slides from **Resource 3.7**.

Solutions: Lesson 3

Main problem

This problem is not really about the numbers but more about how pupils justify their choice of figures and the decisions that they make.

Here are some figures that teams might use in their argument:

Logging

300 000 hectares at \$1000 per hectare gives a one-off figure of \$300 million (\$300 000 000)

Cattle ranching

300 000 hectares at \$51 gives a figure of \$15.3 million per year which rises to \$44.4 million if the highest figure of \$148 per hectare is included. Teams might opt for a middle value of around \$100 per hectare which would raise \$30 million per year.

Harvesting

300 000 hectares of rainforest at \$426 per hectare will raise \$127.8 million per year.

Eco-tourism

Assuming that the figure provided is accurate then \$75 000 might be raised per year by eco-tourism.

General

An argument might be that the one-off profit from selling to Log Inc for logging and cattle ranching is attractive. For example, Log Inc's potential income from these two activities would be \$300 million from the initial logging and an additional \$300 million from the ranching, giving a total income of \$600 million over the ten years at an average of \$60 million per year. Log Inc would be prepared to pay half of this to the villages for the sale of the land.

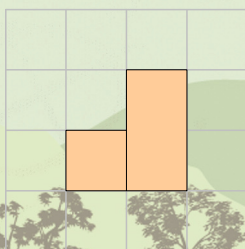
However, it is clear to see from this that the sustainable option of harvesting is more than twice as profitable over a ten-year period and has the additional benefit that the income will continue into the future. Even when the loss of income from the current arrangement of leasing the land is taken into account, this would be a better option.

Using these figures, the income generated by ecotourism is almost negligible although teams might argue that calculating a figure per hectare is inaccurate.

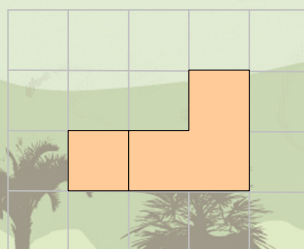
Supplementary or homework problems on Resource 3.4

1 Views of Log Inc's headquarters

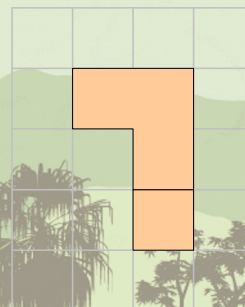
Front view



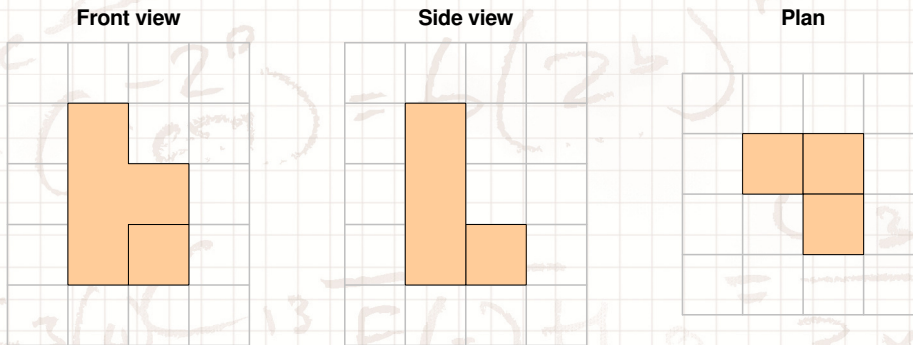
Side view



Plan

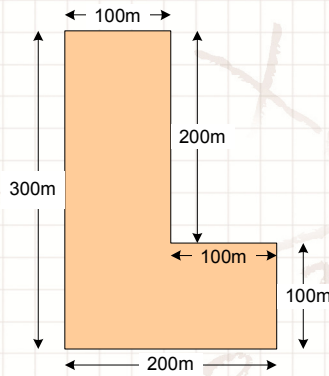


Views of the sleeping block



2 Pupils' own solutions

Different solutions are possible but one possibility is:



3 Pupils may find it helpful to draw diagrams such as:

	A	B	C	D	E
A	×	AB	AC	AD	AE
B	BA	×	BC	BD	BE
C	CA	CB	×	CD	CE
D	DA	DB	DC	×	DE
E	EA	EB	EC	ED	×

In general, n people can pair up with $n - 1$ other people, but since A observing with B is the same pair as B observing with A, and so on, each pair is counted twice. So the total number of pairs is $\frac{1}{2}n(n-1)$.

For 9 people, the number of pairs (and hence the maximum number of shifts) is $9 \times 4 = 36$, and the length of a shift is 2 hours.