

I BET YOU DIDN'T KNOW...

Termites can help rainforests survive droughts

Scientists have discovered that vital (yet sometimes villainous) termites may also play a key role in the biggest, most complex challenge facing the world today - global warming.

What are termites?

Termites are insects that live in colonies and eat wood and plant matter (Figure 1). They are not just detritivores (organisms which feed on dead plants, animals and their poo) but are also *decomposers*. This means that, with the help of micro-organisms in their guts, the termites can break down even the toughest woody *cellulose* fibres into simple substances such as water and compounds containing useful nutrients including nitrogen and phosphorus.

Figure 1. Termites (*Hospitalitermes* sp.) are found in massive numbers in tropical rainforests.



What do you know about recycling in nature?

Decomposers are nature's recycling team and a crucial part of food chains and webs.

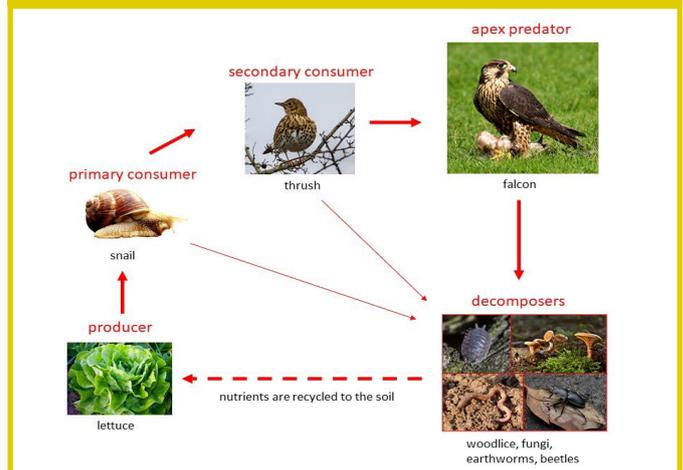
Dr Rebecca Ellis,
PSTT College Fellow, links
cutting-edge research with
the principles of primary science



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All food chains start with *producers* (plants) which use nutrients from the soil, water and energy from sunlight to make their own food by photosynthesis. Energy then passes along the food chain from plants to animals. Initially, energy is given to herbivores who eat the plants and then to carnivores who eat the herbivores. What happens next? Without decomposers, dead plants and animals (and their poo) would pile up and there would be no nutrients available for new plant-life. Nutrients are recycled to the soil by the vital decomposers (Figure 2).

Figure 2. Nutrients are recycled in nature.



However, termites do not differentiate between dead wood on the forest floor and wood that is used to build houses. Termites become serious pests when they invade homes, eating the windows, doors and even the structural wood, foundations and the furniture (Figure 3)! They cause billions of pounds worth of damage every year worldwide.

Figure 3. Termite damage on the outside of a building.



Global warming and the rainforests

Scientists have estimated that about 50% of life on Earth can be found in tropical rainforests (Figure 4). Many of the plants there are used in medicines and new species are still being discovered every year. This exciting *ecosystem* now only covers about 2% of the Earth’s surface but has a huge influence on our climate. The rainforest has a high density of plants, from the towering emergent layer to the forest floor. As these plants use carbon dioxide for photosynthesis and release vital oxygen, rainforests have been called, ‘the lungs of the world’. Carbon dioxide is a *greenhouse gas* that has increased in our atmosphere over the last 200 years, resulting in global warming. So rainforests can help stabilise the climate and could be part of the solution in halting global warming. Unfortunately, climate change is already affecting the health of the rainforest because increases in temperature and changing weather patterns lead to decreased rainfall.

Figure 4. Rainforest in Kinabalu Park, Borneo.



Little things run the world?

Scientists are worried that an increase in water stress will lead to an increase in tree mortality and a decrease in forest growth so that rainforests lose their resilience.

Questions to discuss:

Why do you think that it is important that rainforests are resilient?

What other threats are there to the rainforests?

Entomologists (scientists who study insects) noticed that, surprisingly, termite activity and numbers increased during droughts and they designed their research experiments to find out more about the role of termites. In some test areas of the rain forest, the scientists removed and poisoned termites without affecting other invertebrates. Meanwhile, in the control areas they left the termites unharmed. They monitored the areas closely for two years, which included a period of drought.

Question for children to consider:

Can you identify the independent variable in the experiment?

During the drought period, they found some significant differences between the test and control areas (Table 1).

Table 1. The effect of termites on the rainforest during drought.

	Depth of leaf litter	Soil moisture	Soil nutrient analysis	Survival of seedlings
Control area with termites (compared to the test area with termites removed)	22% lower	36% higher	Better distribution of soil nutrients	51% higher

These findings show that during droughts in the rainforest, the increased activity of termites in the soil ‘buffers’ the decreased activity from microbial (bacterial) decomposers. Possible reasons for termites being more active during droughts are that dry conditions are favourable for tunnelling and foraging above ground. Unlike microbial decomposers and fungi, termites can collect leaf litter from above ground and then move it below ground through their underground tunnels. They do not rely on trickles of water.

As well as eating the dead materials, the microbes in their guts help termites break them down into simple substances: water and nutrients. Termite poo containing water and nutrients then increases the soil moisture and makes it nutrient rich and able to support forest growth.

Because termite activity increases just when other decomposers are struggling, a rainforest with termites will be more resilient to the increased frequency of droughts (due to global warming) than scientists expected. This just goes to show how important every little living thing is to ensure the smooth running of our world!

Words of wisdom

The scientists who took part in this research were an international team from Hong Kong, the UK, Australia, South Africa and Malaysia. They noted that previous researchers have found that human disturbance of the rainforest (for example by logging, farming or mining) reduces termite populations. They warned that rainforests that have been affected by human activity are likely to be less resistant to drought because of their lower levels of termites. This provides more evidence that 'untouched' biological communities are important to protect whole ecosystems during global warming.

GLOSSARY

cellulose

a compound containing nitrogen, oxygen and hydrogen which is an important structural part of green plants

control

the group in an experiment that does not receive treatment by the researchers and is then used to compare how the other tested subjects do

decomposer

an organism that breaks down dead organisms (and their waste) into the substances that plants need for growth, e.g. fungi, earthworms, beetles and bacteria

ecosystem

a community of living things (e.g. animals and plants) in a habitat, together with the non-living parts of the environment (e.g. air and water)

greenhouse gas

a gas in the Earth's atmosphere that traps heat and contributes to global warming, e.g. carbon dioxide

producers

green plants which make their own food

The paper that inspired this work was:

Termites mitigate the effects of drought in tropical rainforest.

By L. A. Ashton^{1,2,3}, H. M. Griffiths⁴, C. L. Parr^{4,5,6}, T. A. Evans⁷, R. K. Didham^{7,8}, F. Hasan², Y. A. Teh⁹, H. S. Tin¹⁰, C. S. Vairappan¹⁰, P. Eggleton².

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