Investigating Fungi Poster
Created by Rose Dow and Richard Geytenbeek

To support our growing understanding of the importance of fungi through time spent with the Adelaide Fungal Studies Group, specifically Pam Catcheside and to build upon Sapphire Mc Mullan's visit we put together the 'Investigating Fungi' poster. We offer this to support the Nature's Recyclers lesson at Arbury Park Outdoor School, as a resource for the Green Adelaide, Nature Education Fungi Kit and to FungiMap as an online resource.

Fungi - Nature's recyclers

According to Sapphire and Pam ASFG it is fungi, saprotrophs (rotter) and some parasites (slow killers) which break down wood. Brown rot fungi produce enzymes that break down cellulose and hemicellulose. White rot fungi break down the lignin by producing lignases. These fungi are the major recyclers required before invertebrates and bacteria can do their work. Some bracket fungi may be saprotrophic in circumstances where the host plant is healthy but may harm, be parasitic to the plant host if it is unhealthy. Fungi release enzymes from fine threads that look a bit like cotton wool! The fine threads are called hyphae (hi – fee) when there are more than one and hypha (hi-fa) when there is one on its own. Lots of hyphae together make a 'mycelium' (my-seal-e-um). Fungi are actually more like animals than plants as they digest their food rather than make their food as plants do. It's just that fungi digest their food from outside their bodies rather than inside as animals do. http://www.the-compost-gardener.com/decomposer.html

Paul Stamets, a renowned fungi expert, calls decomposer or saprotrophic fungi the grand molecular disassemblers of nature. It's a great description. These organisms take large, complex organic molecules, like the fats, carbs and proteins found in dead plants and animals, and disassemble them into the simple inorganic compounds such as water, nitrates and CO2 that plants use as nutrients. Richard has shown the decomposers, both on the forest floor but also in the wood of fallen logs. It is white rot fungi (break down lignin) and brown rot fungi (break down cellulose and chemically alters the lignin) that 'soften or prime' the wood for the invertebrates and bacteria to digest. http://www.britmycolsoc.org.uk/mycokids/fungi-break-down-wood/ https://publications.csiro.au/rpr/pub?pid=csiro:EP151615

Lignin rich leaf veins make beautiful leaf skeletons.

Leaf veins are rich in lignin. This leaf skeleton is what's left after this group of fungi is done.

http://www.ancienttreeforum.co.uk/ancient-trees/ancient-tree-ecology-wildlife/fungi/

This following website explains in kid friendly terms what fungi are made from.
http://www.britmycolsoc.org.uk/mycokids/what-are-we-made-of/

Decomposers – Saprotrophic fungi are called 'Decomposers' as they get their food from dead plants, fungi and animals. They're also good 'recyclers' as the nutrients they release by breaking down the dead organisms goes back into the soil. They keep soil healthy and nutrient rich.

White rot and brown rot examples.
Most are saprotrophic (rotters) and a few are parasitic (slow killers) and in some cases can be both.

Mycelium – Fungi filaments like roots, but finer

The out-of-sight (often forgotten) mycelium is the essential part of the fungus. The fruiting body, for example the mushroom or bracket, is the reproductive structure, rather like the apple on a tree. The mycelium however can be found throughout the year in the soil or wood as the body of the fungus. The **mycelium:**

- Absorbs water and nutrients from the environment
- Produces many sorts of enzymes which are involved in
    - breaking down dead plant, fungal and animal material.
    - Recycling.
    - Soil structure and health

The mycelium may also be an important food source for many soil invertebrates.

The term mycorrhiza is derived from the classical Greek words for 'mushroom' and 'root'. There are two main types of mycorrhizal fungi. Ectomycorrhizae grow on the surface layers of the roots and are commonly associated with trees. These are the fungi that are represented on the poster. They wrap around the root and do not penetrate the cells of the plant. It is these fungi that help our forests grow, (trees would only grow to 2-3 metres without these fungi). The second major group are the endomycorrhizae that grow within the root cells and are commonly associated with grasses, row crops, vegetables, and shrubs. They're the most abundant type of mycorrhiza and the most ancient. It's likely these fungi originated between 350 and 450 million years ago and probably played an essential role in the colonization of land by the plants.

Mycorrhizal fungi help trees and other plants to grow. It is a mutualistic relationship where fungi receive sugars they can't make from plants and where the plants receive water, nutrients and root protection from the fungi. Because the fine threads that make fungal mycelium can spread over long distances and get to places roots can't, fungi can capture water and nutrients and bring them back along the fine threads to plant roots. There's a sophisticated trading process going on that fungi and plants rely on for their survival. The following website is where the idea for the poster came from. Scroll down for the image at the bottom.
https://www.anbg.gov.au/fungi/mycorrhiza.html

Summary

The poster is a great visual representation of the Stringybark forest for students to look at while doing their own fungi investigating, not just in the fungi season. White rot, brown rot and mycelium can be found all year round. When there is white rot and brown rot, invertebrates are often present. The poster also provides an opportunity to create a poster with a local habitat. This way local fungi can also be added and investigated using the Fungimap webite.
As our understanding of fungi expands as more DNA studies are undertaken, we believe it important students can access this knowledge. Nature's recyclers' is a perfect opportunity for students to begin to see and experience first hand the important role fungi have as both recyclers and as critical connectors within our ecosystems.