Lichens 1

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LICHENS – THE MERGING OF VERY DIFFERENT LIFE FORMS

Unlike plants, fungi cannot make their own food from sunlight, water and carbon dioxide (photosynthesis). However about 20% of fungal species live with a photosynthetic partner – mostly green algae but sometimes cyanobacteria – together they become lichens. Lichens can grow in places where individually the partners could not survive.

People used to believe lichens were a single organism – a kind of plant. However, only the green algae are members of the plant kingdom; fungi belong to another kingdom. Cyanobacteria are from yet another kingdom of unrelated organisms.

Which organism does what?

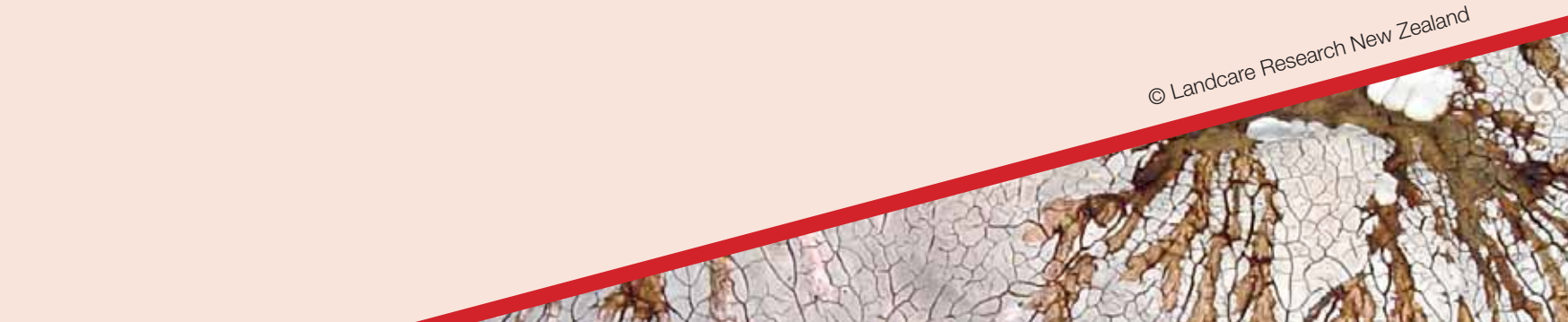
The lichen's body (thallus) is mostly made of fungal threads (hyphae) that enclose a thin layer of the photosynthetic partner below the upper surface. In general, the fungus receives 'food' from the photosynthetic partner (the photobiont), which in turn is protected from the outside environment. Both partners benefit.

A good strategy that has evolved many times

The very first lichens probably date back to before the origin of land plants, when most life on Earth was in the sea. Many very different fungi have independently adopted a lichenised lifestyle. Despite the diversity, all lichenised fungi are ecologically similar in that they involve a photosynthetic partner. Such biological diversity with a common nutritional strategy probably means the lichen life-style has evolved numerous times.

Which partner are lichens named after?

There are about 20,000 species of lichenised fungi but relatively little diversity among the photosynthetic partners (only about 25 genera). Hence lichens are named after the fungal partner involved.



Lichens 2

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LICHEN REPRODUCTION

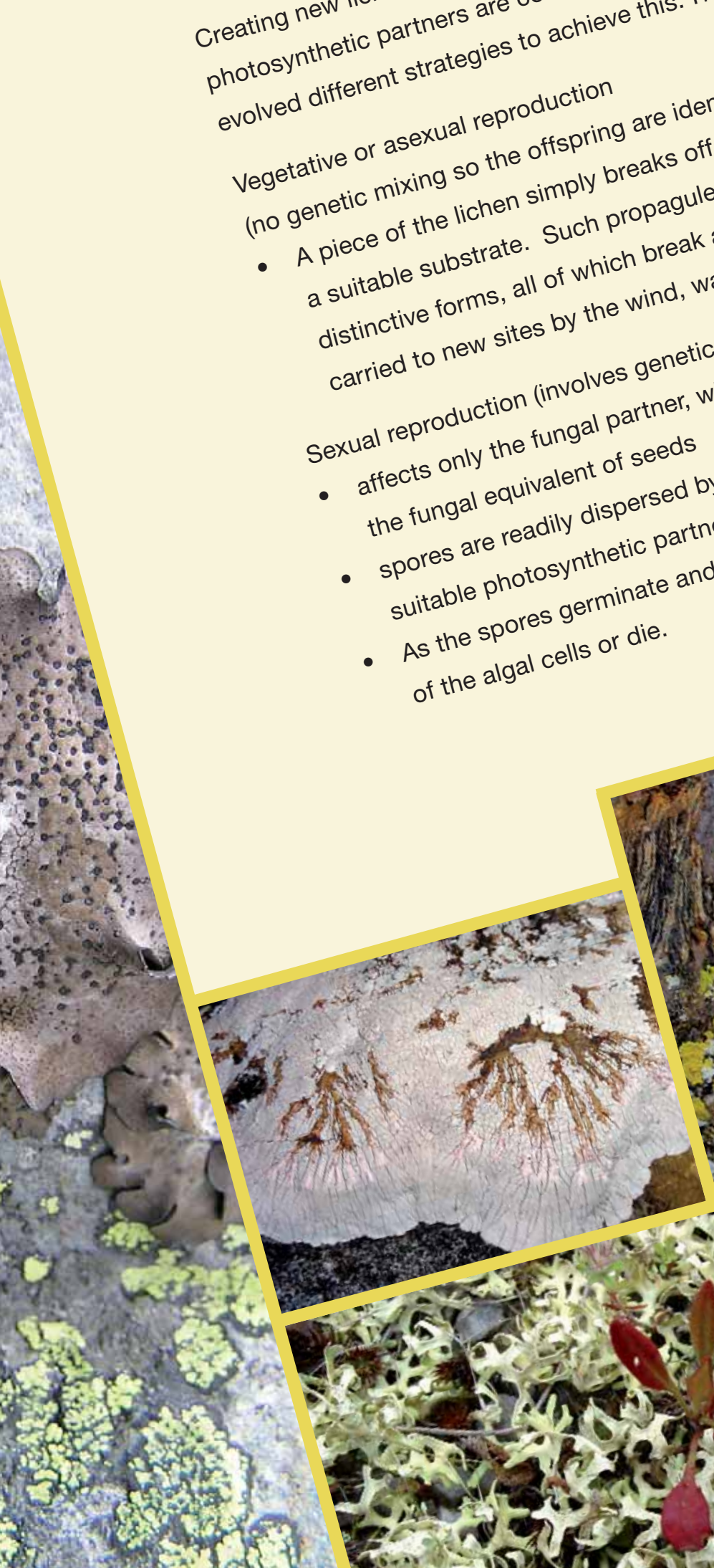
Creating new lichen 'babies' is interesting because the lichen's fungal and photosynthetic partners are completely-unrelated types of organisms. Lichens have evolved different strategies to achieve this. The most common are:

Vegetative or asexual reproduction
(no genetic mixing so the offspring are identical to the parent):

- A piece of the lichen simply breaks off and regrows (propagates) if it lands on a suitable substrate. Such propagules are produced in vast numbers in many distinctive forms, all of which break away easily and retain their vitality as they are carried to new sites by the wind, water, insects or other creatures.

Sexual reproduction (involves genetic mixing):

- affects only the fungal partner, which produces genetically-mixed spores that are the fungal equivalent of seeds
- spores are readily dispersed by wind, water and animals, and some will land near a suitable photosynthetic partner
- As the spores germinate and begin growing, the fungal hyphae must capture some of the algal cells or die.



Lichens 3

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ECOLOGY & HABITATS

New Zealand is rich in lichen species, perhaps the most interesting lichen diversity in the world. Many species are of great size and beauty, especially in wetter, forested areas.

Lichens live everywhere from city footpaths to the summit rocks of Aoraki Mt Cook, tree bark, tombstones, buildings and even harsh seashore environments. Some species can occupy a wide range of habitats; others require very specific humidity, shade, substrate, pH or nutrient-enrichment. In grassland and forest ecosystems, lichens are important nitrogen fixers.
They are among the first organisms to inhabit new surfaces and prepare these for further successional colonisation so they have value in ecological restoration.

POLLUTION DETECTORS

Many lichens are good indicators of pollution.

Acid rain (Sulphur dioxide)

During the mid to late 20th century in the Northern Hemisphere, acid rain left some coal-burning cities and industrial areas almost devoid of lichens, apart from the 'pollution lichen' (*Parmeliopsis ambigua*) that thrived. With cleaner cities, lichens are recolonising areas.

Ammonia

Ammonia (e.g. from intensive animal farming) dissolved in rain or mist can eliminate all but the most resistant lichens.

Nitrogen oxides

Other lichen species cannot tolerate elevated levels of nitrogen oxides (e.g. from agriculture and exhaust fumes) while nitrogen-loving species may flourish. Nitrogen pollution could be one of the greatest threats to lichen diversity.