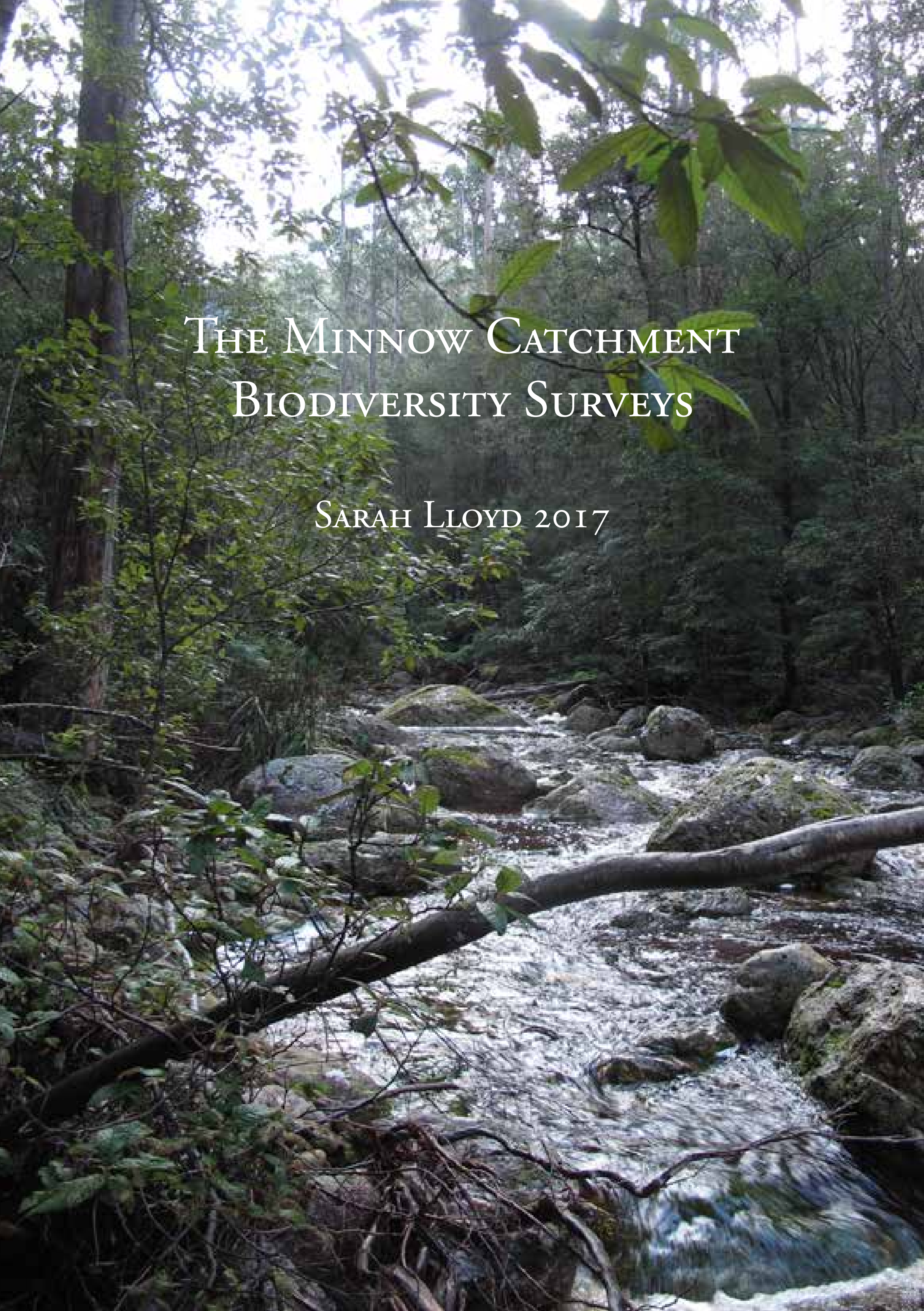


The Minnow Catchment Biodiversity Surveys

Sarah Lloyd 2017

The source of the Minnow River is approximately 1080 meters above sea level on the summit of Mt Roland. Small tributaries merge into a number of waterfalls, the most prominent being the Minnow Falls that cascades down the rock scree on the southeast slope of the mountain. The river then flows through native forest, pine and eucalypt plantations and agricultural land eventually to join the Dasher River at 200 meters above sea level. Unlike the Minnow Falls which is one of the most prominent landmarks on the mountain, many of the named and unnamed creeks and streams and surrounding land that comprise the Minnow Catchment are hidden from view by Mount Roland, and the numerous hills—Gog Range, Kenzies Hill, Conglomerate Hill and Panorama Sugarloaf—from which these waterways flow.

Aboriginal History

The Aboriginal name for Mount Roland, Mount Claude and Mount Van Dyke was Ta Neem Er Ra. The mountains were significant to the Six Rivers Band in several respects: the foothills and waterways were important for childbirth and women's ceremonies; their rocky outcrops were rich hunting sites; and their prominence in the landscape meant they were used as lookouts and for distant communication with neighbouring Aboriginal bands.

There are no written records of Aboriginal life before the British arrived. However, there are descriptions of the area by George Augustus Robinson who in 1834 was travelling to the much-prized ochre mine 'Toolumbuner' on the Gog Range, with his Aboriginal 'companions'.

Robinson noted that the forest was '*overgrown with underwood … All this country had been burnt and the fallen timber was very thick …The natives had been here recently and burnt the grass. Saw several bark huts. This is a favourite resort of the natives and is their road*.' He goes on to state that '*the celebrated mine of ochre … was held in … great esteem by the natives*'. They used fire to maintain a series of tracks that lead to Toolumbuner from several directions giving access to other groups with whom they traded this precious material.

Historical changes in the natural vegetation

Pollen samples extracted from a small lagoon at the top of the Gog Range give a fascinating insight into regional changes in vegetation from about 8000 years ago. These can be attributed to the changing climate, Aboriginal activity, and the impact of European settlement.

The lowest layer, calculated to be from 6000 to 8000 years old, indicate that the vegetation was dominated by rainforest species including beech (*Nothofagus* spp.), celery-top pine (*Phyllocladus aspleniifolius*), treeferns (*Dicksonia antarctica*) with some eucalypts (*Eucalyptus* spp.) and dogwood (*Pomaderris apetala*). Pencil and King Billy pines (*Athrotaxis* spp.) and deciduous beech (*Nothofagus gunnii*)—that now only persist in the elevated areas on the central plateau and at Cradle Mountain—were also present as were wet sclerophyll plant communities of satinwood (*Phebalium*, now *Nematolepis*), cheesewood (*Pittosporum*) and mountain pepper (*Tasmannia lanceolata*), species that still occur today in wet gullies, shaded hillsides and riparian areas. Buttongrass (*Gymnoschoenus sphaerocephalus*) surrounded the lagoon. The pollen samples contain very few burnt particles suggesting that fire was infrequent.

Between 4000 to 6000 years ago the wet sclerophyll forest and rainforest species, especially the fire-sensitive pines and deciduous beech, declined. There was an increase in the diversity of hard-leaved species and a dramatic increase in the number of burnt particles which indicate the drying climate and the effect of Aboriginal burning. The pollen samples also show a decline in buttongrass but an increase in scented paperbark (*Melaleuca squamea*), tea trees (*Leptospermum* spp.), members of the pea (Fabaceae) family; broom spurge (*Amperea xiphoclada*) and silver banksia (*Banksia marginata*).

The upper layer has signs of European settlement with pollen from radiata pine (*Pinus radiata*) and ribwort plantain (*Plantago lanceolata*). Eucalypts still dominated the upper canopy but the understorey of woody shrubs was replaced by heaths (Epacridaceae spp.), grasses (Poaceae) and daisies (Asteraceae). This indicates a gradual opening of the forest and the influence of European agricultural practices.

Recent European activity: settlements, mining and timber harvesting

Settlements started to appear at Beulah and surrounding areas around 1900 when there were no roads, few buildings and the terrain was thickly forested. Land and building materials were so cheap that before WWI a 65-acre (26 ha) bush block was purchased for six pounds an acre and a four-roomed dwelling cost just seven pounds. The settlers' immediate task was to fell the trees with cross-cut saws and axes before using bullocks and chains to clear the vegetation. Any timber that wasn't used for buildings or fences was burnt.

It was a frugal existence with very little cash to buy goods—and few goods available for purchase. Most families had at least one house cow, a vegetable garden, chooks and a pig for making bacon. Rabbits were in plague proportions and bartering was common with people exchanging blackberries or eggs for groceries or clothing. Natural resources were abundant - '*the rivers were full of fish … brown and rainbow trout and our native blackfish*' and '*there were plenty of fresh-water crayfish … any little creek had them*.'

At the peak of agricultural activities up to 60,000 bushels of oats left Beulah representing about two or three thousand bushels (75 metric tonnes) from each property. Potatoes, swedes and peas were also grown and exported from the area.

Early photographs reveal something of that early life near Beulah which '*in [1900] was mostly bush*'. A photograph taken of celebrations near the school after WWI shows a landscape almost devoid of vegetation.

The several attempts at mining were of limited duration. The gold at the Star of The West Mine and the widespread alluvial gold were not in payable quantities despite all the trenches, tunnels and shafts dug in its pursuit. Barite (baryte) was also mined at Beulah from about 1918 to 1922 with limited impact on the land.

In 1933 the Advocate described the 1931 downturn of the timber industry in northwest Tasmania and its subsequent improvement. The swings and roundabouts depended not only on local demand but also on federal tariffs to ensure local timber-harvesting was competitive with imported products, especially oregon pine.

In the 1940s the local council recognised the potential of soft wood plantations. Between 1948 and 1954 one hundred and fifty acres of radiata pine were planted at Beulah. These were harvested in 1998 and replanted in 1999. More recently, native forest and cleared rural land have been replaced with plantations of radiata pine or shining gum (*Eucalyptus nitens*).

The Minnow Catchment in 2017 - what field surveys reveal

The hills and valleys of the Minnow catchment are a patchwork of several different vegetation communities that change depending on aspect, drainage, soil type, fire history and other disturbances. For instance, some of the riparian areas (i.e. along the creeks and rivers) are relatively undisturbed and in the wetter areas rainforest species including native laurel and myrtle-beech still survive. The sunny more exposed slopes are covered in dry forests dominated by the endemic black peppermint with a rich understorey of flowering plants.

However, the catchment is much more than just the waterways. Most of the forest that once grew around Beulah is long gone and in other areas large swathes of the original native vegetation have been cleared and replaced with plantations of shining gum or pines. Many native plants and animals are unable to survive in areas where agriculture and plantation forestry are the predominant land use.

Minnow River Picnic Ground

Blackwoods, silver wattles and three species of eucalypt—giant ash, white gum and stringybark—form the forest canopy at the picnic ground. Small myrtle-beech grow close to the water on the north side of the creek and there's a small grove on the south side. The mid and understorey vegetation is rich and varied with prickly beauty, goldey wood, prickly geebung, dogwood, caterpillar wattle, native currant, cheesewood and stinkwood. There are numerous species of fern including soft waterfern, hard waterfern, soft treefern, ruddy groundfern, bracken, mother shieldfern, silky fanfern and common filmyfern.

Bryophytes—mosses and leafy liverworts—proliferate and in some areas dense patches cover the ground or fallen logs and branches, often interspersed with a range of colourful fungi.

The noise of the fast flowing tannin-stained river masks the songs of most forest birds, but Silvereyes, Crescent Honeyeaters, Grey Shrike-thrush, Golden and Olive Whistlers, Green Rosellas, Tasmanian Scrubwrens and Forest Ravens can often be heard above the sound of rushing water.

Minnow River headwaters (MU1)

Closer to the headwaters of the Minnow River upstream from the picnic ground the vegetation includes additional wet forest species including native laurel, mountain pepper and musk. Common heath, native cherry and guitarplant occur on the sunnier slopes above the river.

Huge boulders of conglomerate rock characteristic of the area form stepping stones across the river on the way to the Minnow Falls.

Minnow Creek and Kenzies hill

Close to the Minnow Creek tall stringybark and giant ash and sub-canopy trees including musk, sassafras and cheesewood provide a shaded and humid environment suitable for the proliferation of numerous species of ferns, mosses and liverworts.

The floods of July 2016 scoured the ground in the immediate vicinity of the waterway and changed the course of the creek in some areas.

The vegetation on the dry, north-facing slope of Kenzies Hill is gradually recovering from the fire that raged through the area in 2007 (?? is this the right date?)

Headwaters of the Minnow River: The Mount Roland Plateau

Dense sub-alpine scrub and heathland surround the headwaters of the Minnow River on the Mount Roland plateau.

Buttongrass dominates the moorland vegetation on the flat plains where the peaty soil is waterlogged for most of the year. Other moorland plants include the soft-fruited tea-tree, banksia and swamp paperbark. Smithton peppermint, Tasmanian snow gum and alpine yellow gum are the only eucalypts able to withstand the occasional snow falls, cool temperatures, strong winds and high rainfall experienced on the plateau. Other plants have adapted to the harsh conditions by developing small hard leaves.

The walk in early October was too early for many of the spring and summer flowering herbaceous plants and daisies that attract an enormous array of invertebrates, especially pollinating insects.

The most conspicuous insects were the jack-jumpers working away on their mounds of leaves, twigs, seeds and small pebbles.

Mosses and liverworts

Mosses, liverworts and hornworts are collectively known as bryophytes. They are believed to have been the first plants to colonise the land. They lack true roots, but attach to logs, trees, rocks or soil by hair-like rhizoids through which they take in water and minerals.

Unlike flowering plants, most bryophytes don't have a transport system for conducting water, nor do they have a covering on their leaves that prevents water loss. Instead they have the remarkable ability to absorb water through their leaves and can quickly transform from a dry crisp if they experience prolonged dry periods, to a photosynthesizing green plant once water becomes available. This ability, along with the water they hold on their leaves by surface tension, makes them crucial in maintaining a stable humid atmosphere in forest and other ecosystems.

Ecological roles

Soil-colonising species bind the soil surface, and help to prevent erosion and reduce evaporation.

Mosses and liverworts that grow on the bare surfaces of logs, rocks and soil make ideal seed beds for the germination and establishment of flowering plants.

Bryophytes provide shelter, habitat and food for a range of invertebrates such as insects, mites, snails, worms, amphipods and spiders. Many birds use mosses in their nests.

Thallose liverworts have thick leathery leaves.

The fertile structures on mosses, called sporophytes, have solid stalks and long-lasting capsules.

Ferns

Ferns range in size from tall treeferns that can attain great heights of up to 12 meters to tiny filmy ferns that are just one cell thick and superficially resemble moss.

In the Carboniferous Period (340 million years ago) ancient ferns and giant clubmosses dominated the planet. In the Triassic and Jurassic Periods (245–210 mya) ferns along with cycads and conifers, were the main food of plant-eating reptiles. Their decline at the end of the Cretaceous (145 mya) coincided with the rise of the flowering plants.

Ferns are able to tolerate shaded areas not favoured by flowering plants so they dominate permanently humid places such as close to the Minnow River. Some, especially the familiar bracken fern, also occur in drier areas.

Ecological roles

Ferns provide shade, shelter and food for a range of vertebrate and invertebrate animals. At certain times of the year when other food items are scarce, the endemic Green Rosella feeds on the spores of treeferns. Some birds (e.g. the endemic Scrubtit) often nest among the fronds of treeferns and the Tasmanian Boobook has been observed sheltering under the fronds during the day. Pink Robins and pygmy possums use treefern hairs in their nests.

A recent study in Tasmania identified 108 beetle species associated with treeferns. They especially favour the region at the top of the trunk where leaves, twigs and other organic material accumulates and remains moist. This area is also known to be a hotspot for slime moulds.

Scrambling coral fern *Gleichenia microphylla*.

Filmy ferns such as this *Hymenophyllum cupressiforme* are only one cell thick.

Fungi

Numerous fungi in a multitude of colours start to appear after the first rain in autumn on the soil and organic material such as living plants, logs, stumps, branches, twigs and leaf litter. They come in a range of shapes and sizes, from robust and delicate gilled fungi to puff balls, corals, discs, brackets and jellies.

Fungi, unlike plants, are unable to photosynthesise so they must get all their nutrients by other means: Saprotrophic fungi get their nutrients from decaying organic matter; parasitic fungi get their from living plants or animals; and mycorrhizal fungi obtain nutrients through mutually beneficial associations with plants.

Ecological roles

The fungi we saw during the first outing to the picnic ground were on decaying logs and stumps. They were all saprotrophic fungi, the group that obtains their nutrients from decaying vegetation. As they perform the important function of decay, they make nutrients locked up in this material available for other organisms.

Parasitic fungi were nowhere to be seen, possibly because of the time of year or the health of the area. Healthy areas with a diversity of plants and animals are able to withstand attack by parasitic fungi far better than impoverished areas with little plant diversity.

Approximately 95 % of all plant species on Earth have a symbiotic (i.e. mutually beneficial) relationship with mycorrhizal fungi. Nutrients are exchanged through invisible hair-like threads called hyphae that form something akin to a worldwide **underground** web! These threads are pathways for transporting nutrients such as carbon, nitrogen and water. Fungal hyphae effectively extend the plants' root zone ensuring the plants grow faster, are better able to withstand drought, resist pathogens and weeds. It is believed that the crucial associations between plants and fungi assisted the flowering plants to colonise the land.

Heterotexrus miltinus

Crepidotus 'orange'


Clavulinopsis miniata


Chlorociboria aeruginascens


Bracket fungi


Flammulina velutipes


Hygrocybe graminicolor


Galerina hypnorum

Lichens

Lichens are a fixed partnership between at least two organisms: a fungus and a green alga, a blue-green alga—or both. The alga contain chlorophyll and provides the fungus with food in the form of sugars through photosynthesis. The fungus, which usually makes up the bulk of the lichen, provides the alga with some nutrients and protection from harsh conditions. Lichens with a blue-green algal component are able to fix atmospheric nitrogen. This mutually beneficial relationship allows lichens to inhabit some of the most hostile places on the planet including deserts, mountain tops and rocky seashores subject to salt spray.

Lichens obtain carbon dioxide, oxygen and inorganic nutrients from air and water. Because they are extremely efficient at absorbing water from mist, fog, dew and run-off they are very susceptible to atmospheric pollutants and can not survive in highly polluted areas.

In most areas the number of lichens far exceeds the number of flowering plants. For example, in rainforest there are usually four times more lichen species than flowering plants.

The identification of lichens is very difficult and often requires the use of highly toxic substances.

Ecological roles

Lichens quickly colonise bare soil which helps to retain moisture and prevent erosion. They physically and chemically break down rocks and contribute to soil formation.

Lichens contribute to nutrients in rainforests. Species are blown from the treetops, land on the ground and add nutrients to the soil. Some species fix atmospheric nitrogen; others trap nutrients from rain and mist.

Many birds use lichens in their nests. For instance, the Pink Robin decorates the outside of its nest with flakes of leafy lichens.

Menagazzia sp. on dogwood near the Minnow River.

Several species of crustose lichens on a rock at the Minnow picnic ground.

Slime moulds (Myxomycetes)

Slime moulds appear in similar habitats to fungi and, like fungi, they reproduce by spores. However, slime moulds are not fungi, and after a varied taxonomic history which has seen them placed in the plant, fungi and animal kingdoms, slime moulds are now classified as Amoebozoans.

Slime moulds have two completely different feeding stages. From their spores come single-celled amoebae that feed mainly on bacteria in the soil. Their second feeding stage—the plasmodial stage—feeds in the soil or on woody substrates on bacteria, algae, fungi, possibly lichens, and each other.

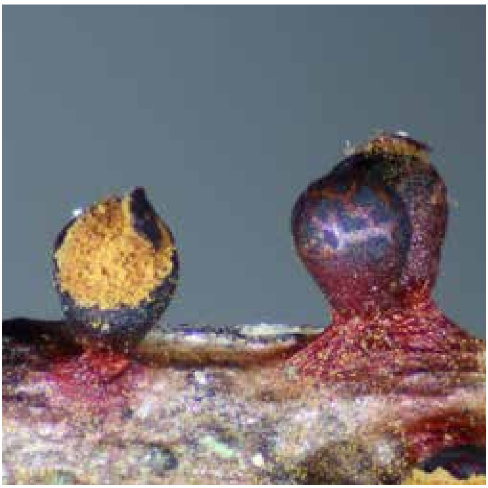
When conditions are favourable, the plasmodia start to transform to fruiting bodies. The average size is about 2 mm high, but they can be large amorphous blobs up to 10 cm across, or tiny stalked species little more than 0.1 mm high.

Apart from a handful of species, most slime moulds are difficult to identify and microscopic examination of their spores and other features is required.

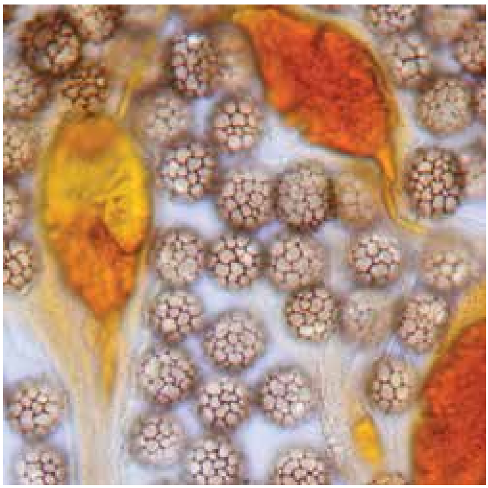
Ecological roles

Because slime moulds are thought to have little or no economic value they are mostly overlooked in biodiversity inventories. Their small size and ephemeral and unpredictable appearance makes their ecological roles difficult to assess. However, as they feed on bacteria at both their feeding stages, they are likely to be important in controlling populations of bacteria. Some species can remove toxic metals such as zinc from old mining sites.

Slime moulds provide food for a range of invertebrates. Collembola (springtails) feed on plasmodia and developing fruiting bodies and a range of beetle species feed on their spores.



A very extensive colony of *Trichia* sp. was collected from a fallen eucalypt at Minnow Creek.



Spores of *Elaeomyxa reticulospora,* a slime mould found at the Minnow picnic ground.

Flowering Plants

Flowering plants started to dominate the Earth at the end of the Cretaceous Period about 145 million years ago and are now the most species diverse plant group.

Ecological roles

Flowering plants—and all plants containing chlorophyll such as mosses, liverworts and algae—photosynthesise. Photosynthesis is a process by which carbon dioxide, water, and certain inorganic salts are converted into carbohydrates using chlorophyll and energy from the sun. A by-product of photosynthesis is oxygen which is important in making the planet habitable by other organisms.

Flowering plants are abundant in most terrestrial ecosystems. Different species have evolved to cope with different climatic conditions and soil types. For example, the range of species that thrive on the exposed sunny slopes at Kenzies Hill is very different from the species adapted to grow in shady riparian areas along the Minnow River.

Rapidly germinating species such as silver wattle and fireweed quickly colonise cleared areas. They shade the soil, help prevent erosion and protect the seedlings of plants that are slower to germinate.

Invertebrates—especially insects—live within the roots, branches and trunks of flowering plants where they feed on living or dead plant tissue. Some (e.g. bees) are specialised to feed on pollen, while others (e.g. weevils) feed almost exclusively on seeds. Spiders also live on plants where they hunt or ambush insects.

Marsupials such as pademelons and wallaby shelter during the day in the understorey; in the evenings they emerge to browse on grasses, sedges and shrubs.

Birds are dependent on flowering plants for shelter, nesting sites, and food in the form of nectar or seeds. Many Tasmanian bird species feed on insects, spiders and other invertebrates that themselves are dependent on plants for food and habitat.

Seed pods of Christmas mintbush.

New growth on mountain clematis, a common climbing plant in Tasmania's forests.

Cicada nymphs live in underground cells where they feed by sucking root sap. After 9 month to several years mature cicadas come to the soil surface and emerge from their nymphal skin. Exoskeletons are often found on the bark of eucalypts.

Top: some galls resemble flower buds but are structures formed by a plant in response to the presence of an invertebrate such as a mite, fly, beetle, moth or wasp. Bottom: galls on a eucalypt leaf.

Invertebrates

Over 90% of the world's fauna are invertebrates, i.e. snails, earthworms, spiders, millipedes, centipedes, springtails and insects. They are abundant and dominate the processes of terrestrial ecosystems.

Ecological roles

Soil-dwelling species such as worms and millipedes influence the structure of the soil. Bees and other insects regulate plant diversity by pollinating and dispersing seeds. Herbivorous species break down organic matter; predators and parasites control population of other animals and spiders control insect populations.

In turn, invertebrates are an important food source for birds, mammals and each other.

Birds

Birds are colourful, vocal and active so they are the most conspicuous component of the fauna. Many of the species observed in the Minnow catchment are endemic in Tasmania i.e. they are found nowhere else on Earth.

Ecological roles

Many of Tasmania's forest birds—including the robins, endemic honeyeaters, currawongs and whistlers—feed on invertebrates, especially insects and spiders. They are very important in keeping trees and other places free of species that may reach pest status if left unchecked.

Nectar-feeding birds perform the vital role of pollinating plants, and fruit and seed-eating birds perform a crucial ecological role of spreading seeds away from parent plants.

Raptors such as Wedge-tailed Eagles, hawks and falcons prey on living or dead animals. Introduced species including starlings, sparrrows, rabbits and mice form the main part of their diet where native animals have declined. Thus they are among the few species that control numbers of introduced species. Raptors keep prey populations healthy by taking weak, deformed and old individuals. Some clean up animal carcasses, especially road-kills.

Acknowledgments and References

I sincerely thank the Mount Roland Rivercare Catchment committee—Richard Sands, Greg Taylor, Julie Hargreaves and Barbara Alsop—for giving me the opportunity to undertake biodiversity surveys in the Minnow Catchment

This Mount Roland Rivercare Catchment Inc. project was supported by Cradle Coast NRM ......

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