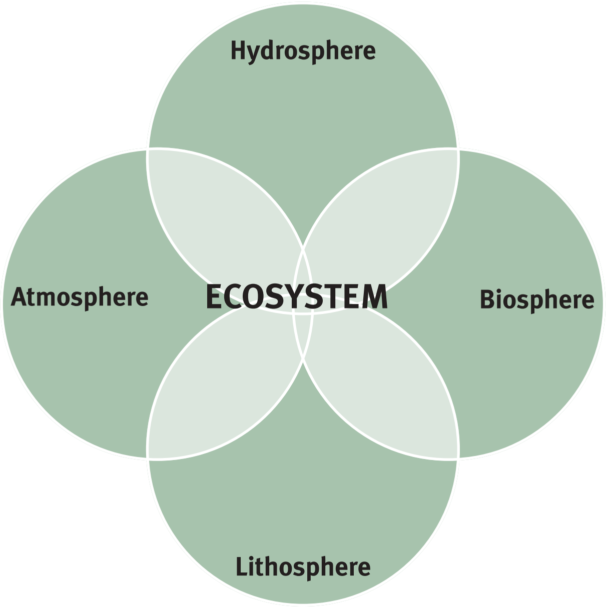
Ecosystems

An ecosystem is a term used to describe a community of plants and animals, and their interactions with the non-living aspects of the environment such as the soil, water and air. It is the study of the transfer of energy and matter between the living and the non-living world at a given location. This could include a garden, wetland, river, forest or coast.



What's in an ecosystem?

An ecosystem has two main components, the biotic or living component and the abiotic or non-living component.

Biosphere
Consists of all organisms in the five kingdoms:

- Monera – microscopic single celled prokaryotic organisms such as bacterias and the cyanobacterias, e.g. blue green algae
- Protistata – single celled eukaryotic organisms which include amoebas, diatoms, protozoa and slime moulds
- Fungi – (mostly) multicelled eukaryotic organisms including mushrooms, moulds and yeasts
- Plantae – (mostly) many celled eukaryotic organisms including most algaes, moss, ferns, conifers and flowering plants
- Anamalia – multicelled eukaryotic organisms including invertebrates – animals without backbones and vertebrates animals with backbones

Hydrosphere
Consists of all the water on earth including:

- Lakes
- Rivers
- Oceans
- Ice-caps
- Groundwater
- Water vapour

Atmosphere
Consists of the layer of air around the planet including:

- The troposphere that contains most of the oxygen
- The stratosphere which houses the ozone layer to filter harmful solar radiation

Lithosphere
Includes the Earth's crust and upper mantel.

- It consists of rocks and minerals, soil and nutrients needed to support life such as phosphorus

Why are there different ecosystems?

The physical characteristics of an ecosystem determine the species that are able to live there. For example, wet forests support plants that such as ferns that require moisture to complete their life cycles. These plants are unable to exist in hot dry climates.

Factors such as rainfall, temperature, light and salinity also impact upon the distribution of plants and ecosystem types.

What does an ecosystem do?

The function of an ecosystem is to harness the suns energy and transfer that energy between all living things. Ecosystems also cycle matter such as the nutrients in a plants leaves between their biotic and abiotic parts.

The processes that drive these cycles are interactions between the ecosystem components. Evaporation is an interaction between the hydrosphere and the atmosphere, taking heat out of the ecosystem. The process of photosynthesis is a interaction between the atmosphere, the hydrosphere and the biosphere.

Photosynthesis equation

Carbon Dioxide + Water + Solar Energy

=

Glucose + Oxygen

The flow of energy in ecosystems

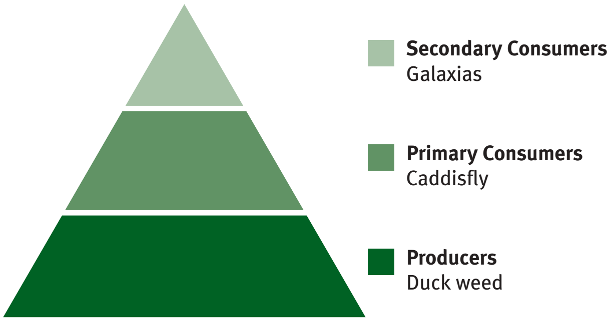
Organisms
Organisms have a functional role in the transfer of this energy based on where they are in the food chain. Producers or autotrophs can manufacture simple sugars via photosynthesis and the help of sunlight. This task is undertaken primarily by plants on land. In aquatic ecosystems, producers are phytoplanktons such as cyanobacteria and microscopic algae.

Once harnessed by plants, the energy may be transferred to animals through consumption. Animals that eat plants are known as herbivores. Animals that eat animals are termed carnivores. Some animals eat both plants and animals and are called omnivores.

The final stage of the cycle is to return the matter from dead plants and animals and their wastes back into useful matter for the ecosystem.

The decomposers are organisms that physically and chemically break down complex organic molecules into inorganic compounds that can then be utilised by the producers again.

Food chains and food webs
Food chains rarely have more than four feeding levels. Simple food chains can be identified in ecosystems by looking at the diet of an organism, i.e. Caddisfly larvae eat duckweed. But in reality these relationships are more complex,
i.e. a Caddisfly larvae eats not only duck weed, but grass and a variety of plant matter.



Biomass and ecological pyramids
Biomass refers to the weight of all organic matter in an ecosystem. Each feeding level has a different amount of biomass. For example, in a wetland ecosystem, there may be thousands of free floating duck weed (producer), a few hundred Caddisfly larvae (primary consumers) and only a handful of Galaxias (secondary consumers)

As energy in the form of food is transferred between each trophic level, a percentage is lost in the form of heat via respiration through the animal functioning.

The flow of matter in ecosystems

The main chemical elements of life are carbon, nitrogen, phosphorus, oxygen and hydrogen.
All these elements cycle through the living and non-living components of an ecosystem. Hydrogen and oxygen are usually referred to in the water cycle. These cycles are called biogeochemical cycles.

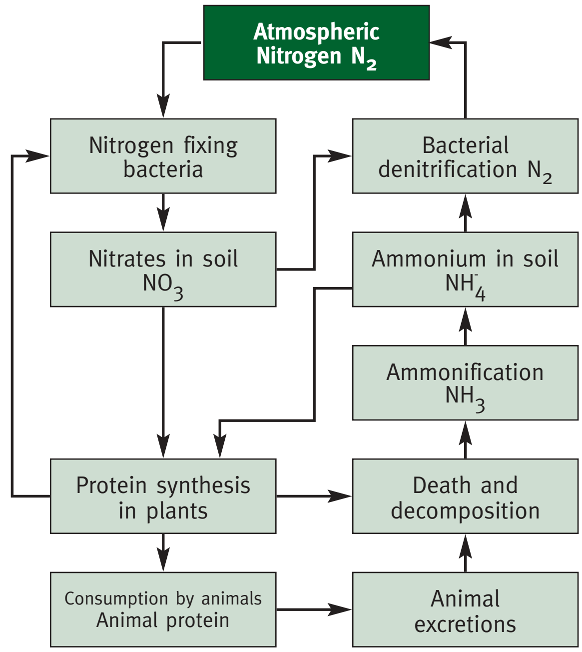
Ecosystems are complex. Appreciation of how they work has enabled the removal of dangerous chemicals such as DDT from our lives, and allowed for the development of sustainable agricultural practices.

Nutrient Cycling

The cycling of key nutrients necessary for plant and animal growth are called biogeochemical cycles. This is because the nutrients pass through living and non-living components of the ecosystems via chemical reactions during the cycles.

The key cycles are the nitrogen, phosphorous and carbon cycles. The hydrological cycle and sulphur cycle are often included as they directly and indirectly impact upon the other cycles.

Nitrogen cycle



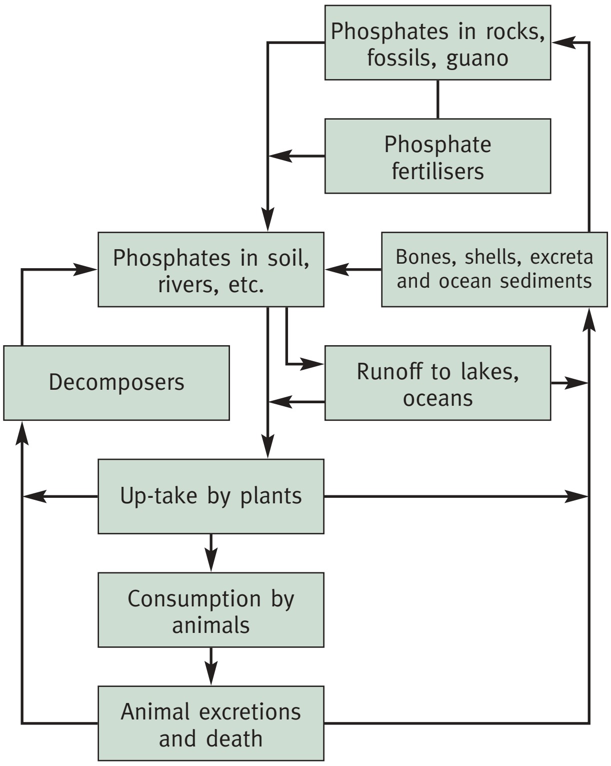
Nitrogen is essential for normal bodily functioning and is contained in proteins, enzymes, hormones and many vitamins. Nitrogen deficiency in plants causes stunting and yellowing, and in animals and humans is a key indicator of poverty related malnutrition.

Nitrogen gas makes up 80% of the atmosphere, but in this form it cannot be utilised by most living organisms. Nitrogen-fixing bacteria and some forms of blue-green algae can convert atmospheric nitrogen into nitrates, and make them available to plants.

Legumes such as acacias, beans, peas and clovers form a symbiotic relationship with the bacteria in special nodules on their roots. This enables them to 'fix' nitrogen into the soil, in the form of nitrates. These plants, as well as others, can then utilise the nitrogen.

The death of living organisms allows decomposers such as bacteria to break down the nitrogen from dead proteins into ammonia, which ultimately is available to plant roots as nitrogen, repeating the cycle.

Phosphorus cycle

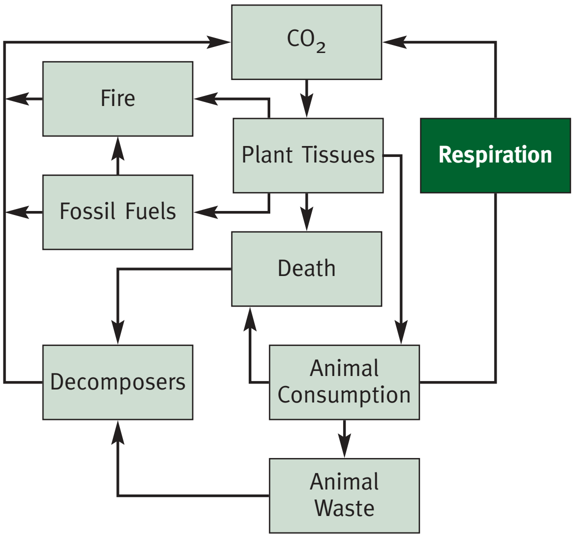


Phosphorus is an essential nutrient of plants and animals, where it is important for cellular respiration, cell membranes, as a component of DNA and RNA, and in teeth and bones.

Phosphorus cycles very slowly, beginning with the slow breakdown and weathering of rocks containing phosphate. The phosphates dissolve in soil water where they are taken up by plant roots.
These plants are then consumed by animals that utilise the phosphorus in their metabolism.

When the animals or plants die, they are broken down by decomposers in the ecosystem, making the phosphorus available again in the soil for a new cycle. Bird excreta and fish by-products are significant contributors to phosphorus levels in soil and water.

The carbon cycle



Carbon is the basic building block of carbohydrates, fats, proteins, DNA and RNA. Carbon dioxide (CO_2) comprises 0.036% of the atmosphere. Most carbon on Earth is stored in ocean floor sediments and carbon-rich organic rocks such as coal and peats.

The cycle commences with the process of photosynthesis. Atmospheric carbon dioxide is converted into complex carbohydrates for the creation of new plant tissue. Oxygen is released as a by-product. CO_2 is also soluble in water, where it is available to water plants and algaes. CO_2 in the form of carbonates react with calcium to produce calcium carbonate, for the production of marine organism shells and skeletons.

Carbon dioxide is returned to the atmosphere in a number of ways:

- Respiration by animals consuming oxygen and releasing CO_2
- Respiration of decomposers or predators feeding on living or dead plants
- Burning of fossil fuel reserves releases CO_2 and other carbon rich gases
- Volcanic eruptions
- Burning of trees and plants as firewood or for land clearing
- Weathering of carbonates such as limestone

Reference

Miller, G. Tyler (1996) *Living in the Environment: Principles, Connections and Solutions.* Wadsworth, USA.

CASE STUDY
Algal blooms in the Gippsland Lakes

Blue-green algae were one of the Earth's first organisms to photosynthesise. They are believed to be responsible for our oxygen rich atmosphere. They are naturally occurring in our waterways, and there are many different species. Some produce toxins that can be harmful to humans and animals. Algal blooms occur when there is excess nutrients in the water. All plants rely on nitrogen, carbon and phosphorus to grow.

Eutrophication is the process where excess nutrients such as phosphorus and nitrogen allow for the explosive growth of water plants and algae, including blue-green algae. Dissolved oxygen levels fall as these organisms die and are decomposed. This changes the nature of the water, making it difficult for fish and other aquatic organisms to survive.

Algal blooms can also affect the tourism industry of the Gippsland Lakes and as major blooms appear to be occurring more frequently this is a major concern for the region.

Nitrogen and phosphorus are soluble in water, and can be easily lost from land-based ecosystems into rivers, streams and lakes. Phosphorus levels are high in irrigation runoff water, transported on soil particles. Sewage is another source of excess phosphorus. It is thought that carp may disturb the lakes sediments, releasing phosphorus.

Managing phosphorus
Now that the role of phosphorus in algal blooms has been identified, the task is to reduce the loads from catchments into the lakes. It is important to maintain healthy streamside vegetation on public and private land to minimise soil erosion. Other methods such as better sewage treatment and replacing septic tanks will also help. Individuals can help by cleaning up after their dogs and gardening in an environmentally friendly manner. Boat users on the Lakes need to ensure safe disposal of boat toilets into pump out facilities.

Reference

www.gcb.vic.gov.au/gippslandlakes/documents/L6algal.pdf

Pest Plants and Animals

Pest plants and animals are organisms deliberately or accidentally moved from their own ecosystems and introduced to another. They are considered a pest because they impact negatively on natural and agricultural resources. It is unlikely that we will rid our environments of all introduced species. Management of pest plants and animals is often necessary to give ecosystems a chance to recover.

Types of pests

Weeds
There are four categories of weeds in Victoria:

1. **State prohibited weeds**
   These are weeds that either do not occur in Victoria and pose a significant threat if they were to establish or if present in Victoria, pose a significant threat and eradication is considered feasible.
2. **Regionally prohibited weeds**
   Weeds that are not widely distributed in a region, but are capable of spreading further. Eradication from the region is considered a possibility.
3. **Regionally controlled weeds**
   Weeds that are usually widespread in a region, that have sufficient impact. Control to prevent further spread is considered important.
4. **Restricted weeds**
   Plants that pose an unacceptable risk of spread if they were sold or traded.

Feral animals
These are usually domestic animals that have escaped into the wild or were introduced after European settlement, e.g. foxes, rabbits, pigs, goats.

Agricultural pests
Many species of insects and nematodes.

Environmental weeds
Plants that have naturalised and impact upon the value of native bush land. These can be introduced from overseas or other areas of Australia.

Marine pests
Introduced marine pests are species moved generally by human activities to an area outside their natural range, and that threaten human health, economic values or the environment.

Native animals as pests
Some native animals have adapted well to changing land use patterns and are considered agricultural pests, e.g. wombats, kangaroos, corellas. Restrictions on controlling these animals apply.

Common pests of Gippsland

Weeds
Blackberry, willows, ragwort, bridal creeper, thistles, cape broom, gorse, capeweed.

Mammals
Foxes, deer, rabbits, wild dogs.

Fish
Mosquito fish, carp.

Birds
Blackbirds, starlings, Indian mynas, sparrows.

Marine
Northern pacific sea star.

Pest ecology

Plants
Organisms in ecosystems have particular roles for example producers or consumers. If a plant is introduced into a new ecosystem it must be able to reproduce to survive. If the new environment falls within its limits of tolerance, e.g. it is not too cold or too salty, the plant will find a niche grow to maturity and reproduce. Once actively reproducing the plant is considered naturalised.

As a producer it will now be in a foreign food web. To perform the ecological functions of energy and matter transfer, it will need consumers to eat it and decomposers to release the organic compounds and minerals back into the ecosystem – for use by other producers. If nothing eats it or breaks it down it can dominate the landscape, locking up valuable nutrients and energy and actively causing the ecosystem to function poorly. The next step of the successful invader is to find a method of dispersal to inhabit more areas and ecosystems.

The rise of the blackberry to pest plant status occurred as European settlers planted it for food. Birds and foxes fed on the berries and excreted the seeds as they travelled, and a moderate climate enhanced its spread. In Europe, the blackberrys die back in winter, which helps to control its growth.

Animals
Many pest animals were introduced for human purpose by settlers in Victoria. The Acclimatisation Society of Victoria, whose sole purpose was to introduce foreign animals, performed some introductions such as the house sparrow and the blackbird. They also released game animals on Phillip Island in the 1960's to attract hunters.

Some members thought that the Australian bush was too quiet by day, and would like to hear the chattering of monkeys in the trees! Rabbits were introduced several times unsuccessfully before their successful introduction in Geelong in the 1840's.

Some pest animals such as goats, dogs, cats and pigs were domesticated animals that were lost or dumped, and managed to successfully adapt to independent conditions.

Finding a niche for a pest animal often means an impact on predator prey relationships or competition for resources . Introduced animals can also spread disease.

Management of pest plants and animals

It is unlikely that we will eradicate pests completely from our ecosystems. One of the aims of pest management is to reduce the impact of pest invasions on biodiversity by reducing their numbers. With pest plants, physical removal is a common practice, such as willow removal in our waterways. With animals, this often means culling species such as foxes.

Biological control
Biological control refers to the utilisation of biological agents, such as diseases or predators of a pest taken from its country of origin.

CASE STUDY
European Carp

Carp belong to the family of fish called cyprinids and are native to Asia. They are close relatives of the common goldfish. Carp were originally introduced in the 1960's to stock farm dams, but the practice has since been banned, however they still entered our river systems. The Murray Darling Basin has been infested with the carp, as have the Gippsland Lakes and all of their tributaries.

Carp have a higher tolerance to variations in water quality than many of our native fish; and can increase turbidity in slow flowing water due to their feeding on lake and river floors. They are prolific breeders and can out compete native fish for food. Carp have also been associated with bank erosion due to their feeding on bank vegetation.

Although an introduced species, Carp are a resource and need to be managed accordingly. Carp can be harvested and used for bait, fertiliser and human consumption. However, Carp have responded positively to already stressed aquatic ecosystems. One of the best tools in reducing their impact is to ensure that rivers and streams are in peak condition, and provide suitable habitats for our native fish. Currently there are no known sightings of Carp in the healthy rivers of Far East Gippsland.

Waterwatch run 'Catch a Carp' days each year in the Gippsland region, contact your local Waterwatch for information.

Resources

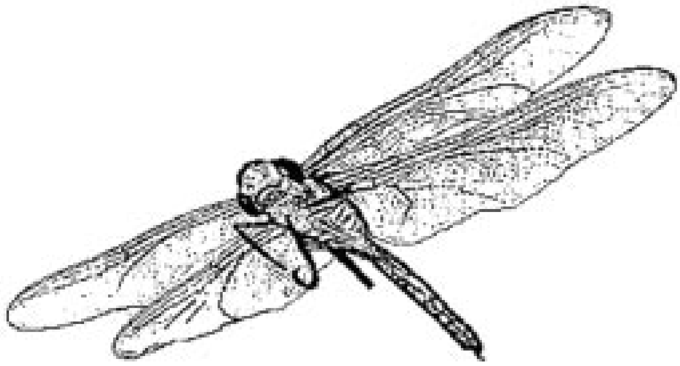
Co-operative Research Center for Australian Weed Management
www.weeds.crc.org.au

Biotechnology Australia online school resources
www.biotechnology.gov.au

Macroinvertebrates

Invertebrates are animals without backbones; they include insects, worms, snails, shrimps, water fleas and more. 'Macro' means visible with the naked eye. Many aquatic invertebrates are called macroinvertebrates. They form an important part of the food chain. Their survival depends on appropriate water quality and habitat. By sampling and identifying macroinvertebrates at different locations, we have a clearer idea about the 'health' of the waterway.

Why are they important?



Macroinvertebrates form an important part of the aquatic food chain. Sunlight is converted to energy by aquatic plants and algae. The plants are then eaten by invertebrates, which are in turn eaten by larger invertebrates, which are eaten by fish, birds, frogs etc. Many macroinvertebrates also help decompose organic material.

Where do they live?

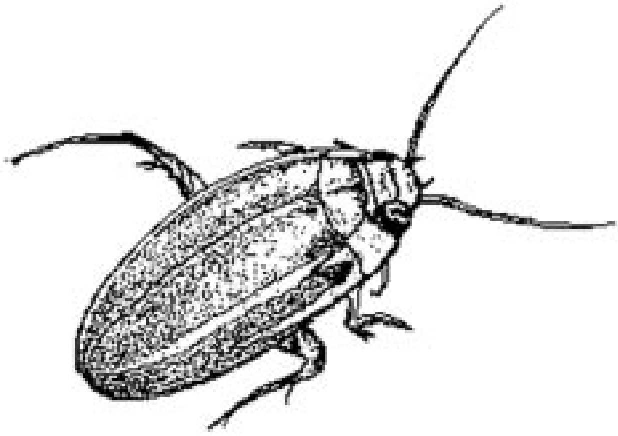
Moving water such as rivers, creeks and streams
Moving water is different from still water, and organisms must be adapted to these different conditions. Within a river or stream the water flows vary.

Habitats include:

- Riffles – the shallow rocky parts of rivers with fast flow
- Pools – deeper and slow flowing water
- Runs – the transition between pools and riffles

The organisms in riffles are adapted to faster-flowing waters, whereas the animals in pools are adapted to slower-moving water. Organisms living in moving water must be able to 'hang on'. They have streamlined bodies, or special hooks or suction-type attachment structures. Some organisms build structures to keep themselves in place such as caddisfly larvae.

Still water such as wetlands, backwaters, lakes and pools
Organisms in still or slow-moving water don't have to hang on. Pools in streams are considered slow-moving waters, which means that these organisms must actively search for food. They are not necessarily streamlined; they have adapted to move. Some have adapted to live on the surface, some live on the bottom, some live in the leaf litter around the edges, and others burrow into the soft sediments. You often see a wider range of sizes and shapes among the organisms in still or slow-moving water.



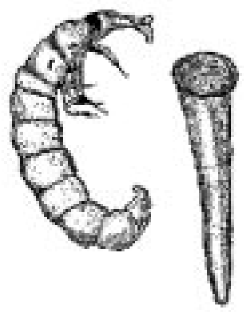
Macroinvertebrates as indicators of waterway heath

In ecosystems, high diversity or number of different species is an indication of a stable or healthy system. In order to survive, macroinvertebrates need specific ranges of environmental conditions such as temperature, oxygen levels, pH and salinity. Reduced water quality can affect macroinvertebrates by decreasing macroinvertebrate diversity, leaving only those species tolerant of poor water quality.

Other factors that lead to a reduction in species diversity include:

- Pollution
- Increased sediments that reduce light penetration to aquatic plants and smother gravel habitats
- Removal of riparian vegetation, which supplies food in the form of organic material such as leaves and bark and keeps water temperatures cool
- Removal of snags or woody debris. This provides habitat and moderates water flow
- Barriers such as dams, which can alter the natural, flow regime
- Increased nutrients from catchment run-off will change the ecosystems

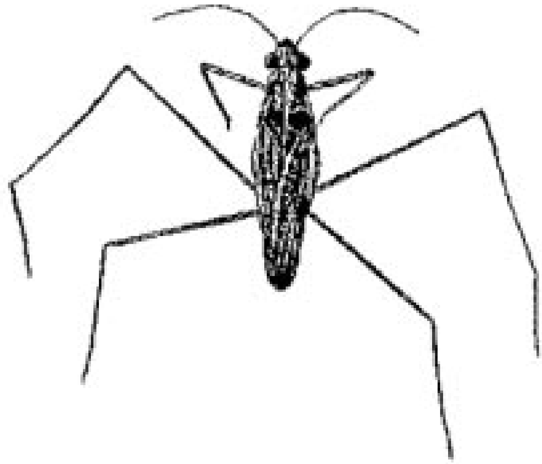
CASE STUDY
The Crafty Caddis Fly



The adult caddis fly of the Trichoptera Order is similar in appearance to other flying insects. They are short lived fast fliers that are mostly seen at night gathering around lights near streams and ponds. The larvae of the Caddis fly however are very distinctive. Many build themselves a small tubular house out of sticks, stones, plant material or sand. The larva holds itself in the tube with hooks coming from the end of its abdomen.
The larvae can anchor itself or have a portable case it carries with it. So when collecting macroinvertebrates watch out for tiny sticks or stems that appear to have heads or legs and may be swimming along, they probably contain the crafty caddis!

Reference

Hawking, J.H., Smith, L.M., Le Busque, K. (2004 onwards) Identification and Ecology of Australian Freshwater Invertebrates.
www.clw.csiro.au/ColourWebGuide/



References

www.vic.waterwatch.org.au

Gabas, Stephan. *Aquatic ecosystem assessment using Macroinvertebrates Organisms as a Bioindicator*. SGS Australia.

Resources

Waterwatch Victoria
www.vic.waterwatch.org.au

Managing our Biodiversity

Biodiversity is the variety of all living things; the different plants, animals and microorganisms, the genetic information they contain and the ecosystems they form. Unlike resources such as oil and coal, biodiversity is renewable – but only if we use it and nurture it wisely.

Gippsland's biodiversity

In Victoria a Biodiversity Strategy was launched in 1997. It highlights 21 'bio-regions' that identify the patterns of ecological characteristics in the landscape or seascape. Bio-regions are areas of similar vegetation, topography and climate.
The bioregions of the Gippsland area include:

1. Victorian Alps
2. Highlands – Southern Fall
3. Highlands – Northern Fall
4. Coastal Plains – Gippsland Plains
5. Wilson's Promontory
6. East Gippsland Uplands
7 East Gippsland Lowlands
8. Terrestrial Wetlands
9. Rivers and streams
10. Coastal zone

These bio-regions consist of many different ecosystems which are identified as broad vegetation types. For example, the Gippsland plain bioregion has fourteen broad vegetation types including Plains Grassy Woodlands and Swamp Scrub complexes. There are less than 2% of the original areas left of these broad vegetation types – mostly because these ecosystems were easily cleared for agriculture.

Threats to biodiversity

Any action that causes the reduction in the number of different species in an ecosystem, or the loss of an entire ecosystem, is termed a threatening process. Threatening processes include human activities such as land clearing, pollution and processes associated with European settlement, such as introduced plants and animals, changed fire regimes and erosion.

The goals of biodiversity management in Victoria

The broad goal in Victoria is to see a reversal of the decline in the amount and quality of our vegetation, with no net loss. Other goals include:

- that ecological processes and the biodiversity that depends upon our terrestrial, freshwater and marine environments are maintained, and in some cases restored (such as creek side vegetation)
- there should also be no further decline in the viability of any rare species or ecosystem

Managing biodiversity

All levels of government and the community are responsible for the management of biodiversity.
At a federal level there is a National Strategy for the conservation of Australia's Biological Diversity.
At the state level, the Flora and Fauna Guarantee Act 1988, governs the management of plants and animals. Its Biodiversity Strategy outlines the goals of the state government and the methods of maintaining biodiversity.

At a local level, there are council vegetation clearing by-laws and the Victorian Planning Provision Framework. Organisations such as Catchment Management Authorities work with local councils and landholders to restore streamside vegetation.

Volunteer programs such as: Land for Wildlife, the Good Neighbour Initiative, Waterwatch, Field Naturalist Clubs, Parks Victoria Friends groups, and Threatened Species Networks, all work together to monitor and restore biodiversity in Victoria.

There are over 700 Landcare groups whose members are farmers that realise that healthy ecosystems on farms mean healthy farms and better productivity.

School involvement in Waterwatch is a great way to monitor Victoria's wetlands, rivers, streams and coastal zones.

CASE STUDY
Gippsland's threatened species

There are many animal species in Gippsland that are considered threatened due to loss of habitat. Examples include:

Baw Baw Frog – Philoria frosti
The Baw Baw frog is only found in an 80 km^2 area on the Baw Baw plateau. It needs a special habitat to survive. Unlike most tadpoles, Baw Baw tadpoles do not eat. They hatch with a yolk sac that feeds them until they become frogs. They do not swim either; developing into frogs under vegetation and leaf litter, where there is little free flowing water. It is thought the original population was between 20,000 and 30,000 frogs. Now less than 600 remain. The cause of decline for the Baw Baw frog is unknown, but could include climate change, pollution, habitat destruction or disease.

White-bellied Sea-eagle – Haliaeetus leucogaster
The White-bellied Sea-Eagle is a large bird of prey with a low Victorian population. It is estimated that approximately 25 pairs live around the Gippsland Lakes, 25 pairs around Corner Inlet and a further 50 pairs throughout the rest of Victoria.

The threatened status of the species can mostly be attributed to human disturbance including habitat fragmentation and nest disturbance.

Although there is little direct evidence, other possible threats include: poisoning during pest animal control programs;; deliberate shooting; eggshell thinning because of the past use of DDT; and food chain contamination by heavy metals. Immediate objectives by natural resource managers include gaining an accurate estimate of the total breeding population, identifying and protecting all known nest sites; and maintaining and improving areas of suitable habitat.

(Source: Department of Sustainability and Environment: Approved Action Statement For Animals No. 60)

The Giant Gippsland Earthworm – Megascolides australis
The Giant Gippsland Earthworm is one of the world's largest earthworms. It is restricted to a small area in the Bass River Valley of South Gippsland bounded by Loch, Korumburra and Warragul. Recent studies showed that the worm was only found in 6% of the area surveyed and that over 80% of the worms were found within 40m of creek banks!

It is considered vulnerable, meaning that the species may risk extinction if there is continued pressure on the population through habitat destruction.

Therefore the most important way of conserving the earthworm is to protect its habitat, stream banks.

Other threatened fauna species include:
Barred Galaxis
Giant Burrowing Frog
Eastern Quoll
Helmeted Honeyeater
Hemiphlebia Damselfly
Hooded Plover
Large Ant Blue Butterfly
Leadbeater's Possum
Little Tern
Longfooted Potaroo
Regent Honeyeater
Southern Right Whale
Spot-Tailed Quoll
Tasmanian Pademelon
Warragul Burrowing crayfish

References
www.dse.vic.gov.au
www.wwf.org.au
www.birdsaustralia.com.au

Resources

Victorian Museum
www.museum.vic.gov.au/bioinformatics/

Department of Sustainability and Environment
www.nre.vic.gov.au/plntanml/biodiversity/

Australian Natural Resources Atlas
audit.ea.gov.au/ANRA/atlas_home.cfm

Australian Museum Website
www.austmus.gov.au/biodiversity/

Fire

OUR BIODIVERSITY

Fire, as a natural event, has been a part of Australian ecosystems for millions of years. Many of our plants and animals have evolved strategies to ensure they recover from fire. Aboriginal use of fire has been recorded from earliest European colonisation. Early pioneers sited low intensity fires that were used for cooking and warmth. Aboriginal people also managed grasslands by burning to encourage grass growth and to assist in hunting.

Fire in Gippsland

Fire has different impacts on landscapes depending upon the fire regime. There are three variables that impact on fire regime, the intensity of the fire, how frequently the fire burns and what season the fire occurs. Severe fires such as those in 1939 and 2003 occurred during extremely hot summers after many years of below average rainfall.

Although devastating to people, property, infrastructure and animal populations, the environment will regenerate. However, fires at high frequencies do have the ability to change ecosystem composition.

If plants that generate from seed do not grow to maturity and produce seed before the next fire, that species can be lost from an ecosystem.

The effects of fire on our catchments

Biodiversity
The immediate impact of fire is the loss of our vegetation. However, grass trees soon burst into flower and seed. Eucalypts such as Eucalyptus radiata, shoot buds from specialised epicormic buds beneath their thick bark. Acacia species may regrow from seed or from root suckers after fire.

Animal populations loose their habitat after fire. Fire of low intensity may allow for species such as possums to shelter in tree crowns. Many insects and spiders are killed, but flying insects may escape. There is no doubt that the habitat changes caused by fires impact upon our animal species in the form of loss of food and shelter. A regrowing forest then provides new habitat and food chains become established again.

Soil
The soil undergoes many changes after a fire. Low intensity fires may sterilise the soil, destroying plant pathogen and leaving the soil ready for germination of new plants. High intensity fires create an ash bed that is high in plant nutrients such as nitrogen and phosphorus. Heavy rain after fire can lead to leaching of nutrients and erosion before plants recolonise and stabilise the soils.

Water
Fires can impact heavily on water quality and quantity. After fire, soil and ash are mobile and rainfall may wash these into waterways, impacting the aquatic ecosystems. After the fire there may be increases in surface runoff into streams and rivers, increasing flows.

After the forest regenerates the actively growing trees have a high demand for water, reducing the surface and groundwater flows from a catchment.

Ecosystem recovery from fire

In the first few weeks after a fire, plants begin to recover. Eucalypts sprout from epicormic buds and wattles and peas grow from root suckers. Many fast growing herbaceous plants appear. These are vital in quickly trapping nutrients and stabilising soils. Over time these species are out competed. Insects and mobile animals begin to return to the area and birds are attracted to flowering plants.

As the forest matures, many species are out competed as there are limited amounts of nutrients, space and light available. The species diversity decreases as the forest begins to resemble the structure of the original vegetation type.

CASE STUDY
Fire and endangered species

Ecologists have found that plant and animals vary in their requirements of fire frequency. Some species require frequent fires, but others such as the mountain pygmy possum could perish under a regime of frequent fires. One of their key food sources, the mountain plum pine, is highly fire sensitive.

The eastern Victorian fires in 2003 burnt more than one million hectares. The fires burnt in significant areas of the Victorian alpine region, including the Alpine National Park and Snowy River National Park. It is estimated that a number of threatened species have been affected by the fires.

The fires may have impacted upon threatened species such as; the mountain pygmy possum, tiger quoll, brush-tailed rock wallaby, spotted tree frog, long-footed potoroo, eastern wallaroo, Alpine tree frog, Alpine water skink, Alpine she-oak skink, Alpine bog skink and the Booroolong frog.

Impacts range from changes in water quality to loss of habitat and food sources.

Resources

Parks Victoria
www.parkweb.vic.gov.au

Victorian National Parks Association
www.vnpa.org.au

Department of Sustainability and Environment
www.dse.vic.gov.au