Solomon Islands Forest Life

Information on biology & management of forest resources

Tyrone Lavery, Patrick Pikacha & Diana Fisher

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For further information please contact:
Tyrone Lavery: tyrone.lavery@uqconnect.edu.au

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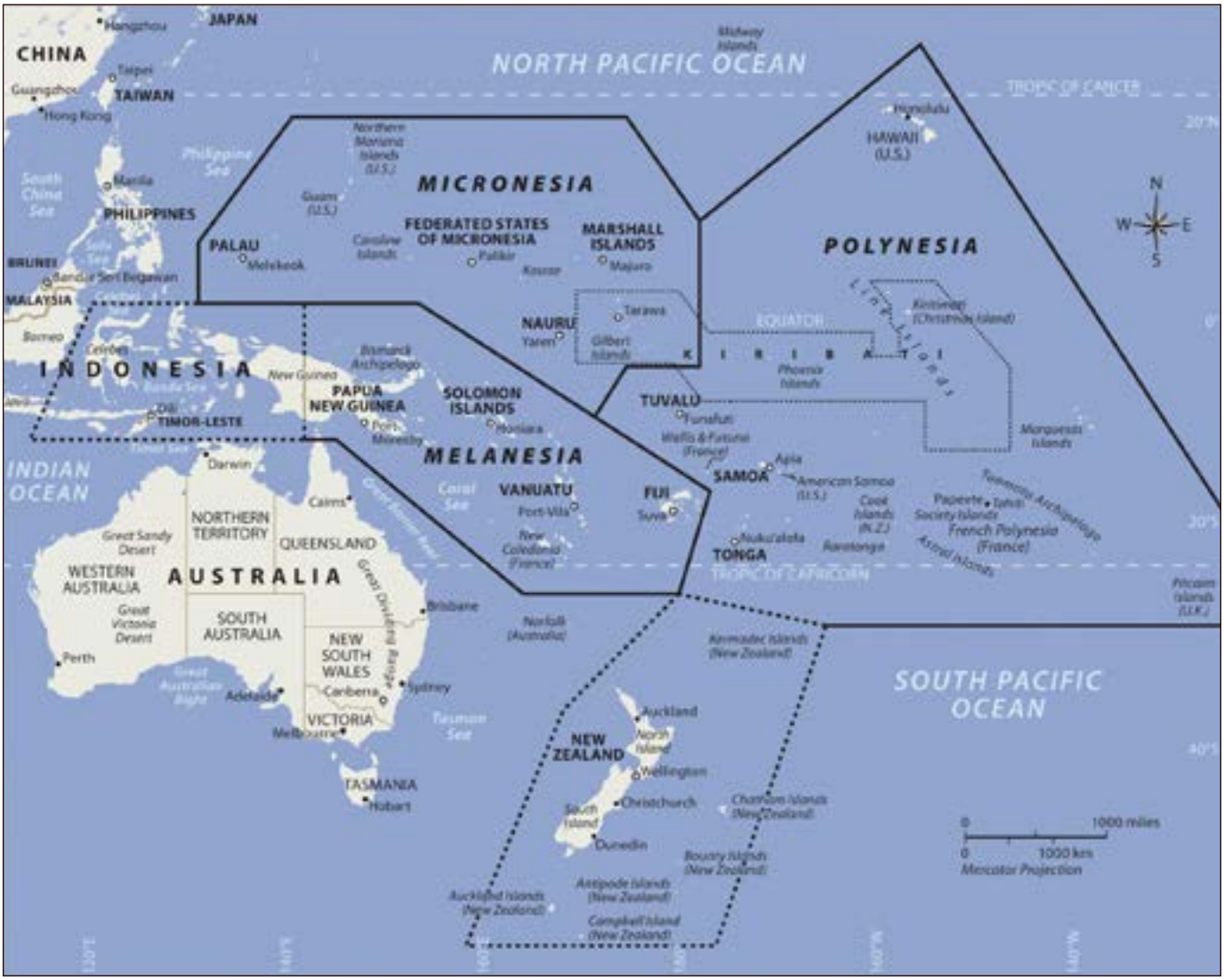
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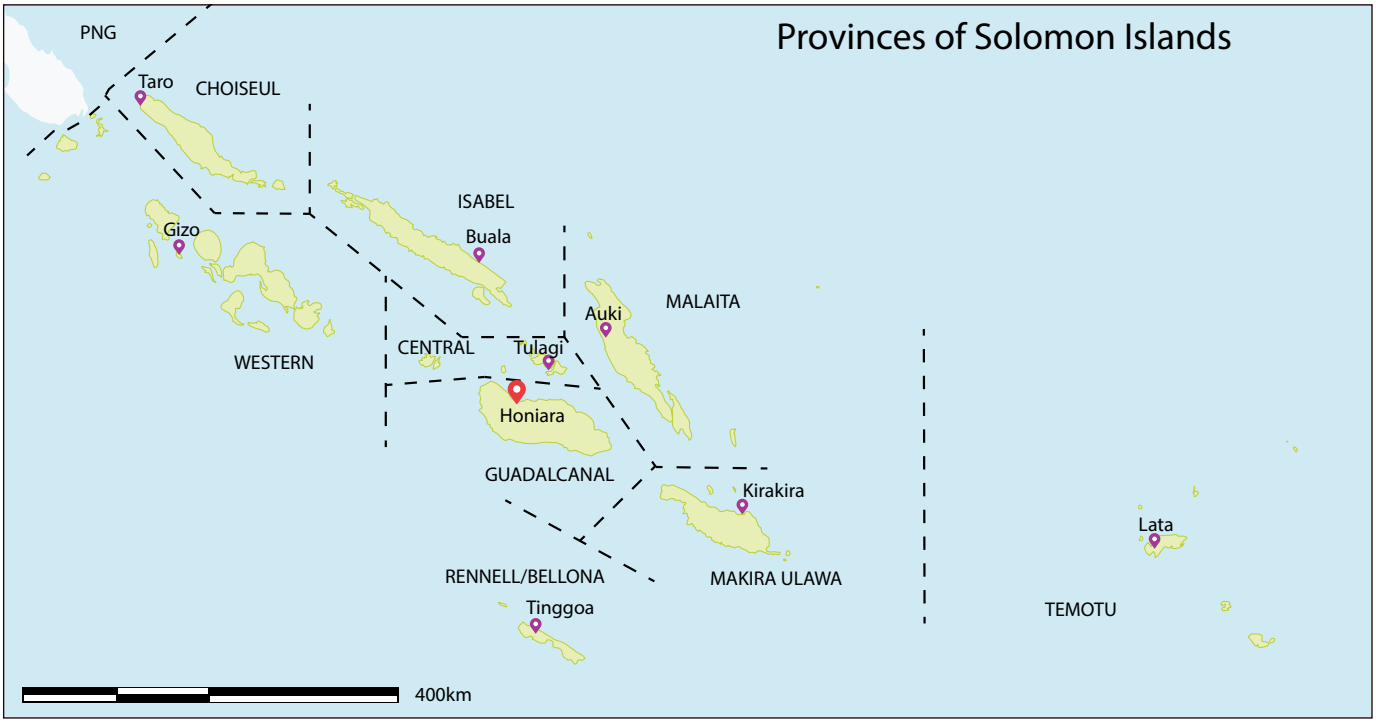
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Lata
RENNELL/BELLONA
MAKIRA ULAWA
Tinggoa
TEMOTU
400km

Introduction

Solomon Islands Forest Life gives an overview of the terrestrial environments of the Solomon Islands, their ecology, important species, and some of the key threats they face. The Solomon Islands are one of the most biologically rich archipelagos on earth. Huge proportions of the animals and plants found there are endemic, meaning they are found nowhere else on earth. These species are closely linked to the culture, livelihoods and well being of people.

Commercial logging, mining and a fast rate of population growth threaten the forests of Solomon Islands and are placing increasing pressure on natural resources. This book aims to complement the already deep understanding of the terrestrial environment by Solomon Islanders, allowing them to learn more and assist them in understanding how to manage new threats. This book and its companion *Solomon Islands Marine Life*, together provide a unique resource on the extraordinary natural world of the Solomon Islands.

Photo: P.Pikacha

Mottled flowerpecker

Bird watching at Betikama

Photo: P.Pikacha

Solomon Islands Biodiversity

Solomon Islands are part of the East Melanesian Islands 'biodiversity hotspot'. A biodiversity hotspot is a region identified by scientists that contains an unusually high number of species.

The Solomon Islands support unique and fascinating plants and animals. It is important to understand what has shaped ecology in the Solomon Islands as it helps us understand how the country is unique and the importance of conservation and sustainable development.

The diversity of life in Solomon Island forests are the result of a number of interacting factors that operate in very interesting ways. These factors are constantly shaping and altering the communities of animals and plants over time and include:

- climate (temperature, rainfall, cyclones);
- geology and soil types;
- volcanic activity and plate tectonics;
- salt air and salt water;
- flooding by freshwater;
- fire;
- isolation of the islands;
- interactions between different animals and plants; and
- human interactions.

All of these factors operate together, and can be constantly present or can occur as rapid events resulting in dramatic change.

Marovo Lagoon

Photo: P.Pikacha

Island Biogeography

The sizes, heights and degrees of isolation of the various islands also play a big part in determining which animals and plants can be found on them. Biogeography is the study of how plants and animals are distributed in the environment. The Solomon Islands are one of the best places in the world to study island biogeography - how different animals and plants are distributed among islands of different sizes and distances from other islands. Islands that are large and close to other islands or land masses like New Guinea tend to have a greater number of species, whereas those that are small and isolated generally have fewer species. There are endless possibilities between this - some islands are large and very isolated and some islands are small and very close to other land masses.

There are also other factors that play a role. For example, sea levels have not always been at the levels they are today. Approximately 18,000 years ago sea levels were up to 130m lower than they are at present. This meant that many of the islands we recognise today were joined together by land bridges (shown in grey). Buka, Bougainville, Choiseul, Santa Isabel, Ngella and possibly Guadalcanal were all joined as a single island. Many of the Western Province islands were also joined together.

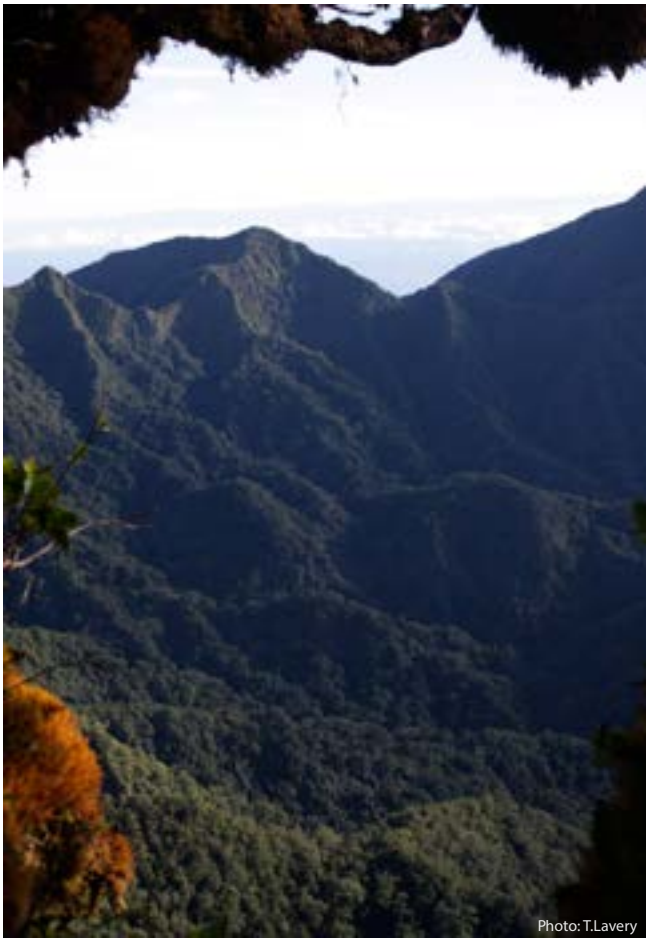


Photo: T.Lavery

The islands that were joined together often share many of the same species. Because the islands that joined together formed a larger area of land, they can also sometimes support more species than is expected for their size.

Other factors that influence how many and what types of species an island can support include:

- → how long it has been isolated from other land;
- → habitat suitability (including climate and which other species occur there);
- → location relative to ocean currents; and
- → the human activity/disturbance on the island.

Maraone Village, Makira

Climate

The climate of the Solomon Islands is influenced by its location close to the equator and the moisture provided from the surrounding ocean. Winds, temperature, humidity, rain and geography (the shapes and positions of islands) are all related and interact to produce weather patterns.

The south 'trade winds' can divide the climate into wet and dry seasons depending on which direction the wind is coming from. However, this rainfall does not always follow a regular pattern due to 'inter-tropical doldrums' which can extend the dry season on some islands.

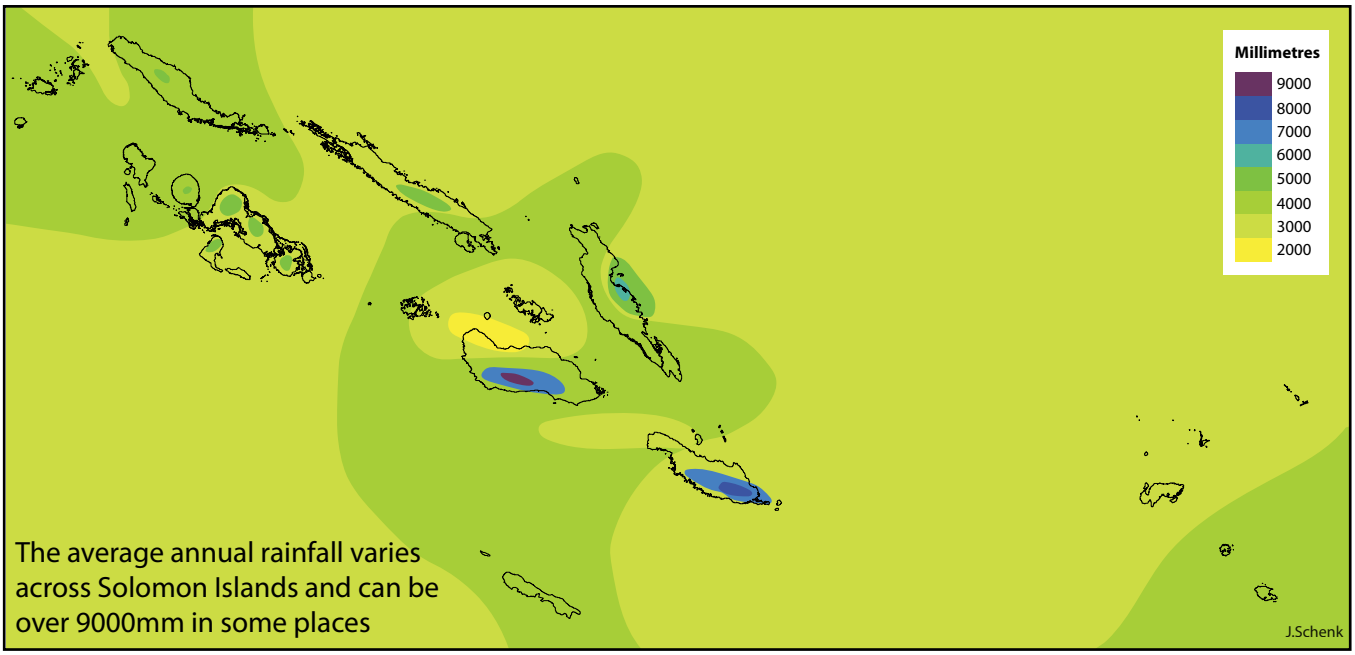
Wind

During April to November (which is usually the dry season) the steady trade winds blow from the south-east resulting in fine days and occasional rain. In November to April, these winds normally change, blowing from the northwest and bringing with them heavier rains.

Rainfall

Some islands have a 'double maxima' in rainfall (there are two periods of the year when high rainfall is received). These usually occur between July and August and again between December and March. These periods of heavy rainfall are followed by minima in May and from October to November.

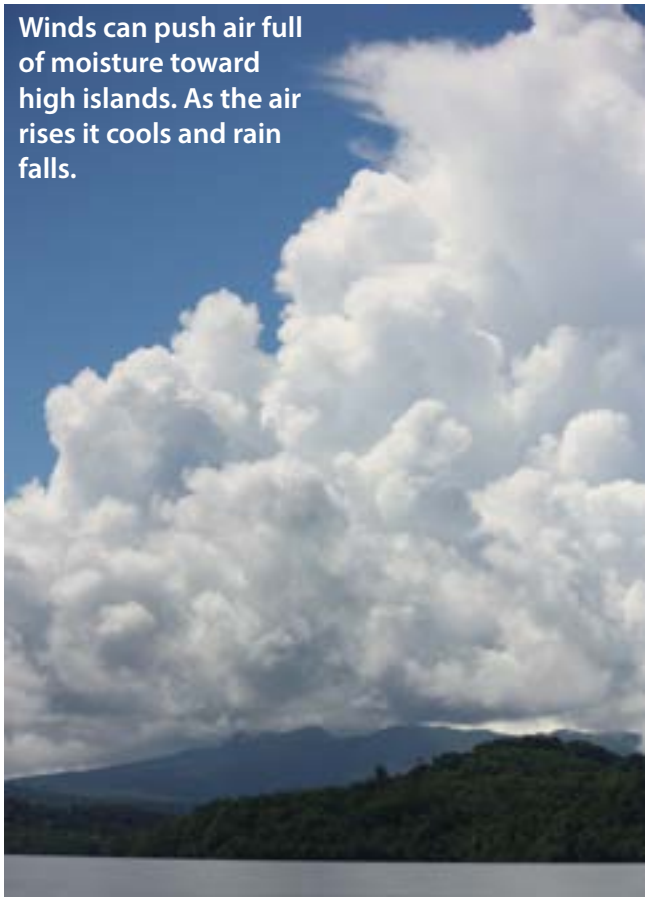
Where mountain ranges occur on the major islands there is often only a single maximum and minimum that occurs. Rainfall direction is also variable with some islands receiving the heaviest



The average annual rainfall varies across Solomon Islands and can be over 9000mm in some places

rain from the south-east, some from the north-west and others receive it from both directions.

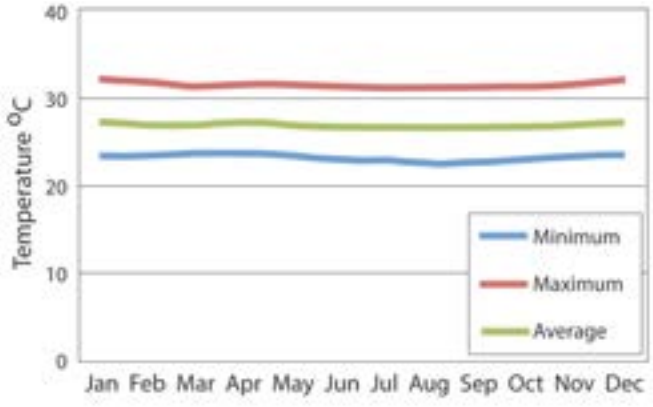
The average rainfall in Solomon Islands is 3,133mm per year but it can be as low as 2,000mm per year in the 'rain-shadow' of Guadalcanal and as high as 9,000mm on the mountainous 'weather-coast' of that island. Rain-shadow areas are not only found on Guadalcanal but also northern Makira, Florida Islands and the southern coasts of Santa Isabel and San Jorge Islands.



Winds can push air full of moisture toward high islands. As the air rises it cools and rain falls.

Temperature

Temperature in the Solomon Islands shows little seasonal variation throughout the year. The average maximum temperature is 29.8°C and the minimum 22.9°C. The lowest temperatures occur in July (average 24.6°C) and the highest average temperature is in January (26.1°C). These consistently high temperatures contribute to high humidity and rainfall patterns.



Humidity

Humidity (the moisture in the air) in Solomon Islands is high compared with other parts of the world. This high humidity (varying between 90% in the warmer months and 60% when it is cooler) is partly maintained by the high temperatures and areas of ocean that surround the islands.

Cyclones

Tropical cyclones affect the Solomon Islands between November and April. In the 41-year period between 1969 and 2010, 41 tropical cyclones passed within 400km of Honiara, an average of one cyclone per year. The number of cyclones varies widely from year to year, with none in some seasons but up to five in others. Over the period 1969–2010, cyclones occurred more frequently in El Niño years.

Forest life

The forests of Solomon Islands are rich in life. This book covers some of the more common and well known species. Many more are out there waiting to be discovered.

Flora

Flora (or plants) are an essential part of the natural world. They convert carbon dioxide to oxygen, provide habitat for animals, regulate the water cycle and provide many products that people use every day.

10

Algae

Algae are a diverse group of organisms that are not necessarily closely related. Most are aquatic (live in water) and have chlorophyll.

11

Bryophytes

Bryophytes include mosses and liverworts, they are non-flowering, do not have a vascular system (tubes that transport water and nutrients within plants), do not have true stems and leaves and do not reproduce by seed.

12

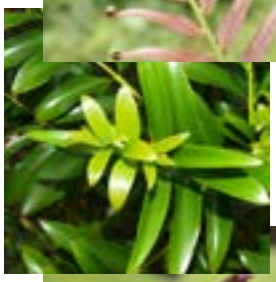
Ferns

Ferns are a group of non-flowering plants that have a vascular system and stems and leaves. Ferns reproduce by spores that can be found on the backs of their leaves.

13

Gymnosperms

Gymnosperms are an ancient group of plants that includes conifers, cycads and gnetales. They are non-flowering plants that produce seeds, have a vascular system and true stems and leaves.



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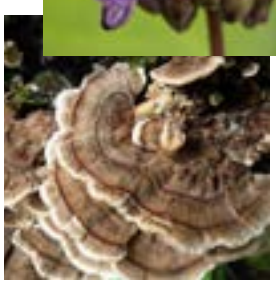
Angiosperms (Flowering Plants)

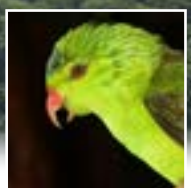
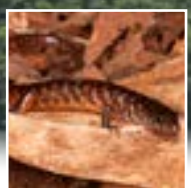
Flowering plants are the most diverse group of plants that includes many of the plants that people rely on for food. Angiosperms produce flowers that are specialised structures for reproduction.

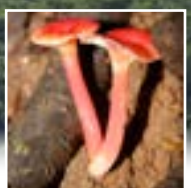
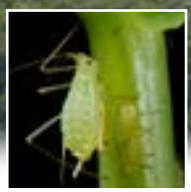
33

Fungi

Fungi are different from plants, animals, protists, and bacteria. They become more noticeable as mushrooms and moulds when fruiting and are important for recycling nutrients that are important to other organisms.



Fauna

The term fauna is used to describe all animal life. Fauna include invertebrates that are animals without a back-bone (e.g. insects and arachnids) and vertebrates that do have a backbone (e.g. reptiles and birds).

Insects

This group include beetles, dragonflies, bees and wasps, ants, bugs and butterflies.

Arachnids

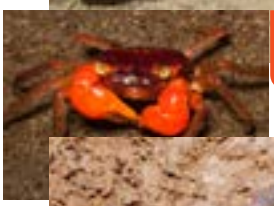
Spiders, scorpions, ticks and mites are all examples of arachnids.

Centipedes & millipedes

Centipedes and millipedes have segmented bodies and one pair of antennae.

Crustaceans

Crustaceans are primarily marine, but there are freshwater and terrestrial species.



Annelid worms

Annelid worms include earthworms and leeches. Earthworms are important for nutrient recycling.

Molluscs

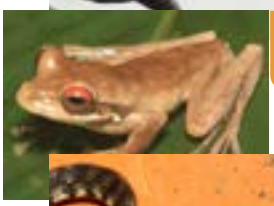
The greatest diversities of molluscs live in the sea, snails and slugs are examples of molluscs that live on land.

Freshwater fish

The freshwater fish of Solomon Islands are important indicators of water quality.

Amphibians

Frogs are the only type of amphibian that occur in Solomon Islands.

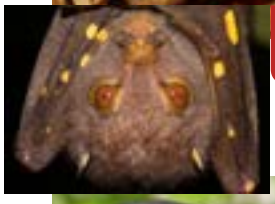


Reptiles

Reptiles are vertebrates and include skinks, geckoes, monitor lizards, dragon lizards, snakes and crocodiles.

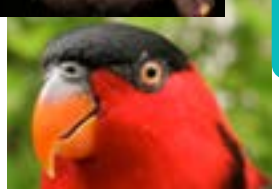
Mammals

The main mammal groups that occur in Solomon Islands are bats and rats. However pigs, possums, dogs and cats are also examples of mammals.



Birds

Birds are vertebrates with feathers and beaks. They can often fly and produce distinctive songs that can be used to identify different species.



Flora

Photo: P.Pikacha

Introduction

Flora (or plants) are essential components of the natural world and without them we would not survive. Humans rely on plants and the vegetation communities they form for:

- Air: the oxygen we breathe is produced by plants through a process called photosynthesis.
- Food: everything we eat comes directly or indirectly from plants.
- Plant products: they produce many useful products like timber, natural dyes, oils and medicines. Many of the houses in Solomon Islands are made entirely from plants.
- Habitat: plants create the habitat needed by most species of animal
- Water: plants regulate the water cycle. They help distribute and purify water and they help move water from the soil to the atmosphere by transpiration.
- Climate: through transpiration, plants help cool the planet. They store carbon and through this process they remove carbon dioxide from our atmosphere and reduce the potential for climate change.

Photo: P.Pikacha

Photo: D.Young

Types of plant

The group of organisms referred to as plants includes green algae, mosses, liverworts, ferns, conifers (or gymnosperms) and flowering plants (or angiosperms). Red and brown algae, lichens and fungi are not plants.

Angiosperms (flowering plants) are the most diverse group. They have what is known as a vascular system, their reproductive structures are flowers and they produce seeds and fruits. Because they are the most diverse and numerous group, flowering plants are also the dominant photosynthetic organisms in most **terrestrial ecosystems.** Most important food plants are angiosperms. The largest plant families are orchids, daisies and legumes (e.g. beans).

Algae

The term algae is used to describe a diverse group of organisms that are not necessarily closely related. Most are aquatic (live in water) and have chlorophyll (green pigments) that allow them to convert sunlight into food. Organisms that can convert sunlight into food are photosynthetic.

Algae are found in both freshwater and marine environments. They lack the structures that plants have (e.g. leaves, roots and vascular systems). They can be single celled, many celled (e.g. as filamentous long strands of cells), or have bodies similar to other plants with different cell types.

Green algae

Most green algae occur in fresh water, usually attached to submerged rocks or as scum on the surface of the water. There are also some terrestrial and marine species. Green algae can be motile (able to swim) or nonmotile (unable to swim). Their cells have a central cavity (or vacuole) and pigments like chlorophyll to capture light and produce energy. Each cell has an outer wall made of two layers. Green algae can be important as food and a source of oxygen for other aquatic organisms.

- → *Most algae are photosynthetic*
- → *Excess nutrients in the water can cause Cyanobacteria blooms that are toxic to people*

A blue-green algae bloom

Cyanobacteria (blue-green algae)

Cyanobacteria are commonly referred to as algae but are more closely related to bacteria than other algae. They use photosynthesis to produce carbon and can also use nitrogen from the atmosphere. This nitrogen fixation can be an important source of nitrogen for other plants and animals. In some cases where there is too much nutrients being released into lakes or rivers large 'blooms' of cyanobacteria can occur. This can be a significant problem as many species of cyanobacteria contain toxins that can make humans sick if they come in contact with them.

Bryophytes

Bryophytes (mosses and liverworts) are plants, but unlike most plants, they have no true leaves or stems. They also have no **vascular system** - which is a series of tubes that can transport water and nutrients within plants. Because they have no vascular system, mosses cannot grow very large. With no stems, individual plants must grow close together, and use each other to stay upright. If you look closely you will see that mosses are actually carpets of tiny individual plants.

Where are they found?

Bryophytes can be found in moist, shady places anywhere from sea level all the way to the tops of mountains.

At higher elevations on Kolombangara, Guadalcanal and other large islands, the forest is almost continually covered by a layer of cloud or fog. The constantly wet conditions provide the perfect environment for bryophytes to grow. Almost everything is covered in dense mats of mosses and liverworts. Some trees become so completely covered with mosses and other plants that it is difficult to see the host tree.

Why are they important?

Bryophytes help keep forests healthy, recycling nutrients by breaking down fallen logs for use by more complex plants. They also help prevent soil-erosion by covering the soil and absorbing water.

- → *Non-flowering plant*
- → *Important for nutrient recycling and erosion control*

Photo: P.Pikacha

Mt Popomanaseu, Guadalcanal

Ferns

Ferns are a very ancient group of non-flowering plants. They differ from mosses by having a vascular (water-carrying) system and stems and leaves. In this way, ferns are like other vascular plants such as grasses and trees. Unlike flowering plants, which reproduce by seed, ferns reproduce by spores that can be found on the backs of their leaves. These little brown or yellow dots are receptacles that contain thousands of spores.

Fern species live in a wide variety of habitats.

Photo: M.Pennay

In Solomon Islands, they are found in moist shady positions beside waterways, the tops of mountains, within grasslands and on disturbed areas where land slides have occurred.

One species of fern (*Diplazium esculentum*) forms an important food source in Solomon Islands. It grows besides rivers or in swampy areas and the young shoots are picked and used as a type of vegetable.

Ferns at the summit of Kolombangara

Photo: T.Lavery

Gymnosperms

Gymnosperms are a group of plants that include conifers, cycads, ginko and gnetales. Gymnosperms have a vascular system, they produce seeds like Angiosperms (or flowering plants) but they do not have flowers. Conifers, cycads and gnetales all occur in Solomon Islands. They are relatively ancient groups of plants and are distributed widely throughout the world.

Conifers are cone-bearing woody plants. In Solomon Islands, examples of conifers include the Kauri pine (*Agathis macrophylla*) that is found in Temotu province and *Podocarpus* trees.

Cycads are another ancient group of plants that are found throughout much of the tropical and sub-tropical world. They are the oldest living representatives of the Gymnosperms and were once much more common and diverse than they are today. Most species are very slow-growing, only producing a few leaves each year.

Gnetales are another fascinating group of plants that were also once much more diverse than they are today. In Solomon Islands the best known example is the species *Gnetum gnemon* that can be found in lowland forests and has edible red fruit.

Podocarpus sp.

Cycad

Photo: J.Perner

Kauri pine

Gnetum gnemon

Angiosperms

Introduction

The angiosperms (or flowering plants) are the most diverse group of plants on the planet. They live as epiphytes (living on other plants), floating and rooted aquatic plants (in both fresh and salt water) and as terrestrial plants with an almost endless variety of sizes, life spans and forms. On land they can be vines, shrubs, small herbs, giant trees and even parasitic plants.

Some of the major families of flowering plants you may be familiar with are:

– orchids (Orchidaceae);
– palms (Areaceae);
– grasses (Poaceae);
– daisies (Asteraceae); and
– peas and beans (Fabaceae).

There are many more families of flowering plants than this and together Angiosperms are crucial for human life. Many of the crops we grow today (kumara, cassava, pawpaw, bananas, eggplants, tomatoes, beans, apples, guavas, coconuts, cut nuts and ngali nuts) are all flowering plants.

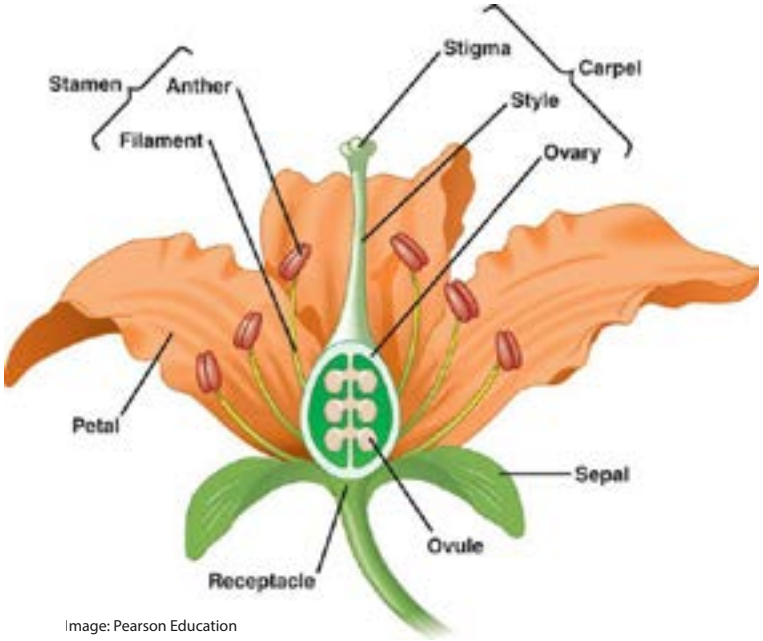


Image: Pearson Education

Passionfruit flower

Flowers

Flowers are the structures of Angiosperms that are designed for reproduction. Some Angiosperms have both male and female parts in the same flower (perfect flowers) whereas other species have separate male and female flowers (imperfect flowers). Sexual reproduction in plants occurs when the pollen from an anther is transferred to the stigma. We call this pollination.

Pollination can occur via outcrossing (when the pollen from a flower is transferred to a stigma on an entirely different plant) or via self pollination when the pollen is transferred to the stamen on the same flower. When the ovules are fertilized, they will develop into seeds. The petals fall off the flower, leaving the ovary behind which will develop into a fruit.

Pollination

Pollination (when the pollen of a flower's anther is transferred to a stigma) is extremely important for the functioning of forests and production of food. Without pollination, the wide varieties of fruits that people eat would not develop.

Photo: L. Ré-Jorge

Attracting pollinators

Many plants have evolved characteristics that are suited to different pollinators. For example, flowers that are pollinated by bats tend to be white or light coloured, open at night and have strong smells. Flowers pollinated by birds are usually odourless because birds do not have a strong response to smell. Flowers that are pollinated by beetles are often large and greenish or white in colour and have a strong smell (usually spicy/ fruity, or like decaying organic material). They are also dish shaped with the pollen easily accessible. Flowers pollinated by butterflies are usually pink or lavender in colour, frequently offer a landing area for the butterflies and have a smell. The flowers usually offer nectar and this is usually hidden in narrow tubes that can be reached by the long tongues of the butterflies.

Sunbirds are pollinators of flowers

How do plants get pollinated?

Pollination can occur in several ways. People can deliberately transfer pollen from one flower to another and some plants are pollinated by wind or water. However, usually plants rely on animals to pollinate their flowers for them. Bees, butterflies, moths, flies, bats and birds are all common pollinators. Often this is by accident as the animals frequently visit flowers to collect food - sweet nectar or the pollen that are present in the flower. Often these are produced by flowers specifically to attract pollinators. The petals of a flower are also typically designed to help attract pollinators. When feeding, the animals accidentally rub against the anthers and get pollen stuck to themselves. When they move to another flower to feed they then transfer the pollen to the stigma of the flower.

- → ***Flowering plants need pollinators to fertilize their flowers.***
- → ***Attractive petals and nectar are used by plants to attract pollinators***

Ngali nut

The ngali nut (*Canarium indicum*) is a flowering plant native to parts of Indonesia, Vanuatu, PNG and Solomon Islands. It is among the oldest and most important crops in Melanesia, and part of one of the world's first known permanent agroforestry systems (when food trees are planted together with other crops and land uses).

In some parts of Solomon Islands traditional calendars were based around the trees' flowering and fruiting cycle. Old trees are often great indicators of the locations of pre-missionary villages and religious sites.

Ngali nuts begin to produce flowers approximately 5-7 years after they are planted. After the flowers develop it takes the fruit between 5 and 8 months to reach maturity. This is characterised by a colour change from green to blackish purple. The inside of the nut is split up into a 3 celled ovary which normally contains only one fully developed nut kernel. Some estimates indicate that a mature ngali nut tree can produce around 100kg of nuts per year (including the shell). This equals approximately 15kg of kernel per year.

Palms

Palms are very important plants in Solomon Islands. The sago that provides leaf for roofing is a palm, and the lawyer cane that is used to sew the leaf is another type of palm. These materials can also be used to make walls and some houses even have palm trunk floor boards. People may relax in the house and drink a coconut or chew betel nut which both come from other types of palms!

Coconuts are an extremely useful type of palm. Almost all parts of the plant can be used by people in one way or another.

They are especially adapted to disperse on ocean currents as the husk of the coconut makes the seed float. Coconuts are distributed throughout much of the tropical and subtropical world. However, some studies of ocean currents and genetics (how plants from different parts of the world are related) suggest coconuts may have been originally introduced to the Pacific by people thousands of years ago.

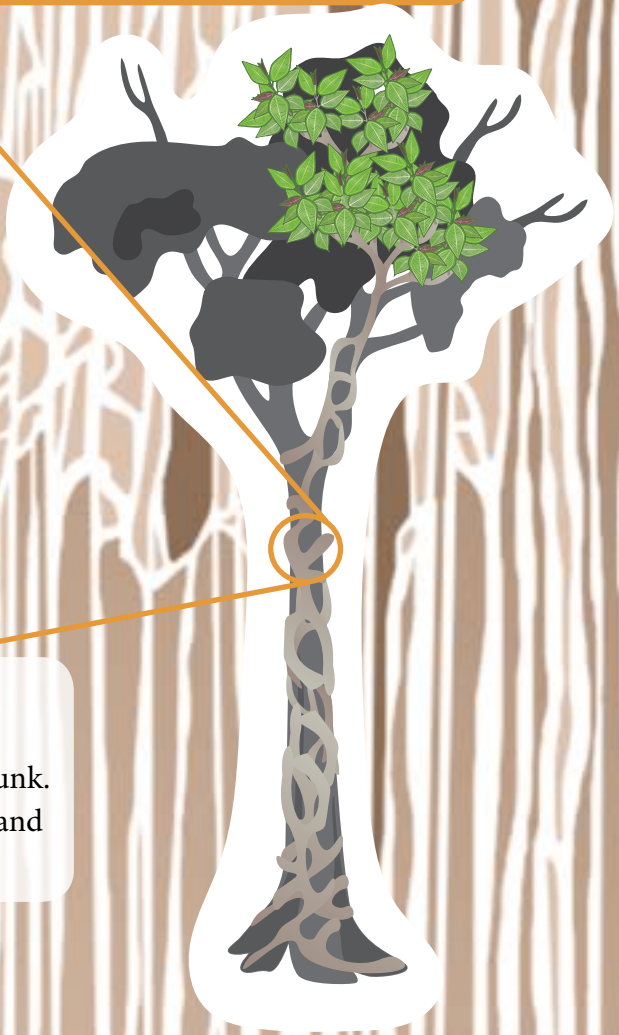
Photo: T.Lavery

Betel nut palms are an important flowering plant

Abololos - stranglers of the forest

A well-known type of tree in Solomon Islands lowland forests is the abololo (or strangler fig). These species begin life as a seed that is deposited by a fruit-eating bird or bat in the upper branches of a canopy tree. If the seed falls into a suitable location with enough water and nutrients, it begins to grow.

As the seedling develops, long roots descend from the canopy along the trunk of the host tree, eventually reaching the ground and entering the soil.



As the strangler fig continues to grow, more and more roots descend along the host tree's trunk. Ultimately they become joined together nearly creating a complete tube around the trunk. The host tree's canopy becomes shaded by the fig tree's leaves and its trunk is constricted by the fig's roots.

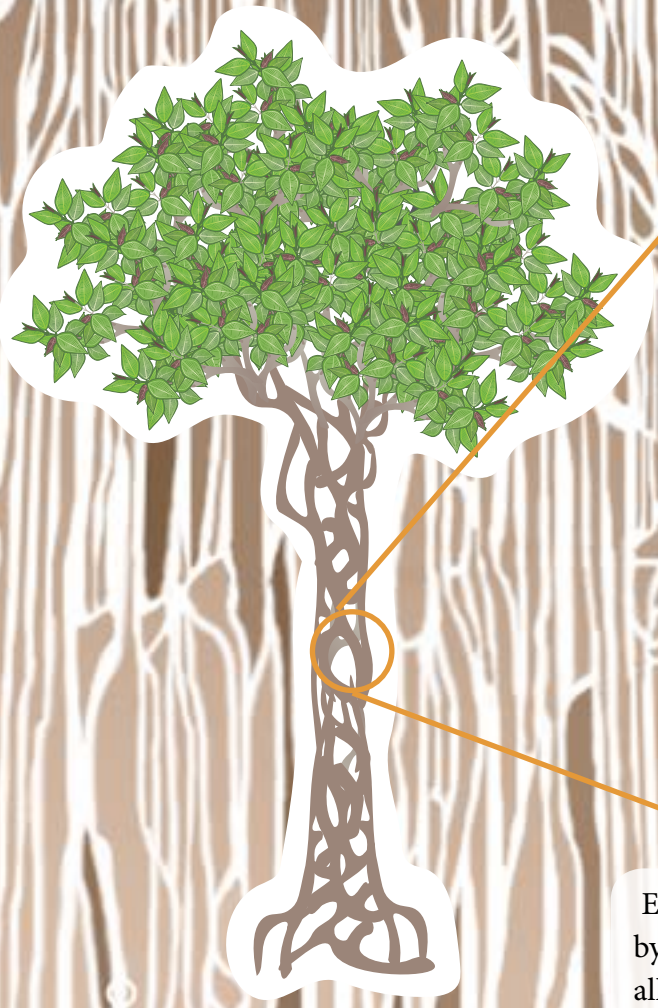


Photo: M.Pennay

Eventually this process can kill the host tree - strangled by the abololo. When the host tree dies and decomposes all that remains is the strangler fig, a gigantic hollow cylinder that follows the shape of the old tree.

Photo: T.Lavery

Photo: T.Lavery

Strangler figs are very important parts of forest structure as they can provide homes for many species. Flying-foxes, kandoras, prehensile-tailed skinks, parrots, frogs and many invertebrates find refuge among the many holes and gaps. The tree's fruits attract birds and bats that eat them and continue the cycle.

Orchids

Orchids are one of the most diverse and widespread groups of flowering plants. They do not have classic roots like other flowering plants. Instead they have rhizome, tuber or aerial roots and can grow in the ground (terrestrial) or on other living or dead plants (epiphytic). Orchids produce several millions of miniature seeds. Only a few seeds will develop into a mature plant.

Many species of orchid have highly specialised modes of pollination and depend on a single species of bird, bee or other insect for pollination. Fore example, the shape and colour of some orchid flowers closely resemble female insects. The flowers attract the male insects of that species and ensure pollination. If the specialised pollinating species are removed, the orchids that depends on them become threatened by extinction.

Vanilla (one of the best known and widely used flavours for cooking) is in fact extracted from the fermented pod of a species of orchid from Central America and Mexico (*Vanilla planifolia*).

Vanilla pods

Ant plants

Ant plants are a very special flowering plant that have developed internal structures that are specially designed to house ant colonies.

When the plant grows it develops a large tuber at the base. As it develops, tissue within the tuber begins to die back and hollow chambers form inside. These chambers allow ants to enter the plant and a symbiotic relationship develops between the plant and the ants. The plant provides a protective shelter for the ant colony, and in return the ants provide additional nutrients to the plant by carrying food into the chambers and they also protect the plant from other insects that may like to feed on it. Not all ant plants are inhabited by an ant colony but most are.

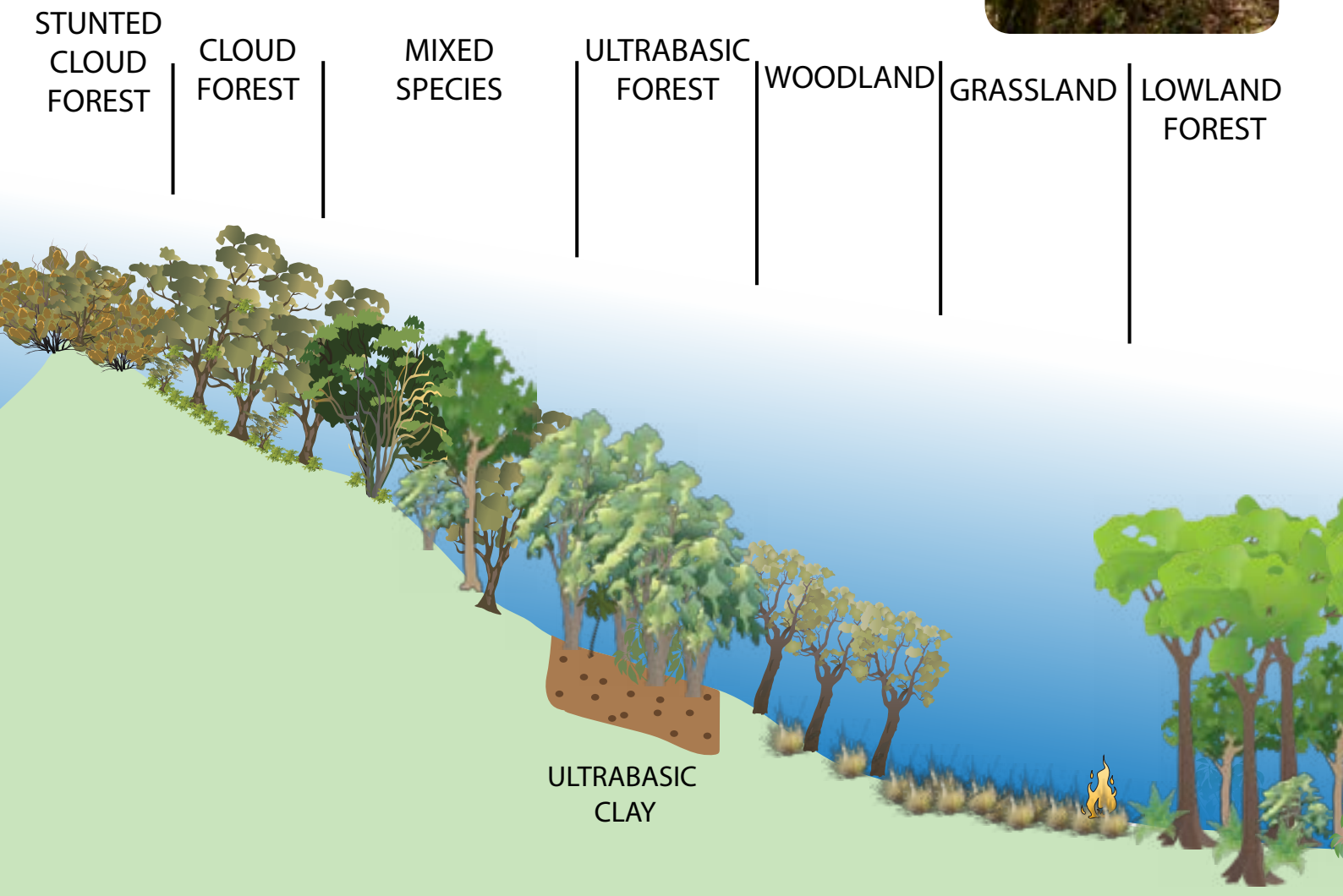
Ant plant

Symbiosis

Symbiosis is a term used to describe when two organisms live in close association with each other for a long time. This can harm one of the organisms (parasitism), benefit neither (commensalism) or benefit both (mutualism).

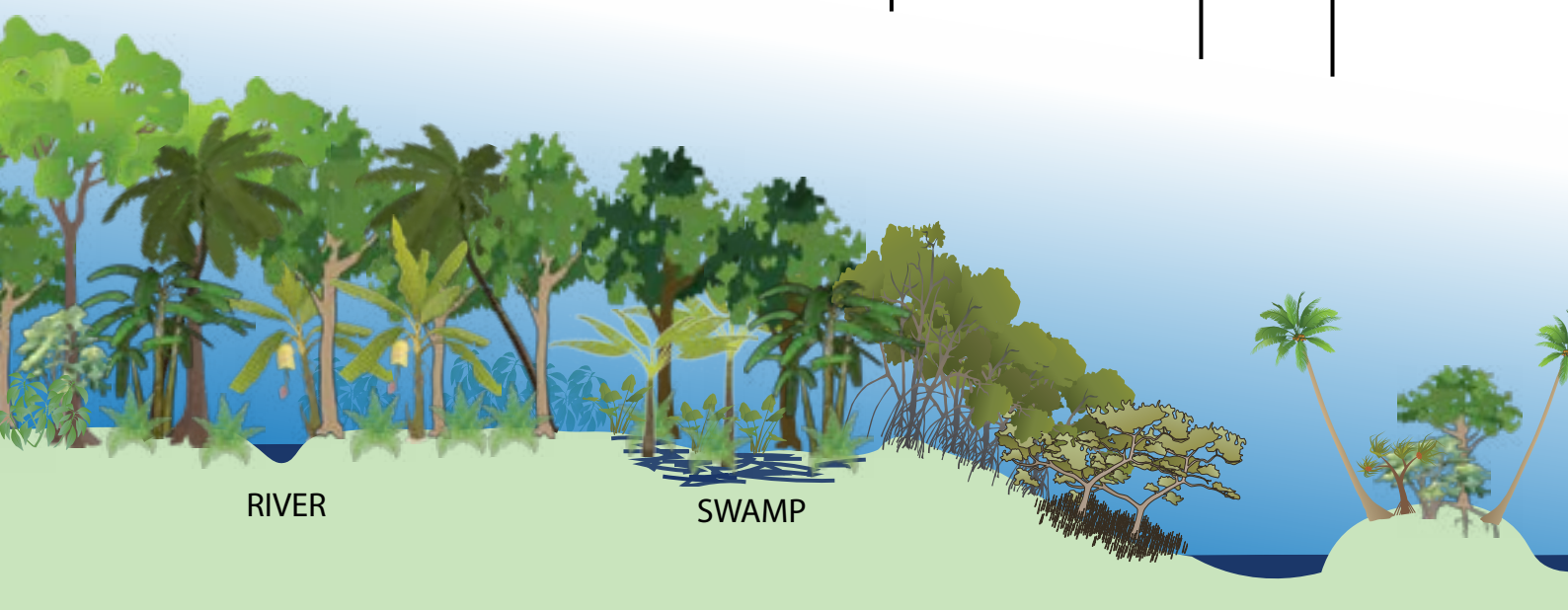
Vegetation Communities

Sets of plant species often grow together, because they prefer areas with a certain rainfall, soil type and position in the landscape. We call these common groups of different plant species 'communities'. Different communities grow on different parts of islands. Changes between communities can be gradual and hard to notice or they can be very obvious (for example when a grassland is next to a forest).



The number and distribution of vegetation communities varies a lot from island to island. Small islands may be dominated by only a single vegetation community. Large islands can support many different communities. Below is an example of how different vegetation communities can occur across a large island from the summit to the sea. It is rare to find all vegetation communities on one island like this.

LOWLAND FOREST | RIVERINE FOREST | SWAMP FOREST | MANGROVE FOREST | SEA | ATOLL OR BEACH FOREST



Importance of vegetation

Individual plant species are essential to the livelihoods of people for food, shelter and medicines. The vegetation communities formed by these plants also perform some services that are essential to people and are often not recognised.

- → Vegetation protects villages from severe weather (storms and cyclones) and it reduces the impacts from floods and landslides. Soil erosion is also reduced by vegetation.
- → Forests absorb rain and slowly release it into creeks and rivers.
- → Vegetated areas protect kastom sites and tambu places. Areas of natural vegetation can also be culturally significant to tribal history.
- → Mangrove and riverine forests provide habitat and breeding areas for many sea-foods such as crabs, fish and shell-fish.
- → Plant and animal communities of the Solomon Islands have scientific value due to their unique ecology, physical composition and endemic species (found nowhere else).

Mt Popomanaseu, Guadalcanal

Mountain Forests

In the mountains of the Solomon Islands, temperature decreases and moisture increases with altitude, and this has resulted in distinct forest zones. These include the mid, lower and upper mountain forests. Mountain forests in Solomon Islands are unusual because they occur at much lower altitude than in New Guinea and Indonesia. These zones also vary across the islands and occur at lower or higher elevations on either side of the larger islands depending on the influence of the central mountain range on rainfall.

Cloud Forest

Cloud forests are vegetation communities occurring in small areas on the tops of the higher islands. The forest is usually very mossy - the ground and tree trunks are covered in thick carpets of bryophytes, lichens, orchids and ferns. The trees are small and stunted due to exposure to wind and colder temperatures and normally only reach a height of 7 to 9 metres. The root masses at the base of these trees can often be exposed above the soil adding greater area for epiphytes to grow.

Similar forests can be found in New Guinea and Indonesia, but in Solomon Islands many of the species found in these countries are absent. This is because Solomon Islands cloud forests are very isolated, situated on the tops of islands, and it is difficult for plants to disperse across the oceans to reach them.

In New Guinea, cloud forest occurs at 2,300 to 2,700 metres altitude. In Solomon Islands it can be found at low elevation on Mt Gallego on Guadalcanal, the Pagoto area of north-eastern Makira, and as low as 690 metres on the crater rim of Vangunu. On Santa Cruz and Santa Anna this forest may nearly reach sea level. Mt Popomanaseu on Guadalcanal also contains a very interesting alpine bog dominated by sphagnum moss.

Photo: P.Pikacha

Threats to Cloud Forest

The mid-mountain and upper-mountain cloud forests usually occur at elevations and locations that are too difficult for machinery. They also do not support very large trees and logging is therefore not a common threat. The main threat to this forest comes from climate change. As air temperatures slowly increase and rainfall patterns change, these will causes changes in the zonation of vegetation on islands. As a result, some species may be lost, increase or decrease in number or even change zonation position.

Photo: P.Pikacha

Ultrabasic Forest

This is a distinctive forest type also known also as 'serpentine' which grows on soils derived from rock that is rich in the heavy metals nickel, titanium or chromium (referred to as ultrabasic rock). This forest type occurs in restricted locations on Santa Isabel, San Jorge and southern Choiseul with smaller areas at Marau on Guadalcanal, Wanderer Bay on Makira and the Florida Islands. The heavy metals in the soils influence the structure and species composition of these forests resulting in an unusual variation. These forests are of lesser height and lower species diversity than normal lowland rainforest.

Threats to ultrabasic vegetation

Mining for nickel and other heavy metals is the most serious threat to these forests. These unusual forests will be heavily impacted not only by clearance for mines but through possible water contamination of creeks and rivers with silt and heavy metal release.

Grasslands

Grasslands in the Solomon Islands occupy only 2% of the land surface. They are usually maintained through regular burning by people as this prevents the forest from regrowing. However, grasslands may also be maintained by low nutrient cycling and high rates of leaching (rain causing minerals to drain away from the soils) which assists in delaying the regeneration of forest. Another type of community (tropical heath) can grow in some well protected locations within the grasslands. These are composed of fire resistant ferns and shrubs which may either have small leaves or are deciduous.

→ *Grassland vegetation communities are usually maintained by fire. Without fire they would eventually be replaced by lowland forest*

The largest area of grassland lies along the northern coast of Guadalcanal where the rain-shadow effect due to the mountains reduces rain. Smaller areas of grassland are also found on Ngella, Gatokae, Malaita, Gizo, Choiseul, Savo, and San Jorge islands.

Swamp Forest

Freshwater swamp forests do not cover large areas of Solomon Islands, being confined to lower lying areas that are permanently or sometimes flooded. Only about 4% of the land surface contains this vegetation type.

Mixed species swamp forest occurs where the soil is waterlogged and very poorly drained. The canopy is usually broken or uneven with the lower tree layers dominated by large numbers of small trees and saplings. The shrub layer is also different being composed of seedlings, large leaved herbs, pandans, climbers and epiphytes.

Threats to swamp forest

Many areas of swamp vegetation have either been too deep or of little value for logging and still remain. However, large areas that contained *Campnosperma* and *Terminalia* trees have been logged and are now becoming rarer in Solomon Islands. Swamps are easily damaged by machinery due to their fine silted mud and increased flooding events from rivers that have been heavily logged. Sea level rise due to climate change will also allow saltwater to affect freshwater swamps near the sea and cause areas of forest to die.

Lowland Forest

Lowland rainforest can be regarded as one of the most species diverse of all vegetation communities. These forests occurred in large areas between the beach or mangrove forest and the mountain forests on the larger islands.

The features of these forests include a species rich canopy and understorey with many different layers of vegetation. Many of the larger trees have wide roots (called buttresses). Palms, vines, epiphytes, gingers, large leaved herbs and ferns are all abundant. Many of the plants have very large leaves to help them capture light in the dark forest. This is a complex forest that offers many living spaces for other organisms. It is this structure and species composition that contributes much of the species diversity in the lowlands of the Solomon Islands. However, the structure of the forest is quite different from forests of Southeast Asia. There are fewer species overall, some Southeast Asian species are absent and there are species that are unique to Solomon Islands.

Photo: P.Pikacha

Canopy trees can reach 30-45 metres in height. Sometimes the forest is interrupted by vine-covered clearings and small tree thickets. Over 100 species occur as canopy trees in Solomon Islands and many of these do not grow larger than circumference of 2 metres. Cyclones have a large influence on the structure of this forest type, preventing the development of extremely large trees and keeping the age of most below 300 years. Emergent trees (that stand out above the main canopy) are less common than in Southeast Asia and are also less diverse (commonly they are strangling figs).

Threats to lowland forest

→ *Lowland forests are the main focus of logging companies and few areas of unlogged 'primary forest' remain*

The lowland rainforests of Solomon Islands have been the main focus for logging by commercial companies. In fact there are few areas of lowland forest that have not yet been logged. What remains now is highly valuable for conserving biodiversity and to act as areas from which the logged forests can regenerate. On some islands such as Malaita, much of the lowland forest has been cleared for gardens and as the populations increases across the country, further pressure will be placed on the pockets of remaining lowland forest for this purpose. Mining will also add to the decline of these forests as this industry increases in Solomon Islands.

Photo: P.Pikacha

Riverine or Valley Forest

Valley or Riverine forest occurs on river banks and valley depressions. On the riverbanks it occurs as a narrow plant community while in valley depressions it can be any shape. Usually the area of this vegetation type in any one place is relatively small in size.

Riverine forest is a mixture of plants from the lowland and swamp forest communities creating a distinct species composition and structure.

Photo: P.Pikacha

Threats to riverine vegetation

Areas of riverine vegetation are usually narrow and because they occur close to waterways and valley depressions they can be sensitive to physical damage. Many of these plant communities have been lost to logging and in many cases they have also been impacted by large amounts of soil washing down from upstream logging activities. This prevents or prolongs forest recovery. Gardening and timber cutting are often concentrated along rivers because they are easier to access by canoe. As the Solomon Islands population grows, these activities are beginning to disturb more riverine areas as gardens and timber removal are expanded further and further upstream.

Mangrove Forest

Mangroves occur throughout Solomon Islands in coastal areas where there is protection from storms and heavy seas. It is a special forest type that is adapted to living in areas that can be covered by salt water. Under these conditions most plants would die, but mangroves have special adaptations to live with the high salt levels. The largest areas of mangrove forest are found along the coasts of Santa Isabel, Malaita, New Georgia, the eastern end of Guadalcanal, and Makira. Mangroves cover approximately 2.3% of the Solomon Islands land area. Most species have their origins in Asia and many reach the eastern limit of their distribution in Solomon Islands. Mangroves are an extremely important connection between the marine and forest environments. Many terrestrial animals use mangrove forest to find food in the marine environment. You can read more about this in *Solomon Islands Marine Life*.

Threats to mangrove forest

Logging has not heavily impacted mangroves as logging machinery cannot operate in the deep muds where they often grow. However, as logging of the lowland forest continues and timber becomes scarce, increasing pressure will be placed on mangrove forests for village timber supplies. Mangroves are also increasingly being cleared around village areas to provide more land as the population increases. This reduces the protection from storms and cyclones that is provided by this vegetation community. Sea level rise from climate change will also affect mangrove plant communities resulting in species composition changes and even more vulnerability to storm damage.

Photo: P.Pikacha

Atoll or beach Forest

The beach forest of the Solomon Islands (which fringes the major islands, coral atolls and raised reefs) is quite typical of that found throughout the Indo-Pacific region. This is because many of the plants have salt resistant fruits that are adapted to long distance ocean dispersal. One of the most common trees in this forest type is the tamanu or buni tree (*Calophyllum inophyllum*). Two main types of beach forest are dominated by this tree are recognised in Solomon Islands. In one, the beach almond (*Terminalia catappa*) is also common, and in the other the box fruit, or fish poison tree (*Barringtonia asiatica*) is common.

Photo: P.Pikacha

Threats to beach and atoll forests

Beach forests have been logged on the larger islands and many areas have been reduced. On Guadalcanal large areas of the beach forest found along the east coast has been cleared. On the smaller islands and atolls there is risk of loss due to small scale removal of trees for timber and carving and sea level rise resulting from climate change. A growing environmental problem in this vegetation is plastic pollution on beaches and near sea forest locations from houses and rubbish thrown from passenger ships.

Epiphytes

In the Solomon Islands rainforests, the competition for space and light is intense. A huge number of species try to gain some advantage by growing on other plants. We call this type of plant an epiphyte. In Solomon Islands epiphytes include ferns, orchids, ant plants and mosses and liverworts. These plants do not really harm the other trees and plants they grow on, they simply use them as a space in which to grow. Although, in some instances bryophytes can cover a large proportion of the surfaces of a plant's leaves and this probably decreases its ability to capture light.

Epiphytes increase the diversity of habitats available in the forest. If you look closely at an epiphyte, often you will notice a wide diversity of insects living inside them. Some birds build their nests among epiphytes and some of the native Solomon Island rodents also sleep among them during the day time.

Fungi

Introduction

Fungi are different from plants, animals, protists, and bacteria. Most are small in size or are very difficult to see, living in soils, on dead matter, and in symbiosis with plants, animals, or other fungi, where they go unnoticed. They may become more noticeable when fruiting, either as mushrooms or as moulds.

Nutrient cycling

Fungi play important roles in the forest. They are essential to the recycling of nutrients in all terrestrial habitats. This is because they are the dominant decomposers of the tough parts of plants, such as the cellulose and lignin that form cells walls and wood.

Due to the high rainfall, the nutrients in Solomon Island forests are easily removed from the soil by leaching. Plants therefore rely on the cycling of nutrients by fungi. Fungi immediately cycle nutrients from decomposing leaf litter and other forest organic material and they make it available directly for plants to use. In fact, all forest trees are connected by fungi under the ground.

Fungi that glow in the dark

If you have wandered through the forest at night, you may have noticed that some species of fungi can produce their own light.

We call the light produced by a living thing bioluminescence, and it results when energy is released from a chemical reaction. The reason why some species of fungi glow is uncertain. It may help to attract insects that help spread the fungi's spores through the forest.

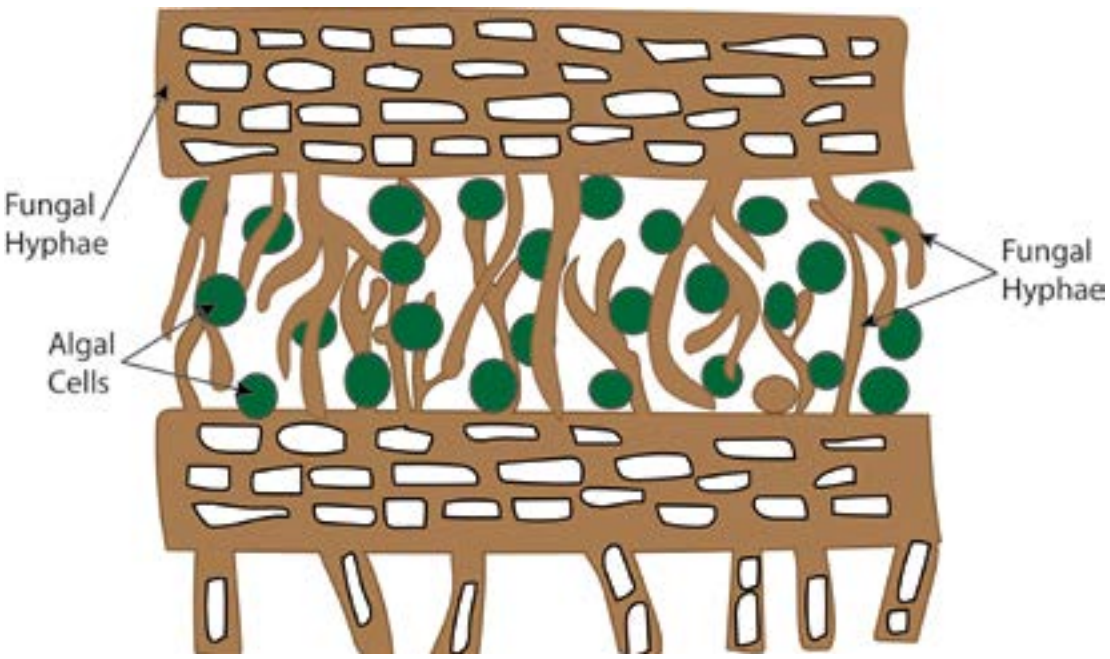
Lichens

Fungi can also form important partnerships with algae or cyanobacteria (photosynthetic bacteria) to produce lichens.

Most lichen partnerships consist of a single algae partner (called the phytobiont) and a single fungi partner (called the mycobiont). However, some lichens can contain more than one type of algae.

The fungi creates the structure of the lichen (using structures called hyphae). The algae and cyanobacteria contain chlorophyll and can manufacture their own food with the help of light via the process of photosynthesis. The fungi can not manufacture their own food in this manner so they 'harvest' some of the food that is created by the algae.

Lichens are widespread throughout the world and occur from the tropical rainforests, to desert areas, to the polar areas that are free from ice. They can grow on a wide range of surfaces including soil, rock, wood and living trees. They will also grow on man-made structures to like concrete and metal. Many of the wooden houses in Solomon Islands have lichens growing on their walls and roofs.



Variable dwarf kingfisher

Fauna

Photo: T.Lavery

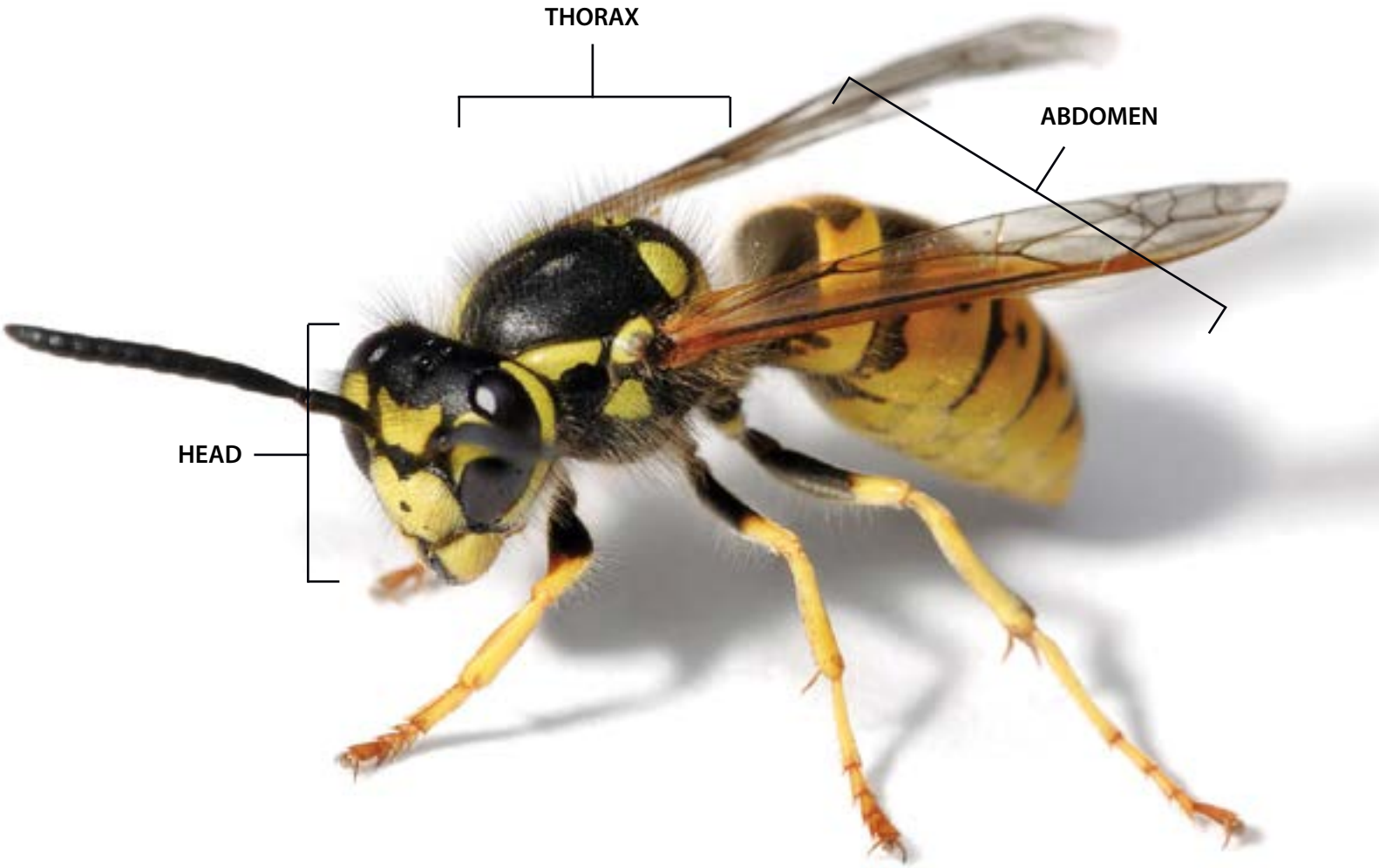
Insects

Introduction

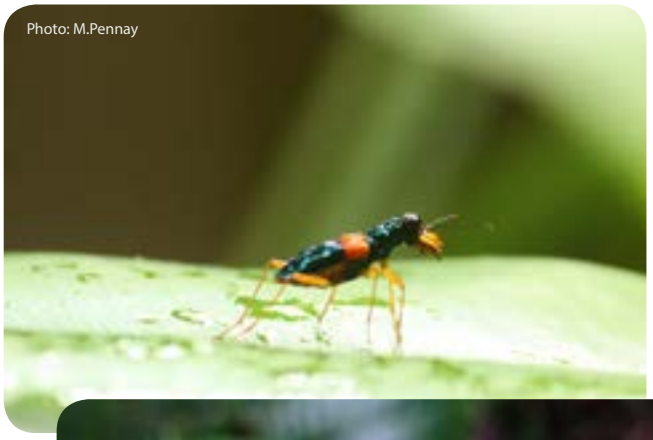
Insects are the most diverse group of Arthropods and in fact are among the most diverse groups of animals on the planet. They include major groups such as beetles, flies, bees & wasps, moths & butterflies, grasshoppers & crickets, stick & leaf insects, praying mantids, and dragonflies & damsel flies, among many others. Insects have a body that is divided into three segments (head, thorax and abdomen), three pairs of legs, antennae, and usually two pairs of wings. More than one million different species of insects have been given a scientific name, but some experts believe that there may be as many as 30 million insect species in the world that have yet to be discovered and identified.

Although insects are small, they are so numerous in most terrestrial ecosystems that they not only outnumber, but also outweigh (have a higher biomass) than all the other animals in a given area.

Because insects are so diverse and common, their influences on the environment are enormous. About 80% of the flowering plants on Earth are pollinated by insects. Insects are responsible for much of the nutrient cycling in the environment, and they condition and aerate the soil. Some insects provide natural population control of other insects, and many different kinds of animals eat insects making them essential parts of the food chain.



This colourful grasshopper was found on Kolombangara Island



→ *There are eight times as many beetle species as there are fish, amphibian, reptile, bird and mammal species put together*

How many species?

Exactly how many insect species occur in Solomon Islands is not well known. However, from the numbers of butterflies and moths in Solomon Islands it has been estimated that there may be as many as 46,015 total insect species. There are 130 species of butterflies, 35 of them are endemic to the Solomon Islands (meaning the are found nowhere else). There are also 31 endemic species of cicadas.

Important pollinators

Insects come to flowers for collecting pollen or sweet nectar produced by the plant. They then pollinate flowers by moving pollen from the male anthers of a flower to the female stigma of a flower. The vast majority of flowering plant species only produce seeds if animal pollinators visit their flowers and about 80% of the flowering plants on Earth are pollinated by insects.

Insect pollinators are therefore critical for food production and human livelihoods. Many of the fruits and vegetables we grow in gardens rely on insects for pollination.

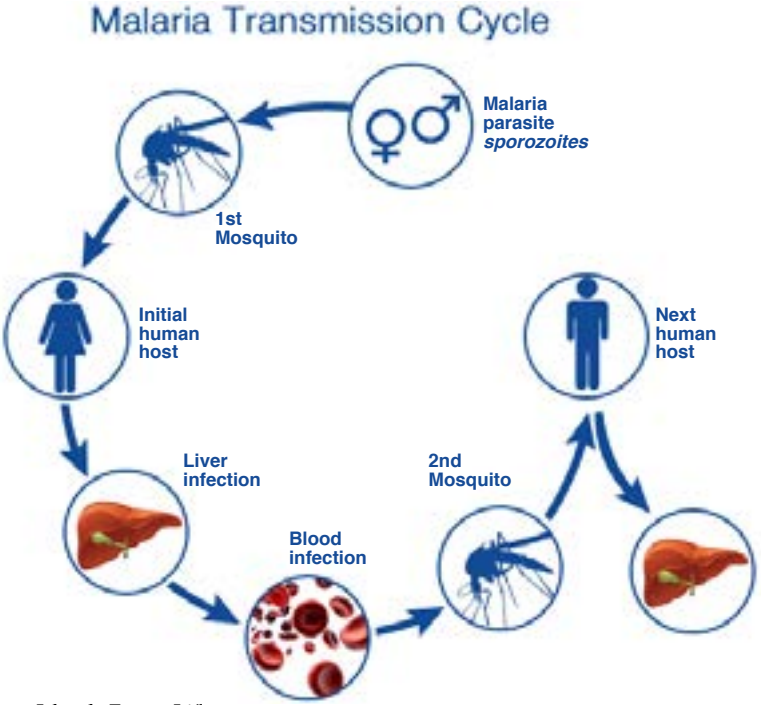
Many insect pollinators are specialists on particular plants and many plant species can only be pollinated by one or a few species of insect. Without the pollination services provided by insects, much of the food production and the ecosystems that we rely on would collapse.

- → *Bees are the best known pollinators but butterflies, wasps, beetles and flies are also important to many plants*
- → *80% of the flowering plants on earth are pollinated by insects*

A female *Anopheles* mosquito

Mosquitoes and Malaria

Mosquitoes are in an insect family that is important to human health in Solomon Islands. This is because they have the potential to spread diseases that affect humans such as Malaria (a plasmodium blood parasite) and Dengue Fever (a virus). Female mosquitoes from the genus *Anopheles* are responsible for spreading Malaria. When an infected female mosquito feeds on the blood of a person, the Malaria parasites are released and the person also becomes infected. The easiest way to prevent Malaria is to avoid being bitten by mosquitoes. *Anopheles* mosquitoes tend to be most active at dusk and in the early evening so being careful to avoid mosquitoes at these times is very helpful. Mosquito nets are also effective at preventing bites during the night.



Little red fire ants

Photo: A.Wild

Little red fire ants (*Wasmannia auropunctata*) (commonly called 'red ants') are an **introduced species** of insect that is native to South America. They are believed to have been introduced to Solomon Islands some time around 1970, possibly arriving with new coconut varieties that were introduced to the country.

Little red fire ants are rated among the top 100 of the world's most invasive species and have already been introduced to many other countries outside of their natural range. They are very small (less than 1.5mm) and have a painful bite. In Solomon Islands, little red fire ants are most commonly found in disturbed areas such as villages and gardens.

Their full impacts on the environment are not well understood. Their stings can harm the eyes of native and domestic animals, causing cloudy coloured areas of damage that likely affect the animals' vision.

Aphids

Little red fire ants are predators and are probably harmful to native animals including insects. They may actually benefit some crops, because they can control insect pests. However, little fire ants sometimes protect insects that harm crops from other predators. For example, they protect aphids that produce a sweet secretion that the ants eat.

Stings from little red fire ants can affect the eyes of some native animals like this variable goshawk

Image: FireAnti

Little red fire ants have been spread to many parts of the world

Arachnids

Arachnids are a group of Arthropods that include spiders, mites, ticks and scorpions. They have a hard exoskeleton and jointed appendages (legs) for walking. Their bodies are divided into two segments (a cephalothorax and an abdomen) and most have eight legs. In some, the first pair of legs may be used for holding their prey and feeding. Unlike insects, arachnids do not have antennae.

No arachnids have wings and therefore they cannot fly. Although, some spiders are able to create balloons of silk that allow them to float on air currents. Many use silk either to help them catch their prey or to reproduce.

Scorpions

Like spiders, scorpions also have 4 pairs of legs. However, unlike spiders they also have a pair of pincers for catching and holding their prey and a sharp sting at the end of their tail that can be used to paralyse or kill their prey.

- *Arachnids are Arthropods*
- *They have a hard exoskeleton, jointed appendages and do not have antennae*

Photo: C.Ernst

Centipedes & Millipedes

Centipedes and Millipedes are both types of myriapod. They are all terrestrial, have a segmented body, one pair of antennae and breathing holes called spiracles. However, centipedes and millipedes are separate groups of animals with quite different characteristics and life styles. The main difference is millipedes have two sets of legs (or appendages) for every segment of their body whilst centipedes only have a single pair.

Millipedes

Most millipedes are nocturnal and feed within the leaf litter and bryophytes of moist forests. They are important decomposers that feed on rotting wood, leaf litter, lichens and fungi and return nutrients to the soil through their droppings. Many millipedes can protect themselves by releasing a nasty smelling and sometimes burning liquid. In one Solomon Islands species this liquid is bright red. Millipedes lay eggs in moist areas underground. Baby millipedes hatch from the eggs and are usually pale in colour with fewer segments.

Photo: P.Pikacha

Centipedes are predators of vertebrates including invasive cane toads

Centipedes

Centipedes are also nocturnal but unlike millipedes they are primarily predators. They are also venomous creatures (they inject a toxin to kill their prey or in self defence). They inject venom using a pair of modified claws or fangs. The last pair of legs also look dangerous as they are strong and brightly coloured, but these are only used to help hold the prey. Centipedes are generalist feeders and eat both invertebrates and vertebrates. Some species feed mostly on earthworms whereas the larger 'giant centipede' (*Ethmostigmus rubripes*) found in Solomon Islands can eat reptiles, amphibians, small mammals and birds.

- → *Centipedes and millipedes have segmented bodies, one pair of antennae and breathing holes called spiracles*
- → *Centipedes are venomous and deliver toxin with modified claws*

Crustaceans

Photo: T.Lavery

Although crustaceans are primarily a group of marine Arthropods, there are certainly many species that spend either all, or a large part of their lives in freshwater or on land.

Crustaceans have an exoskeleton, two pairs of antennae and more than four pairs of jointed appendages. Like insects, their bodies are also made of three segments (the head, thorax and abdomen).

Isopods are a group of crustaceans that live in the sea, freshwater and on land. Because they are vulnerable to drying out, they usually live in moist environments like amongst leaf litter and underneath decaying materials like logs. Many species can roll themselves into a ball when they are disturbed.

Many species of crab also inhabit the forests and sandy shores of Solomon Islands. Some live their entire lives on land whereas others still regularly enter the sea or freshwater. However, all species of land crab must return to water to reproduce. Crabs are important for cycling nutrients on the land, even deep within the lowland forests. Hermit crabs, coconut crabs, fiddler crabs and many other land crabs cycle nutrients through being detritivores. They feed on leaf litter, fallen fruit, and dead animals often taking parts of them deep into the soil via their burrows.

Coconut crabs

The coconut crab (*Birgus lastro*) is the world's largest land dwelling crustacean. It is distributed throughout the western Pacific and Indian Oceans, occurring almost exclusively on oceanic islands or on small offshore islets. For reproduction, mating occurs near the sea. The female then lives within 100 metres of the ocean so that she can regularly moisten herself with seawater. The young are spawned from the eggs into the water and spend between 3 and 6 weeks floating in the ocean as plankton. They go through 4-5 different growth stages before they form a stage called a glaucothoe that can live on both land and water. During this stage, they find a small shell and after 3-4 weeks, they return to land. After 4 weeks of living around the high tide mark, the glaucothoe transforms into a juvenile coconut crab and continues to use a shell for 1-2 years, living very secretively in burrows.

Because they are a highly-prized food item, slow-growing and live on land (making them easy to catch), coconut crabs are threatened throughout much of the world. Juvenile crabs are also vulnerable to introduced animals like rats and pigs.

Photo: M.Pennay

Photo: Wikimedia Commons

Annelid worms

Both earthworms and leeches are types of annelid worms. They consist of multiple segments and each segment has the same set of organs. Many species can reproduce asexually. This means they can reproduce without the fusion of gametes (sperm and eggs) like many animals must do. Many species can also regenerate their bodies in this way after severe injury or damage.

However, in the species that have been studied, sexual reproduction is the normal method of reproduction. Oligochaetes (e.g. earthworms) are full hermaphrodites (they have both male and female reproductive organs). They produce a ring-like cocoon around their bodies where the eggs and hatchlings worms are fed until they are ready to emerge.

Earthworms

Earthworms are an important part of many terrestrial ecosystems as they help to enrich and aerate the soil. Worms dig burrows and this loosens the soil allowing oxygen to enter. They also mix decaying organic materials into the soil helping to make nutrients more available to plants. By enriching the soil like this, earthworms are an important part of many food chains and they are also important as prey for other animals in the food chain. They are a vital source of food for many birds (large and small) amphibians, reptiles and small mammals.

Leeches

Leeches are related to earthworms but are much more specialised in their behaviour and anatomy. They have thick muscular bodies that narrow towards the head. Their heads have a small sucker around the mouth and there is also a second larger sucker at the tail.

Most leeches are blood-sucking parasites that have preferred host species. Some feed on humans and mammals, some on frogs, some on birds and others on freshwater fish. They usually have three jaws which they use to make a Y-shaped cut in their prey. Leeches can then eat several times their own weight in a single meal. Afterwards they will find a dark place to rest and digest their meal.

Some leeches feed on frogs

Photo: P.Pikacha

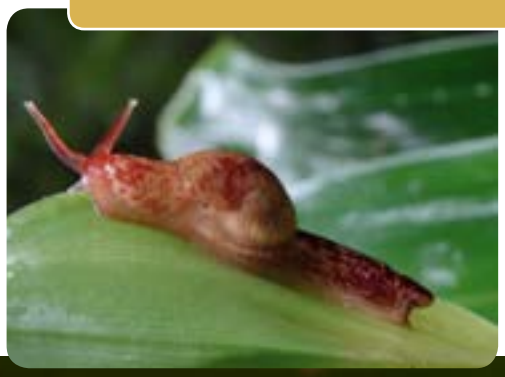
- → *Annelid worms are segmented and each segment has the same set of organs*
- → *Some annelid worms can reproduce asexually*

Molluscs

Molluscs are a diverse group of mostly marine invertebrates. In Solomon Islands forests the main types of mollusc present are snails (which carry a coiled shell to protect their bodies) and slugs (which do not have a shell). There are also molluscs referred to as 'half snails' that have begun to, but have not yet completely lost their shell. Snails and slugs can live on land or in water. They are mostly herbivorous, meaning they eat plants.

One adaptation allowing snails and slugs to survive on land is their ability to produce mucus. This slippery substance prevents their bodies from drying out and it also provides a surface for them to move across more easily.

- *Land molluscs breathe with lungs whereas those found in the ocean have gills*
- *Molluscs produce mucus to help them travel across rough surfaces and prevent them from drying out*



This brightly coloured snail was found on Santa Isabel Island

Photo: T.Lavery

Giant African Snail

Photo: J.van Alphen

The giant African snail is one of the world's largest and most damaging land snails.

Native to Eastern Africa, it has quickly spread around the world and is now established in most tropical countries. The species has already been **introduced** to Guadalcanal and if we are not cautious it will quickly spread to other parts of Solomon Islands.

→ *Each adult giant African snail can produce approximately 1200 eggs each year*

Giant African Snails feed on more than 500 species of plant, including legume crops, ornamental plants, vegetables and the bark of large trees such as citrus and pawpaw. They are a serious risk to agriculture and their ferocious appetite is capable of destroying vegetable crops, fruit trees and Solomon Island forests.

Partula snails

Partula snails

The mouth of a snail contains a small pad called a radula that is covered with tiny, serrated 'teeth'. This enables molluscs to scrape off their food as if they were using sandpaper. Many molluscs feed on decomposing material, algae, leaves, mosses or fungi. But there are also some carnivorous snails that prefer to eat other snails and invertebrates.

A species group of molluscs found in the Pacific are the *Partula* snails. Within this group there are many endemic species that are only found on a single island. However, there are others that have much wider distributions and scientists believe they were traded between islands by Polynesian people for ceremonial purposes.

Photo: www.islandbiodiversity.com

In Tahiti there is an unfortunate example of what can happen when species from other islands are introduced. The giant African snail became established on Tahiti, similar to how it has appeared on Guadalcanal. To control this snail, people introduced a second carnivorous species of snail called the Florida rosy wolf snail (*Euglandina rosea*) to try and control the giant African snails. However, the carnivorous snails instead hunted the 76 native *Partula* species. This caused 48 species to go extinct and another 11 species disappeared from Tahiti and now only survive in zoos.

Freshwater Fish

The Solomon Islands are known to support over 80 species of freshwater fish from 35 different families. The most diverse group is gobioid fishes (gobies) that constitute approximately 60 percent of the overall total number of species. The number of species of freshwater fishes generally decreases from the lower reaches of rivers into the higher elevation watercourses. Diversity especially decreases above barriers like waterfalls. Some species of Solomon Islands fish only occur in the upper reaches of streams, including long-finned eels and *Lentipes* gobies.

Photo: B.Ebner

Lentipes gobies occur in the upper reaches of streams

Importance or freshwater fish

Freshwater fish are excellent indicators of the health of rivers and streams. Most species (especially gobies) prefer areas with high water quality and intact riverbank vegetation. Declines in the diversity and abundance of these species in a waterway is thus a reliable, early indication that water quality is deteriorating. *Lentipes* and other gobies are one of the main indicators of water quality in tropical island rivers.

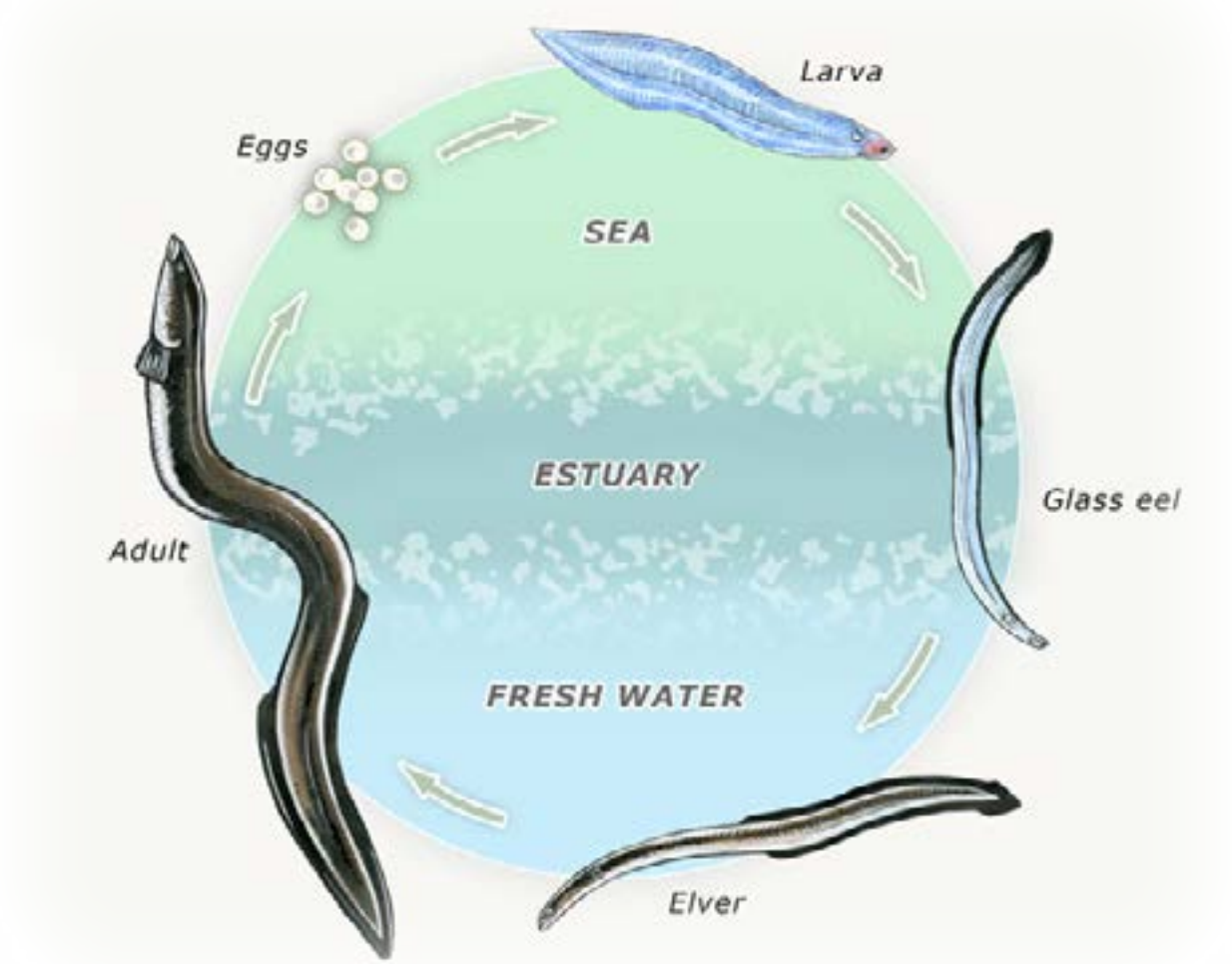
From the rivers to the sea

A large number of Solomon Islands fish rely on both the sea and freshwater rivers and streams to complete their life cycles. We call species that alternate between the sea and rivers 'diadromus'. Some species like mangrove jack and mullet live in the lower reaches of freshwater streams and estuaries when they are juveniles and move out onto the reef when they are adults to breed.

Long-finned eel-fish (*Anguilla reinhardtii*) live in freshwater. As adults, they are the top carnivores in the upper reaches of rivers and streams, feeding on crustaceans, molluscs, insects, fish and even other eels. However, they must travel to the ocean to lay their eggs. Spawning (when fish come together to lay sperm and eggs) occurs in deep ocean waters (believed to be in the Coral Sea), typically during winter.

River eels appear to grow slowly, taking about 20 to 50 years to reach sexual maturity and in general, females grow to a much larger size than males. When mature, the eels migrate downstream (often with the assistance of floodwaters) before swimming up to 3000 km to reach the spawning area in the ocean.

The juvenile eels then pass through two distinct stages: a leaf-like larva called a 'leptocephalus' and an unpigmented, eel-shaped post-larvae known as 'glass eel'. After a long larval period (almost one year) the glass eels come back to the estuaries between October and April. At this time they quickly develop into sub-adults which look exactly like miniature eels and begin to travel back up the rivers and streams. River eels are less affected by barriers than most fish. They are able to move across dams and areas of land that block streams as long as they are damp.



Invasive Fish

When fish from other countries are introduced they can often cause big problems to the local environment. Many people promote the stocking of tilapia (*Oreochromis mossambicus* and *O. niloticus*) into Solomon Island rivers. Although the idea is to provide a continuous supply of fish for food and an alternative source of income for Solomon islanders, this idea does not consider the potential negative effects of introduced species on native fish. Species such as tilapia often affect native species indirectly through competition for space and food resources or directly by eating native species and their eggs and fry (newly hatched or newborn baby fish). Tilapia often create dirty turbid conditions in formerly clean waterways, and severely crowd native fauna due to their fast breeding. Tilapia can replace all other native fish meaning that they are the only type of fish available for harvest. They also remove other edible species such as freshwater prawns from rivers.

Many aquatic species including freshwater prawns disappear when invasive fish like tilapia are introduced into rivers.

How do they arrive?

Freshwater fish are most often introduced directly by humans. Many cases around the world are aquarium pets that people do not want any more and release in nearby waters. Some (such as Tilapia) are introduced as a food source, and others (for example mosquitofish *Gambusia* spp.) are introduced as a method to control other species, such as mosquitoes. Typically, these introduced species do more harm than good to natural environments.

- → *Tilapia are in the top 100 "world's worst invasive species"*
- → *Tilapia replace native fish and increase the turbidity of rivers*

Mozambique tilapia are a very successful invasive species and have contributed to the extinction of over 200 fish species world wide!

INTRODUCED SPECIES

Native fish from the Kolobangara River on Choiseul Island are an important resource for local fishermen

Amphibians

Photo: T.Lavery

Introduction

Amphibians are vertebrates, and ectotherms (they heat their bodies by absorbing heat from the surrounding environment). They have four limbs and can use their skin in addition to their lungs as a way to breathe. Frogs are the only type of amphibians that occur in Solomon Islands. They are typically carnivorous and have short bodies and no tail.

There are 23 species of frog known from the Solomon Islands. Most are closely related, and the most common species belong to one family (Ceratobatrachidae, leaf frogs or eyelash frogs). Two species are endemic to Solomon Islands, whilst the remaining species are also found in Bougainville and/or New Guinea.

The highest diversity occurs in the western islands closer to Bougainville and Papua New Guinea. This diversity steadily decreases towards the eastern islands such that only two species are found on Makira. The skin of native frogs can lose water easily and this makes them vulnerable to saltwater. They find it more difficult to cross oceanic barriers between islands than other types of animals.

Photo: P.Pikacha

Why are frogs important?

Frogs are great indicators of ecosystem health. Their skin means they can be sensitive to environmental change and can be the first vertebrates to suffer from changes in water quality or climate. Most species found in Solomon Islands are widespread throughout the islands and found in a variety of habitats. Frogs are often the most numerous vertebrates present in Solomon Island forests.

Photo: P.Pikacha

Issues and threats

The main causes of amphibian extinctions are pollution, loss of habitat, climate change, invasive species and over-harvesting for the pet and food trades.

An infectious disease caused by a fungus called chytridiomycosis, is also suspected to have caused the extinctions of many amphibians around the globe, including in Australia. Luckily, this fungus has not yet been recorded in Solomon Islands, however it is likely spread by human activity so caution is needed.

Photo: T.Lavery

The Cane Toad

Originally from South America, the cane toad (*Rhinella marina*) is an **introduced species** brought to Solomon Islands in the 1940s. Cane toads were first released on the Russell Islands and Guadalcanal by Levers Plantation Ltd. to help control beetles that were causing damage to coconut plantations. Cane toads have been introduced to many countries throughout the world for similar reasons, and the negative impacts usually far outweigh the intended benefits. Cane toads are fast breeders and introduced populations have the potential to reach densities far greater than those found in South America. The introduction of cane toads has had harmful effects on native wildlife in several countries in the Oceania region. All life stages (including eggs, tadpoles and adults) contain toxins called bufadienalides. The poisoning of native predators when they eat cane toads, their eggs or tadpoles has therefore been one of the most noticeable impacts. Lizards such as varanids (monitors) and skinks, and other reptiles including snakes and crocodiles have declined the most.

- *A female cane toad can lay more than 30,000 eggs at one time!*
- *eggs, tadpoles and adult cane toads are all poisonous to other animals if they are eaten*

Modified habitats generally support the greatest densities of toads. In Solomon Islands, disturbances such as logging create roads that help them disperse into new areas and create habitat that is less suited to native amphibians and better suited to cane toads.

Photo: National Geographic

External fertilization

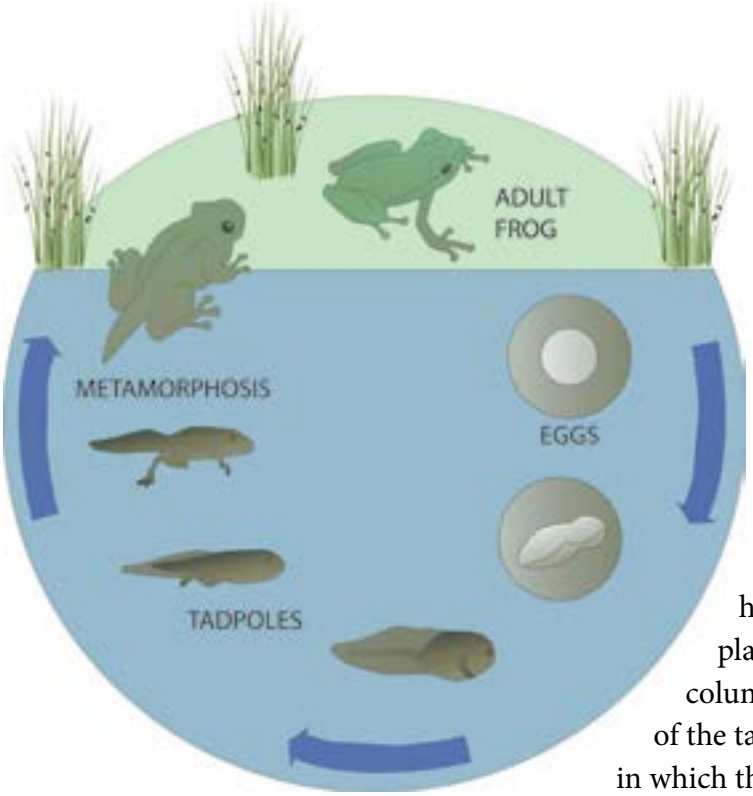
Frogs have external rather than internal fertilization. When a female is ready to reproduce, the male hangs onto the female by gripping her under the arms or around the thighs with his strong thumbs and then fertilizes the eggs as they leave the female's body. The term 'amplexus' is used to describe this period when male and female frogs are together to reproduce.

Treasury Island tree-frogs on Santa Isabel Island

Frog Calls

Male frogs produce advertisement calls to attract females. They have a vocal sac under their lower jaw that can be inflated to create a much louder sound. Each species of frog makes a different call and we can use advertisement calls to identify which species are present within a particular area of forest. Males sometimes call in a chorus - they compete by calling together. Female frogs interpret a lot of information from these calls such as the size and the health of the male. They use calls to select which male will be the best father of their offspring.

Male frogs call to attract females



Life cycle

The most well known method of reproduction in frogs is when egg masses are laid by the adult frogs directly into water. Larvae known as tadpoles develop from the eggs and eventually emerge into the water. These free-swimming tadpoles have gills for respiration, cartilaginous skeletons (soft cartilage rather than hard bone), and flattened tails for swimming. Most are herbivorous (they eat algae and other water plants) and as they feed and grow in the water column, they begin to develop limbs. At the end of the tadpole stage, they undergo metamorphosis, in which the tadpole makes a sudden transition into an adult frog that emerges from the water back onto land.

Direct development

The reproductive strategy of many Solomon Island frog species differs greatly from the above method. Eggs and tadpoles do not require pools of water. Instead, the larvae undergo their development and complete metamorphosis within the egg membranes, hatching directly as small frogs. They still require moist habitats to prevent the eggs from drying out, but this direct development removes the need for freestanding water, enabling the frogs to reproduce in more locations.

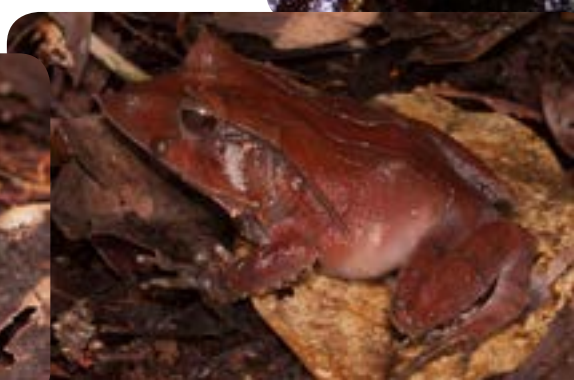
This type of reproduction may also be advantageous for crossing oceanic barriers. Direct development means that eggs can be carried by floodwaters on wood and debris between islands without contacting saltwater.

→ *Many Solomon Island frogs are direct developers and do not require freestanding water to breed*

A tadpole undergoing metamorphosis

Camouflage

The eyelash frog (*Ceratobatrachus guentheri*) is endemic to Solomon Islands and Bougainville. They are experts at camouflage, blending in with the environment to avoid their predators. The unusual and irregular contours along their heads and limbs make their bodies difficult to recognise amongst the leaf litter and foliage. Although they come in an amazing array of colours, they all belong to the same species. The colours allow them to further blend in with the environment - combinations of browns, greens, yellows and white help disguise them amongst leaf litter on the forest floor.



Ecological Niches

An ecological niche is the part of the environment where an animal lives, and its roles in the environment. Solomon Island frogs are a great example to demonstrate this. In a single area of lowland forest you can find adults of different frog species occupying different habitat niches: (1) on flat leaves high in the forest; (2) amongst vines and leaves on tree trunks; (3) on the leaves of understorey plants; (4) amongst leaf litter on the forest floor; (5) on round stones in the river; and (6) amongst boulders at the edges of rivers. The role of a frog in the canopy includes eating leaf-chewing insects, and providing food for tree snakes. The niche of forest floor frogs can include eating crawling insects, small crabs and worms, and providing food for ground-feeding animals such as megapodes and monitor lizards.

Reptiles

Photo: T.Lavery

Introduction

Reptiles are a large group of vertebrate animals that include turtles, alligators and crocodiles, lizards and snakes, and the tuatara that lives only in New Zealand.

Most reptile eggs have leathery shells that prevent them from drying out. Inside the egg, the developing embryo is enclosed in a moist sac known as the amnion, and yolk serves to nourish the embryo.

Very few species of reptiles show parental care, and more often than not, the young are on their own once the eggs have been hatched. Crocodiles are an exception. A mother crocodile is fiercely protective of her nest (a pile of rotting vegetation covering the eggs near the riverbank), and young. She will attack people and other potential predators that come too close. Hatching baby crocodiles call to their mother, and she carries them from the nest to the water in her mouth. In some rare cases, a few reptile species have evolved the ability to give birth to fully developed young, rather than laying eggs (including crocodile skinks and prehensile-tailed skinks that live in Solomon Islands).

The prehensile-tailed skink gives birth to live young

Crocodile skink

Not cold blooded!

Reptiles are different from birds and mammals in that they do not have feathers or fur – they have scales! As reptiles grow, they can generate new skin while shedding their old skin, which allows them to get rid of external parasites like mites and ticks. Most lizards will shed their skin in pieces, whereas snakes can shed it all at once, like a long sock being pulled off of a person's leg and foot. Some types of lizards, such as geckoes, are even known to eat their own shed skin!

Reptiles have the unfortunate reputation of being 'cold-blooded', but this is not exactly true. In fact, some desert reptiles have body temperatures that regularly exceed those of human beings. The more appropriate term is ectotherm, which means that reptiles rely on external sources of heat to adjust their body temperature. This is different from birds and mammals, which can maintain stable internal body temperatures regardless of the external environment. It is also why we often see reptiles basking in the sun – they are simply trying to warm themselves up. Just as easily, they can enter into underground burrows, swim in the water, or relax in the shade to cool down.

Photo: T.Lavery

- → *Reptiles are not cold blooded but instead use the external environment to heat their bodies*
- → *Reptiles regularly shed their skins as they grow*

A saltwater crocodile on the Kolobangara River Choiseul Island

Types of Reptiles

Crocodiles

One species of crocodile - saltwater crocodile (*Crocodylus porosus*) occurs in Solomon Islands. Saltwater crocodiles are the largest of all living reptiles and are the close relatives of species that lived alongside the dinosaurs some 98 million years ago. The largest and most dangerous reptile, at least to humans, is the crocodile. Crocodiles often grow to be as large as 2.5 - 3.0m, but sometimes really old individuals can grow much larger. They use their powerful jaws and teeth to feed on fish, crabs, frogs, birds, other reptiles, and sometimes pigs and flying foxes. The crocodile lives in mangrove swamps, rivers and creeks, and tidal estuaries, but they are also known to venture out into the open ocean. Crocodiles can be particularly dangerous at night because they are more difficult to see and can move very quietly through the water. They also tend to be bolder at night time and are more willing to move further away from the water's edge.

Lizards

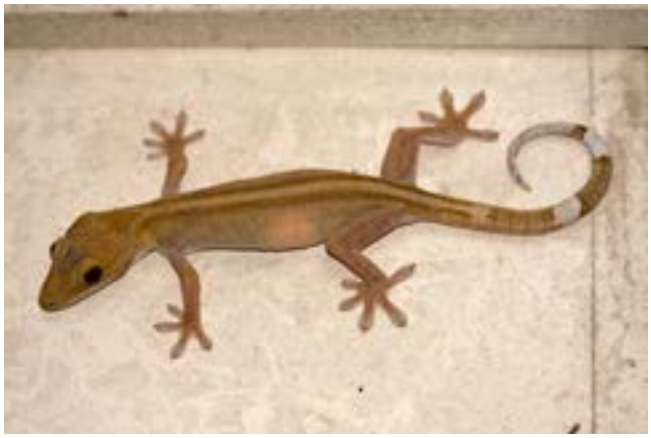
Lizards are by far the most diverse group of reptiles in the Solomon Islands, and within the lizards there are several different types – skinks, geckos, varanids (or 'monitors') and agamids (or 'dragons').

Lizards - Skinks

Skinks are the most common lizards in the Solomon islands. Most species can be recognized by their shiny scales, light-coloured stripes on their backs, small size, and brightly coloured tails (usually blue). However, not all skinks have bright tails or stripes, and some can grow very large. Two of the largest and most unusual skinks in Solomon Islands are the prehensile tailed skink *Corucia zebrata* and Poncelet's crocodile skink *Tribolonotus ponceleti*. The prehensile tailed skink is endemic to Solomon Islands. It is rarely seen during the day, and is one of the few species of reptiles that gives birth to live young. It is also unusual because of its large size and dinosaur-like appearance, not to mention that it uses its tail like an extra hand to help with climbing high in the forest canopy. In contrast, the crocodile skinks live exclusively on the ground and typically can only be seen by turning over rotting logs in the forest. The three species of crocodile skinks in the Solomon Islands have pronounced head shields and strongly keeled (spiny, rough) scales on their back that make them look much more like a miniaturized crocodile than a skink.

A crocodile skink

Lizards - Geckos



The second most diverse family of lizards in Solomon Islands are the geckos. Some geckos have the ability to produce sounds and most have fused eyelids. This means they cannot close their eyes and must clean them by licking them with their tongue. Like skinks, most geckos are small lizards that are known for being good climbers and are most active at night. Many species have claws for digging and moving on the ground, while others have modified scales on the underside of their hands and feet called 'subdigital lamellae', which enable them to move on vertical surfaces or cling upside down in trees and on ceilings. In towns, geckos are often seen on the sides of buildings near lights at night, where they feed on the insects attracted to the light. Also like the skinks, geckos have the ability to 'autotomize' their tails – when predators chase them and grab onto the tail, the tail comes off and wiggles on its own for at least a few minutes. This is because the muscles in the tail can actually store their own energy! As the predator's attention is diverted to the wiggling tail on the ground, the skink or gecko can then escape unharmed and regrow a new tail over the next few months. One gecko introduced to Solomon Islands often loses some of its loose skin rather than its tail if grabbed - the Pacific Gecko (*Gehyra mutilata*).

Photo: T.Lavery

A gecko from Makira Island

Lizards - Monitors

The monitor family is less diverse in Solomon Islands than either the geckos or skinks, but they are quite abundant in neighbouring Australia where they are known as 'goannas'. Monitor lizards are sometimes called 'iguanas' in Solomon Islands but in fact they are not true iguanas. These medium to very large lizards in the genus *Varanus* have long, narrow heads and bodies, and they sway from side to side when they slowly walk across the landscape. They also have long forked tongues that they constantly use to sample chemicals from the air and the ground – these chemicals tell them something about the location of their next meal, or warn them of nearby predators like humans, or even where a potential mate might be hiding out in the forest. Monitors have very large, sharp teeth and well-developed claws that they use to chase down prey, which include small mammals, birds, frogs, and other reptiles.

Lizards - Agamids

The last group of lizards, the agamids, are small to medium sized and are known for being good climbers. Like monitors, there are only two known species of agamids in the Solomon Islands that belong to the genus *Hypsilurus*. Both have long skinny limbs, particularly the hindlimbs, which they use to leap from branch to branch in the trees, often at very high speed. Some people refer to them as 'dragons' because of the row of sharp spines that they have running down the middle of their backs, giving them the appearance of a mythical creature dashing through the forest. If agamids lose their tails they cannot be grown back like those of geckos and skinks.

Photo: T.Lavery

Photo: T.Lavery

Snakes

Snakes are elongated carnivorous reptiles that do not have limbs. They have flexible jaws that allow them to feed upon prey that are much larger than their heads. There are a variety of different snake species in the Solomon Islands, ranging from those that live in the ocean (sea kraits and sea snakes), to those that commonly occur in the trees (South Pacific tree boa and brown treesnake), and to those that live in moist conditions under rotting logs and leaf litter (blindsnakes). The sea snake and sea kraits, along with two other terrestrial species, the Solomons Red Krait *Salomonelaps par* and the Solomons Black-banded krait *Loveridgelaps elapoides*, are members of the cobra family (Elapidae) and are considered dangerous due to their toxic venom. When threatened, the Solomons Red Krait will flatten its head and neck and make a loud hissing sound, similar to the cobras of India and Africa.

Blindsnakes in the family Typhlopidae are highly unusual because at first glance they look more like worms than snakes. They have shiny, smooth scales, a head that is indistinct from the rest of the body, a mouth that is on the underside of the head rather than being at the front of the head (like other snakes and lizards), and the eyes are reduced to small pin pricks. The small eyes are due to the fact that blindsnakes are most active at night and spend the majority of their time burrowing underground where eyes are of little use.

Several other snake species, such as the brown treesnake *Boiga irregularis* and the Solomons treesnake *Dendrelaphis calligastra*, can move rapidly in the trees and feed on small species of birds, frogs, and lizards.

Turtles

The ocean surrounding the Solomon Islands is also home to a number of sea turtles. They are marine animals which spend nearly their entire life at sea. A lot of their biology is therefore described in *Solomon Islands Marine Life*. Turtles are mentioned only briefly here as they do come ashore in Solomon Islands to lay their eggs in the sand above the waterline.

This part of their life history makes the adults, young, and eggs vulnerable to predation. The eggs are often eaten by animals such as monitor lizards and mortality is high when the young turtles hatch from the eggs and attempt to reach the water. Some animals that have been introduced to the Solomon Islands by humans (e.g. pigs and dogs) can be serious predators of turtle eggs and hatchlings.

There are small things that communities can do on land to make big differences to turtle conservation. People on Vangunu and Tetepare Islands for example have made a commitment to protect these special animals by banning harvesting of leatherback turtles. They also help to protect turtle nests from introduced predators like pigs and dogs and even relocate nests above the high tide mark so that they are not destroyed by high seas.

Leatherback turtle eggs

Photo: O.Revoh

Photo: B.Benham

Leatherback turtle nests laid at Zaira on Vangunu Island are relocated to this pen to save them from predators and high tides

Mammals

All mammals suckle their young with milk, and have hair or fur. Some have very little hair (e.g. dolphins and pigs).

All mammals in the Solomon Islands:

- → Give birth to live young. In other words, they do not lay eggs. Long beaked echidnas in Papua New Guinea are monotremes (mammals that lay eggs).
- → Have differentiated teeth, meaning that their teeth vary in shape and function - molars crush food at the back of their mouth, premolars at the side crack hard food and canines can tear tough food such as meat. Incisors nip food at the front.
- → Have four limbs - four legs, two legs and two arms, or two legs and two wings, or flippers.
- → Are warm-blooded (endothermic) - they keep their bodies at a constant temperature. Birds are also endotherms. Most endothermic animals cannot survive much variation in their core body temperature, but some mammals can cool their bodies temporarily to lower their metabolic rate and save energy (**torpor**, which looks similar to sleep or paralysis). Some tropical bats including northern blossom bats, tube-nosed bats and bare-backed fruit bats can become torpid for a few hours at a time.

These characteristics distinguish mammals from all other classes of land vertebrates such as birds, reptiles and amphibians.

Photo: T.Lavery

Little bent-wing bat

Native or introduced?

Native (indigenous) mammals come from the Solomon Islands - they have been here for hundreds of thousands, or even millions of years. Many native mammals in the Solomon Islands are endemic, including giant rats and several species of flying-foxes. This means that they evolved here (have only ever existed in Solomon Islands) and are found nowhere else on earth. Some live on only on one or two islands, or on one mountain. Not all Solomon Island native mammals are endemic - some bats are also found in Papua New Guinea (PNG), Indonesia, and some also in other parts of Asia.

Other mammals like dogs, cats, rats and pigs have been introduced to Solomon Islands more recently.

Native rats

The Bougainville giant rat (*Solomys salebrosus*) is only found on Choiseul and Bougainville. It probably only lives in large areas of forest that have not been logged, and prefers to stay in trees and not come down to the ground. Few people have seen this mammal. Like other endemic Solomon Island giant rats, it is very rare and at very high risk of extinction. There are eight species of Solomon Island tree rats, each restricted to a few islands. Some islands including Makira and New Georgia have a native rat known to people that has not yet been scientifically described, so biologists are unsure if these species are unique to these islands or the same as species found in other provinces. There may be new species still to be recorded.

- → *Most native rats are arboreal - they spend all of their lives in the trees*
- → *One species (Poncelet's giant rat) is the size of a cat and makes large nests of sticks high up in tall trees on Bougainville and Choiseul*

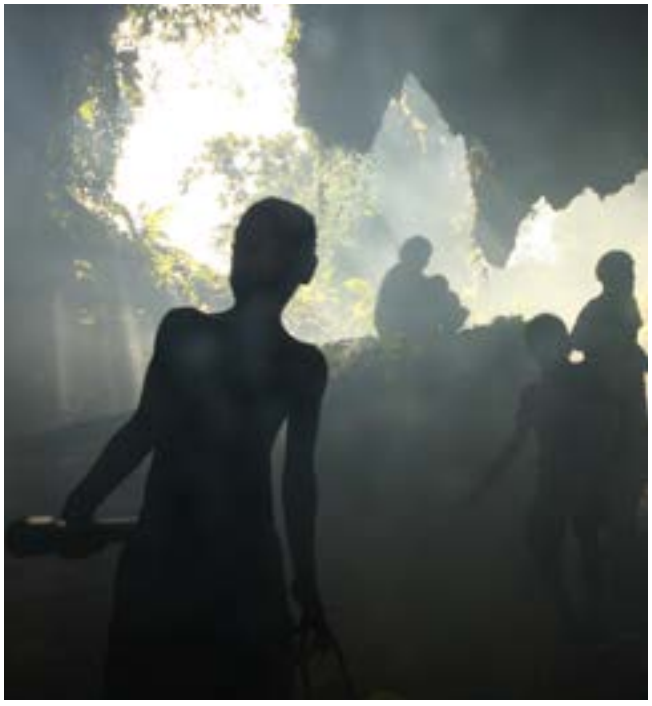
Bougainville giant rat

Bats

Bats are the most common group of mammals in the Solomon Islands, and also have the greatest number of species. There are two groups - mega-bats (that include larger species such as flying-foxes, which mostly eat fruits, nectar and pollen) and micro-bats (including the smaller bats often seen in early evening). These smaller species eat insects and use echolocation to find their way through the forest.

Where are they found?

Caves provide important habitat for many bats. They are quiet and dark places and so make good places for them to rest during the day. Caves are also important places for reproduction. When the young become too heavy to carry, many species leave them inside caves while they go out to find food at night.



- → *Caves are important places for bats*
- → *Larger flying-foxes can roost in caves, hollow trees or in the open hanging from trees*

Photo: P.Pikacha

Why are bats important?

Forest engineers

Flying-foxes are essential to keeping forests healthy. They play important roles pollinating the flowers of plants and dispersing their seeds. Pollen sticks to their fur when they eat nectar or crawl from flower to flower, and when they eat or carry the fruits of plants, they transport the seeds and deposit them into new areas where they can have a better chance of growing away from the parent plant. Because flying-foxes are very mobile, they can disperse seeds a long way, even between different islands. Flying-foxes help the forest regenerate in areas that have been damaged by cyclones or logging. In this way they also help plants adapt to changes in the environment.

- → *Bats are important pollinators and seed dispersers*
- → *Insect-eating bats help control mosquitos and insects that eat garden plants*

Pest control

Smaller bats mostly eat insects and a single bat can consume huge numbers of insects in one night. This makes them very important for controlling some of the insects that are a problem for humans. Bats control mosquitos that can carry malaria and dengue fever. They also control some of the insects that cause problems in gardens.

Issues and threats

Habitat loss and hunting

Some flying-foxes and smaller micro-bats require hollow trees to roost in. Clearing of old trees for gardens or logging can therefore result in the loss of important parts of their habitat.

Larger species of flying-fox like Solomons flying-fox and the Solomons bare-backed fruit-bat are commonly hunted in some parts of Solomon Islands. These large species typically only produce one baby each year. If they are hunted too frequently, numbers can decrease quickly. Flying-fox colonies must therefore be managed carefully to make sure they do not become locally extinct.

How can you help?

Don't over-harvest bats

One way you can help is by making sure the bats in your area are not over-harvested. This might mean not hunting too frequently, or setting aside some tambu areas where hunting of bats is not permitted. Preventing hunting at times when bats are carrying young is also very important as the baby bats will grow and keep a healthy population.

Flying-foxes

There are around 25 species of flying foxes (fruit-and nectar-eating bats) in the Solomon Islands. They range in size from the 10g northern blossom bat (*Macroglossus minimus*) to the ~800g Solomons flying fox (*Pteropus rayneri*). Some of the species are restricted to only a single island. For example, the Makira flying-fox (*Pteropus cognatus*) is only found on Makira and close islands such as Ugi, and the Rennell flying-fox (*Pteropus rennelli*) is only found on Rennell Island.

The New Georgia monkey-faced bat is only found on New Georgia, Vangunu and Kolombangara. It spends the day sleeping inside a hollow tree, often an Ababolo (strangler fig). It usually roosts in groups of two to ten animals, sometimes it shares trees with other bat species such as the dwarf flying fox, or a kandora. At night, it visits fruiting and flowering trees both in forest and around villages and gardens. It has a gentle temperament, and does not bite. It is rare and at high risk of extinction (because it has a small population, and lives only on a few islands where the area of forest with large trees is shrinking).

New Georgia monkey-faced bat

Northern blossom bat

Solomons flying-fox

Dwarf flying-fox

Solomons flying-fox

The Solomons flying fox (*Pteropus rayneri*) is the heaviest species of bat in the Solomon Islands. This species of flying fox only lives in the Solomon Islands. It spends the day roosting in a large camp in a tree with hundreds or thousands of others, and can fly tens of kilometres a night to find fruiting and flowering trees. Large flying foxes such as this species are capable of flying between islands.

- *Flying-foxes are important pollinators and seed dispersers*
- *Some species are rare and easy to hunt so they should be carefully managed to ensure they do not go extinct*

Photo: C.K.Posala

Tubed nostrils

The Umboi tube-nosed (*Nyctimene vizcaccia*) is also a flying-fox, but it is a much smaller species than the New Georgia monkey-faced bat or Solomons flying-fox. There are three species of tube-nosed bats in Solomon Islands - all of the main islands and many small islands have one. You may have heard their high pitched calls at night which sound like a kissing noise. This bat is so small that it can hide under leaves of trees and shrubs. It tends to roost alone and its wings have a brown and yellow pattern with shadows on them. When the bat is roosting it looks like a dead leaf and this helps it hide predators that might attack it (camouflage).

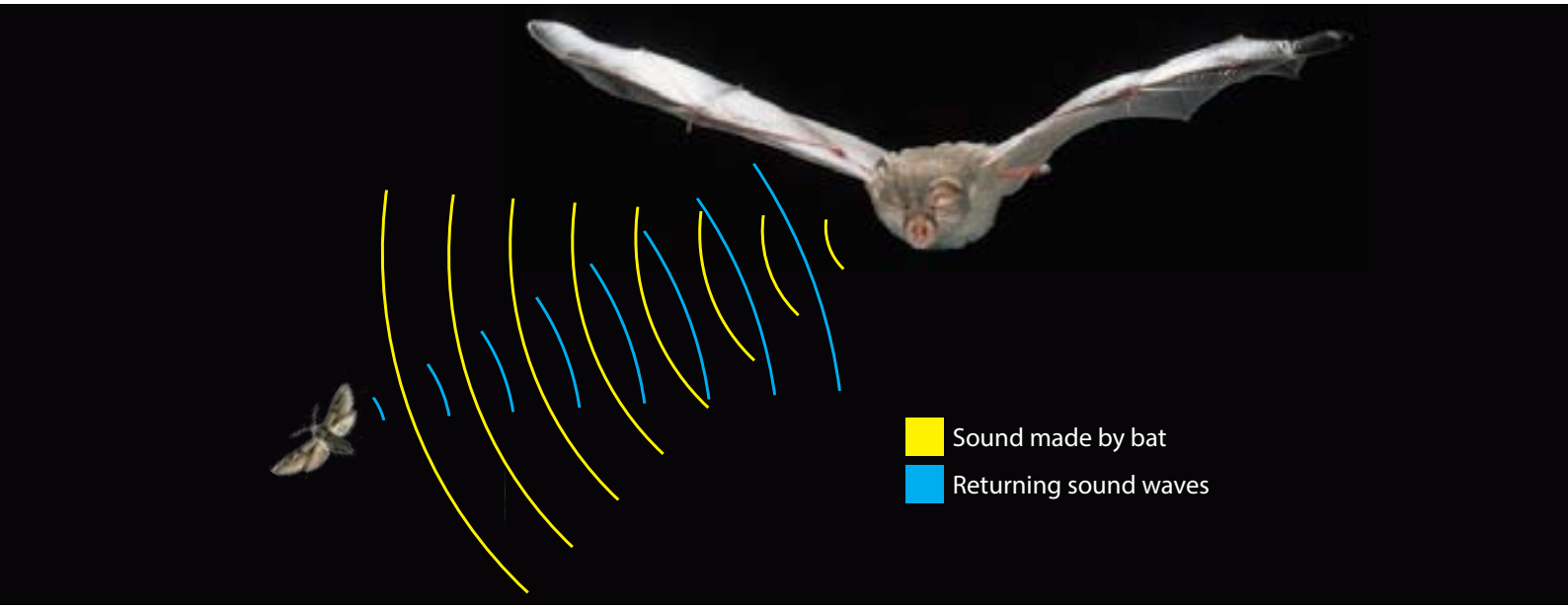
Scientists are uncertain why these bats have such an unusual nose. They eat fruit, and the two tube nostrils facing different directions may help the bat to find ripe fruit from far away, by following the direction of the smell.

Umboi tube-nosed bat

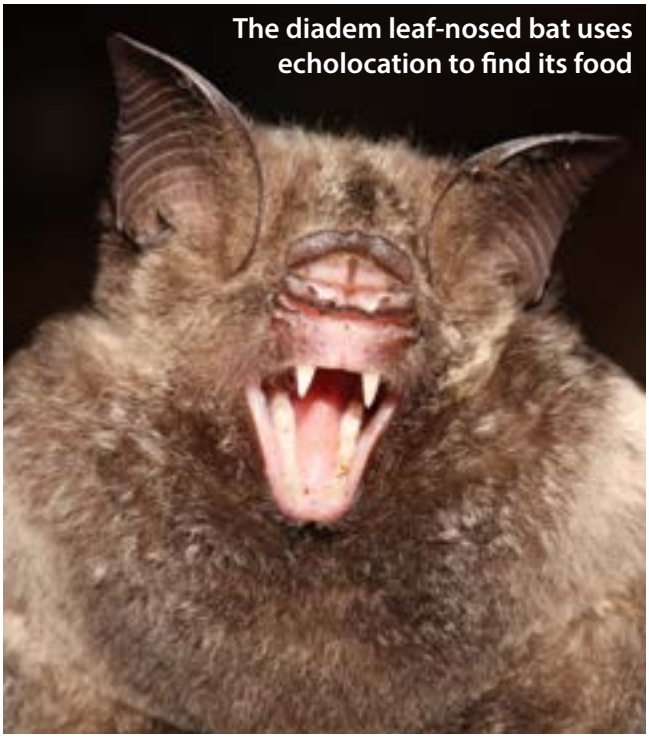
Seeing by listening

The eyes of some bats are so small that they are almost blind, so how do they find their way around at night? They use echolocation – the use of sound waves and echoes to determine where objects are.

Small bats (i.e. microbats that eat insects, not flying-foxes) make very high-pitched calls. Usually humans cannot hear these calls, but sometimes we can hear the lower frequency part of the sound of some bats. It sounds like rapid, high-pitched clicking when the bat flies past. Children and teenagers have better hearing than adults, so you might hear a bat call although adults cannot hear it.



To echolocate, the bats produce loud pulses of sound either with their mouths, or they channel the sound through folds in their face and nose. When this sound hits something, it bounces off and an echo comes back to the bat's ears (which are often huge). The bat's brain can interpret the distance, size, shape and texture of objects very accurately from this echo, especially when the rate of clicking speeds up to a buzz as the bat approaches an insect to catch it.


The diadem leaf-nosed bat uses echolocation to find its food

Echolocating bats can call ten or more times every second, to find their way while flying in darkness and to hunt evasive insects. Flying-foxes do not have echolocation, although the cave-roosting rousette bats click with their tongues to navigate inside dark caves.

"Leaf-noses"

The diadem leaf-nosed bat occurs throughout most of Solomon Islands. It hunts insects using echolocation to find its prey among the leaves of trees and shrubs, and swoops in to pick them up with its sharp teeth.

Leaf-nose bats produce their echolocation sounds through their noses. The complex shape of their leaf-nose helps to direct the sound.

Introduced Mammals

Cats, dogs, pigs and some types of rats are considered to be introduced - they have been brought by people from other countries in their canoes or ships, and have been in the Solomon Islands for 4000 years or less. In many cases, the cats, dogs and pigs have become wild or feral - they live freely in the forest away from people. Do you think that the kandora or cuscus should be considered native or introduced (see opposite page)?

Pigs

The wild pig is one of the world's most widespread mammals on land. Pigs live on every continent except Antarctica, and on many islands. This is because for thousands of years, people in many parts of the world have brought pigs with them for food when they travelled. People probably introduced pigs to Papua New Guinea from Indonesia around 4000 years ago, and from there they were also transported to Solomon Islands. Domestic European pigs were also brought to Solomon Islands more recently, in the 19th century. Pigs have a very broad diet and can survive or live anywhere where there is fresh water and shelter.

Melanesian pig

Rats

The rats that are commonly seen around villages and towns are introduced. Up to three different introduced species can sometimes be found in different parts of Solomon Islands. The Pacific rat *Rattus exulans* (also called Polynesian rat or Kiore) is native to Southeast Asia. It was introduced to many Pacific Islands in the canoes of Polynesian travellers. Perhaps it hid in their supplies, or it was deliberately brought with them for food. In Solomon Islands, this happened around the same time as pigs were introduced. The Pacific rat is most common in disturbed areas such as gardens and villages. It is often commensal, meaning that it lives in people's houses and kitchens and eats their food (without permission!). Another species of introduced rat on some islands is the Large New Guinea spiny rat (*Rattus praetor*). This species has an unpleasant smell. The black rat (*Rattus rattus*) and brown rat (*Rattus norvegicus*) are much more recent introductions, probably arriving when Europeans first began visiting Solomon Islands.

Large spiny rat

Pacific rat

- *Introduced animals are sometimes referred to as feral animals*
- *Some rats are commensal - meaning they frequently live with humans in villages and houses*

Cats

Cats were domesticated by people of the Mediterranean region of Europe around ten thousand years ago. Like pigs, cats now occur on every continent except Antarctica, and on many islands throughout the world, because they have travelled with people. They likely arrived in Solomon Islands with Europeans in the 19th century. Sailors kept them on ships as pets, and to control ship rats.

Introduced cats threaten the survival of small native mammals on many of the world's islands and have caused the extinction of some. This may include endemic Solomon Island rats. At least two endemic rodents on Guadalcanal (the Guadalcanal rat - *Uromys porculus,* and the Emperor rat - *Uromys imperator*) may have been exterminated by cats. Introduced rats may also have played a role in the extinction of these rodents, by hunting native rats, competing with them, or spreading disease.

Kandora - the cuscus or possum

The species of possum that occurs in Solomon Islands is the northern common cuscus or grey cuscus (*Phalanger orientalis*). It also lives on many islands in Indonesia, East Timor, and Papua New Guinea. Populations on several Indonesian islands, the Bismarck islands of PNG and the Solomon Islands are not truly native to these islands. Like pigs and Polynesian rats, they were introduced to these places by people thousands of years ago. Possums have probably been in the Solomon Islands for longer than pigs and Polynesian rats (around 6000 years or more). It is likely that people brought the possum with them for food when they travelled from PNG. The kandora is a very adaptable leaf- and fruit-eating species that can thrive in many types of vegetation, including disturbed and logged forest. Because it has been in the Solomon Islands for so long, we might describe the kandora as 'naturalised', meaning that it is well established, and now has a similar role in the forest to a native mammal. Can we say the same about pigs and Polynesian rats?

Birds

There are some key characteristics of birds that are not shared with other groups. They are endothermic vertebrates with feathers. Feathers can be very different on different birds, but all birds have them, and no other living animal groups do. Similarly, all birds have bills, which do not have teeth, and are not found in other living animal groups. While there are surprisingly few traits that distinguish birds from all other groups, there are lots of features of birds that make them special. For example, they reproduce by laying eggs, have wings, and most species can fly.

→ *The early morning period when birds begin to sing is often called the 'dawn chorus'*

Most birds have some kind of sound making ability and can produce distinctive songs. Many species are more often heard than they are seen. Birds sing for a number of reasons - to advertise their territories, attract mates, deter predators and to make alarm calls. A good time to listen to bird calls is at dawn. At this time, what is referred to as the 'dawn chorus' begins and many species sing to re-establish their territories and begin the new day.

The moustached kingfisher is a rare bird from Guadalcanal that has been seen very few times by scientists. It has a distinctive song that sounds similar to someone laughing.

Bones, beaks and feathers

Most birds fly, and even those that do not fly, still have wings. These wings are one of the many specialized features of birds aimed toward making flight possible. Birds are lightweight and have extremely large muscles and bones in odd places. For example, the bone in the middle of the chest of birds is extremely enlarged; this allows for over-sized chest muscles that help birds flap their wings. The bones in birds' wings are also special; they can be thought of as similar to the bones in your wrist and hand, but birds have fewer bones in their wings than you do in your hand, and these bones have been fused together, so they no longer bend.

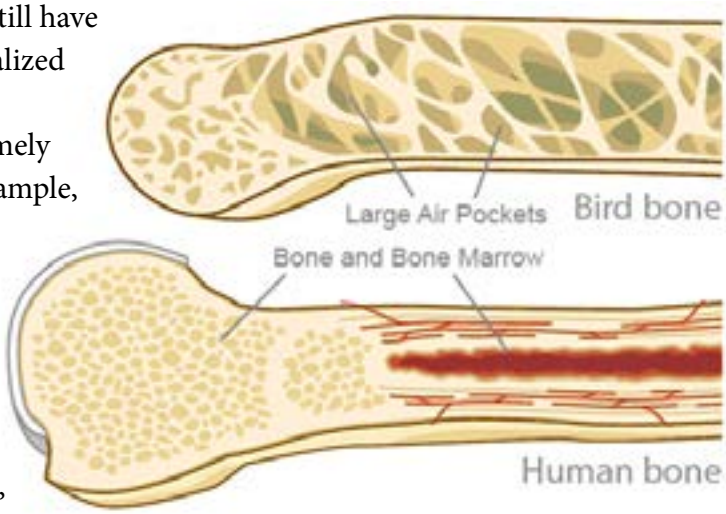


Image: www.askabiologist.asu.edu

More generally, bird bones are hollow, making them lighter to make flight easier. There are many other internal characteristics of birds' muscles, bones, lungs, and even brains, all aimed toward making flight possible.

Image: www.allaboutbirds.org

Feathers

In additional to the amazing internal structures of birds that help them to fly, there are external traits that we are all familiar with that are probably what comes to mind when you think of birds. Of course, the first must be feathers! Feathers are modified parts of birds' skin that are dead cells (like human hair and fingernails). Feathers wear out and are replaced regularly with new feathers – a process called moulting. Feathers may look very different on different birds. They range in colour widely from species to species and even between males and females of the same species. However, all can be thought of as two types of feathers. The first is a fluffy feather near the body that helps birds stay warm or cool. The second is a stiffer outer feather that provides structure and can be functional; these are the feathers on the wing or tails of birds, and they help birds do things like collect food, avoid being eaten, and even to attract mates.

Beaks

Less colourful than feathers (but equally amazing), are the beaks of birds. Beaks are something that all birds have, but there is an incredible amount of variation between species. This variation reflects the different lifestyles of the birds, and they are specially designed to suit different feeding requirements (in the same way we humans might use tools for different jobs). It is often possible to tell what a bird eats, just by looking at its beak. For example, some birds in the Solomon Islands have long thin curved beaks that help them to get nectar out of flowers. Others have short strong pointed beaks that help them to rip apart smaller birds that they catch and eat! Some birds even have short stiff feathers around their beaks that look like the whiskers on a cat, and help to catch the insects that they eat.

→ *Beaks come in an endless variety of shapes and sizes and can be compared to some of the tools people use in everyday life*

These are just a few of the ways that all birds are similar, and a tiny number of ways that different species of birds in the world are different from each other.

Images: Birdlife Australia

Why are birds important?

Seed dispersal

Superb fruit dove

Due to their ability to fly long distances in short periods of time, birds are very effective at dispersing seeds. The most well-known method by which birds disperse seeds is through eating fruits. The bird digests the fleshy part of the fruit and then passes the seeds out at a different location far from the parent tree. This spreads offspring in lower densities over a greater area, giving them a greater chance of survival.

Seed dispersal is vital for the long-term survival of some pants and their ability to find a suitable place to grow. Many rainforest plants have evolved fruits that are very attractive to birds, encouraging them to eat their fruits for just this reason. Bright fleshy fruits are therefore a special feature of rainforests. In some rainforests, over 80% of the plants produce fleshy fruits that are suitable for dispersal by animals.

Photo: K.Zufelt

Common myna

The common myna (*Acridotheres tristis*) is a bird that has been commonly **introduced** throughout many parts of the world. This species is very common in Honiara (often called the 'police bird') and some of the other major towns in Solomon Islands. It is a species that is very adaptable and is well accustomed to living in urban environments.

Photo: C.Tang

The common myna is another species recognised in the top 100 of the world's worst invasive species. In Australia the bird is a problem because it nests in the tree hollows that are needed by other species of bird and mammal. It is uncertain how this bird may be affecting native animals in Solomon Islands.

White-capped monarch

Food chains

Insectivorous birds (those that eat insects) can help to control the populations of insects that may be pests to crops or spread disease. There are also many birds that eat living terrestrial animals and fish, and some that eat dead animals. These predatory birds can help to control pest populations, like rats, and the birds that eat dead animals help to move nutrients through natural systems. All of these direct actions of birds are important to maintaining a healthy environment and can provide clear benefits to people (like reducing garden pests), or more indirect benefits (like maintaining diversity in forests by moving around seeds away from the trees where they are produced).

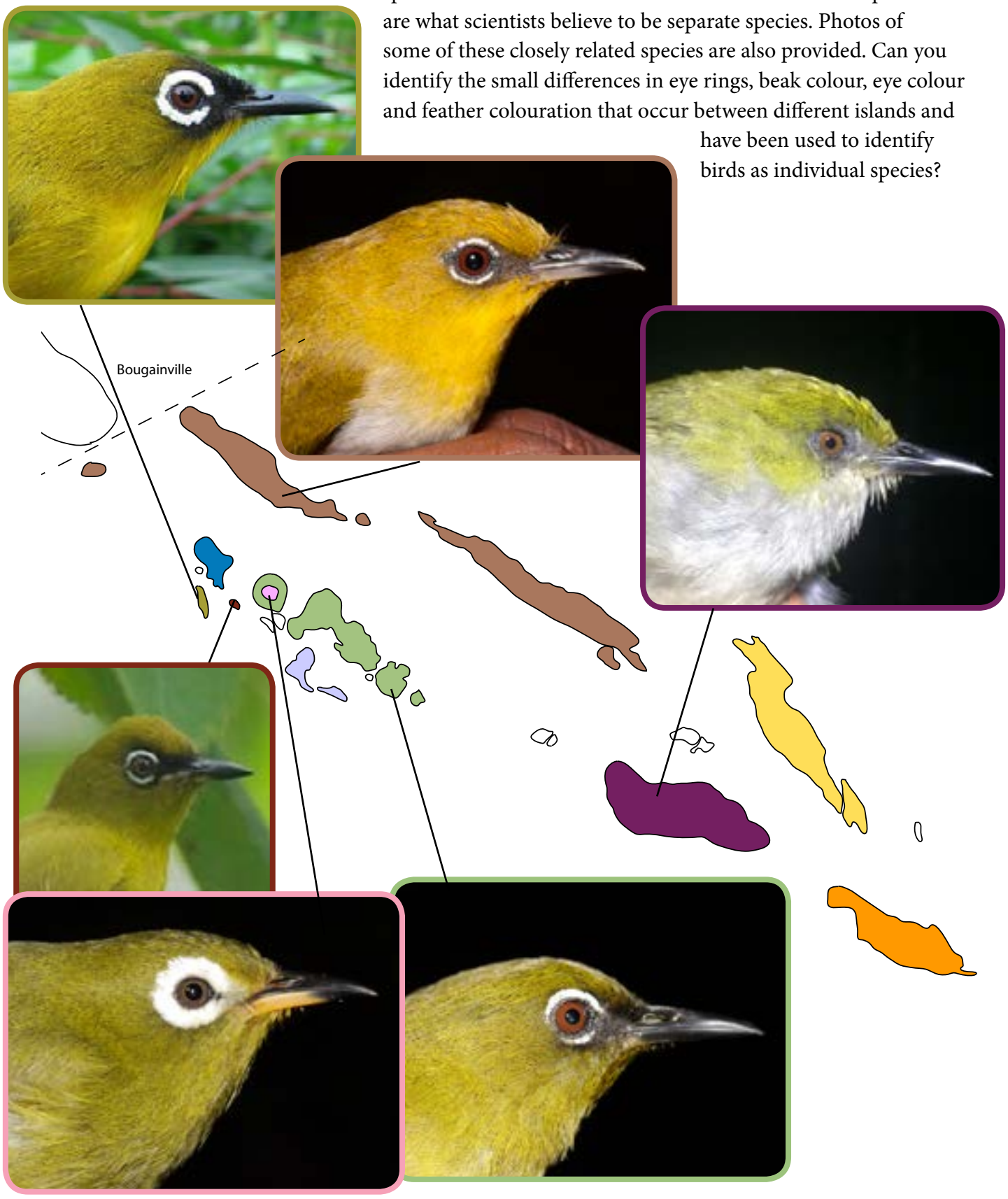
Birds can also be very culturally important in Solomon Islands. This varies from place to place, but things like the Kukuvoju support a feeling of community on Choiseul, and eagles are an iconic species on Malaita. Birds can also be an important attraction for tourists. There are many birdwatchers who travel parts of the wold just to see endemic species that occur nowhere else in the world.

Brown fantail

Guadalcanal honeyeater

Wonderful white eyes

One special group of birds that occurs in the Solomon Islands are the white eyes (*Zosterops* spp.). White eyes are very interesting from a scientific perspective because even where these birds occur on islands that are very close together (for example in the Western Province) they have evolved to become separate species. Each of the different colours shown on the map below are what scientists believe to be separate species. Photos of some of these closely related species are also provided. Can you identify the small differences in eye rings, beak colour, eye colour and feather colouration that occur between different islands and have been used to identify birds as individual species?



Megapodes

Megapodes are a little different from most birds. Rather than using their own body heat to incubate their eggs, megapodes use heat from the environment instead. They do this by burying their eggs in soil that is heated by either volcanic activity, the sun, or decomposition of plant material. Like crocodiles, some megapodes take advantage of the heat produced when bacteria break down the carbohydrates and proteins in dead plants, by building a pile of rotting vegetation for their eggs. Male megapodes carefully select areas with the right temperature to correctly incubate the female's eggs. The eggs have an extremely long incubation period (more than 40 days) and high yolk content (more than 70%). Yolk provides nutrients for the developing chick in the egg. This means that when megapode chicks hatch, they are very well developed and do not need any assistance from the parents. As soon as they have hatched, chicks have all their flight feathers and can run and even fly. The name megapode comes from the words mega (meaning large) and pod (meaning foot) - because of the large feet they use to dig and move leaves and soil.

Melanesian megapodes

Melanesian Megapodes are very interesting because they can use all three heat sources to incubate their eggs. On volcanic islands such as Simbo and Savo, the birds lay their eggs in soil that is heated by the active volcanoes. In these places, the birds form large communal nesting grounds where thousands of birds may lay. In places like the Arnarvon Islands between Choiseul and Isabel, megapodes lay their eggs on beaches that are exposed to the sun. Other populations that do not have access to these heat sources use decaying plant material by either laying eggs in the decaying roots of dead trees or by scraping together piles of leaves on the forest floor.

Photo: F.Olivier

Issues and threats

Over-harvesting

Megapode eggs are an important food resource and many families rely on the income generated from selling them at local markets. This means we must manage the harvest of eggs to ensure they are available in the long-term. Over-harvesting eggs can result in declines in numbers of megapodes and the eggs they lay, or even local extinctions.

- → *high rates of mortality in megapode chicks mean that many megapode eggs must hatch to keep a healthy population*
- → *a closed season of 3 months a year can ensure enough megapode eggs hatch to maintain a sustainable harvest*

Photo: J.Thomson

Megapode chicks are vulnerable

Because megapode chicks are independent as soon as they hatch, they are extremely vulnerable to predators. Most chicks do not survive more than a week after they leave the nest.

How can you help?

Closed seasons

Closed seasons (where the harvesting of eggs is not allowed) are the best way of making sure some eggs are able to hatch and grow into adult megapodes. On Simbo, scientists have found that the best amount of time to close the harvest of megapode eggs is 3 months. This allows approximately 31% of the eggs laid in that time to hatch, producing 10,000 - 16,500 chicks.

Cats and dogs

10,000 - 16,500 chicks sounds like a lot, but unfortunately the majority of these will be killed in their first week after hatching. Many are killed by introduced predators - the dogs and cats that people keep around houses and villages. A good way to keep a healthy population of megapodes is to control the number of cats and dogs that are present near nesting sites.

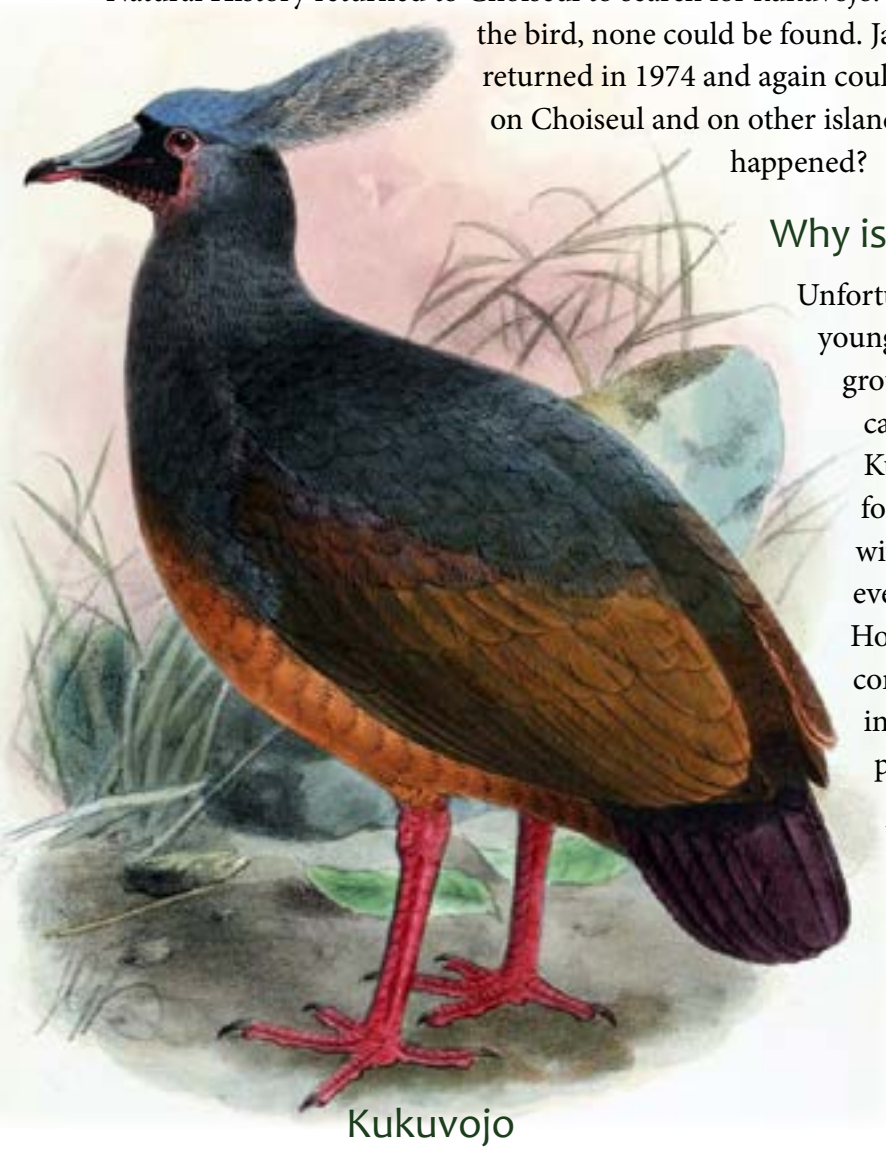
Kukuvojo - Choiseul crested pigeon

In 1904, on the northwest coast of Choiseul, naturalist Albert Meek captured what some think is the most remarkable bird in Northern Melanesia: the kukuvojo, also known as the Choiseul crested pigeon, or *Microgoura meeki*.

This large ground-dwelling pigeon, with its strange crest and brightly coloured face and bill, most likely lived on Choiseul and nowhere else on earth. It is believed to have built its nest on the ground or in low branches in swampy lowland forests. Its young probably left the nest at a very small size to head out into the bush, searching for the fallen fruits and seeds that can be found in the Choiseul forest.

→ *the crested cuckoo dove looks similar to kukuvojo and occurs on Choiseul*

In 1927, only about twenty-three years after it was discovered by scientists, the American Museum of Natural History returned to Choiseul to search for kukuvojo. Although locals reported having seen the bird, none could be found. Jared Diamond (an American bird expert) returned in 1974 and again couldn't find kukuvojo. More recent searches on Choiseul and on other islands have not been successful either - so what happened?



Kukuvojo

Why is it missing?

Unfortunately, kukuvojo's large size, independent young, and habit of nesting and living on the ground can be dangerous on an island where cats, rats, and dogs have been introduced. Kukuvoju probably lived with dogs and pigs for a long period (these probably arrived with the earliest Melanesians). It probably even lived with cats for several generations. However, the later introduction of rats, continued introduction of cats, and increases in dog numbers all may have increased pressure on the Kukuvojo.

Unfortunately, it seems certain that this special bird from Choiseul is now **extinct** – forever gone from the earth.

Like to see more?

→ *http://tinyurl.com/j54dhhz*

Critical issues

The forests of Solomon Islands are biologically diverse, and contain large proportions of species that can be found nowhere else in the world. The following sections explain some critical issues that will be important in the future to maintain the healthy forest environment that Solomon communities depend on.

Forest Resource Management

82

Solomon Island forests provide essential food, income, firewood, recreation, medicine, tourism and many other services. As populations grow and commercial pressures increase, forest resources are becoming threatened by human activities and harvesting. To face these new challenges some communities are reinforcing old customary management systems or implementing new resource management areas and protected areas to control resource use.

Deforestation

84

Deforestation is the cutting, clearing, and removal of a forest or number of trees so the land is no longer forested. There are many different forms of deforestation, including logging for timber, clear-cutting for agriculture or cash-crops, mining for metals, and wildfires. Deforestation and degradation have many negative impacts on the environment.

Plastic and Pollution

87

Solomon Islanders use many products from the natural environment. People carry things in baskets woven from coconut fronds and a large proportion of the food that people eat come from gardens and the ocean. However, these are increasingly being replaced by items from stores that use plastic. Plastics are not biodegradable and this means that when they are thrown into the environment they last for thousands of years, causing big problems for wildlife.

Invasive Species

88

Today there is a large amount of travel between Solomon Islands and other parts of the world by ship and aeroplane. This presents a continual risk that species of plant or animal from other parts of the world will be accidentally introduced to Solomon Islands. We call these “invasive” or “pest” species. They can often get out of control and can cause ecological, economic or health problems.

Climate change

91

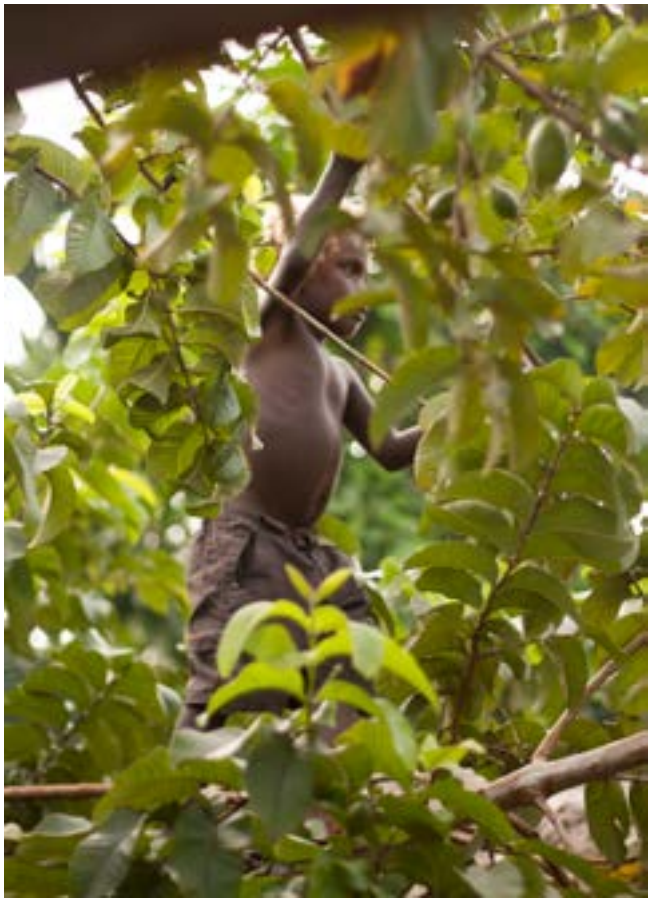
Recently, human activities have caused rapid changes in the climate worldwide. Climate is closely linked to the biology of forests and small changes in climate can have big effects on the health of ecosystems. The Solomon Islands are starting to experience changes in sea level, rainfall and temperature as a result of human-induced climate change. These changes in climate may affect the forest resources that are important for livelihoods.

Forest Resource Management

Solomon Islanders are extremely lucky to have access to abundant natural resources. Many free forest resources are used Solomon Island people in their daily lives such as timber for building houses, leaf for making roofs, bush foods, clean water and traditional medicines. In many parts of the world people must work and earn money to pay for all of these resources.

However, with growing populations it is becoming increasingly important that we plan to use these resources sustainably so that future generations will be able to use them too.

Sustainable use can include only harvesting resources that are needed. For example, we can avoid waste by taking time to select the best-suited resources, such as sticks for houses, before cutting. Destructive harvesting practices such as cutting down a tree to catch a possum should also be avoided. Large trees take a long time to grow and provide important homes. Harvesting such resources for immediate benefits can have long term costs, including fewer resources available in the future.



Ecosystem services

In addition to the forest products people use in their every day lives there are also indirect contributions made by forests that benefit people. Both these direct and indirect contributions are often called ecosystem services.

Forests help regulate the climate, purify our water, keep pests and disease in balance and are culturally important to Solomon Islanders. In these and other ways, forests contribute to the well-being of humans in ways that are often not realised.

In other parts of the world people must pay for the natural resources that Solomon Islanders enjoy for free. Natural resources need to be managed for future generations.

Deforestation

Deforestation is the cutting, clearing, and removal of a forest or number of trees so the land is no longer forested. There are many different forms of deforestation, including logging for timber, clear-cutting for agriculture or cash-crops, mining for metals, and wildfires. Significant deforestation is also caused by degradation. Degradation is a gradual destructive process, such as selective logging or over-harvesting of certain species that result in changes to the forest structure, and a loss of forest cover and species. Some of these processes (such as wildfires) are natural, but most deforestation and degradation occurs because of human activities.

Photo: S.Albert

Deforestation and degradation have many negative impacts on the environment. A major consequence of deforestation and degradation is the loss of habitat for many animals and plants. When species lose their homes they are unable to survive and the numbers of these species decline, with some becoming extinct. Deforestation of rainforests in tropical countries, such as Solomon Islands, is a particular concern because these forests are home to irreplaceable biodiversity.

Even localised deforestation and degradation can cause species extinctions, particularly for island endemic species. For example, when areas of forest are lost through conversion to agriculture or cash crops, these areas are unable to support the same types of species. A study on Makira found that forest areas were important for many endemic bird species, and that these species were not found in cocoa plantations. As cocoa plantations expand and forest areas decrease, the number of birds that depend on the forest will also decrease.

Panguna mine, Bougainville Photo: S.Albert

Local and global consequences

Global

Deforestation has global consequences. It causes changes in environmental processes such as the water cycle and climate change. Removing trees increases the amount of sun that reaches the ground, which dries out the soil and can lead to uncomfortably warm temperatures. This can be harmful to plants and animals as well as humans.

Trees also play an important role in absorbing greenhouse gases. Their removal not only reduces the absorption of these gases, but also releases carbon dioxide into the atmosphere which increases the rate of climate change.

Local

At a local scale, deforestation can increase the impacts of natural disasters. Trees and forests play an important role in absorbing rainfall and stabilising soils.

If heavy rainfall is received in a catchment where there has been a significant amount of deforestation, very little of the water is absorbed and it instead travels quickly into rivers and streams. The water carries with it huge loads of soil and sediment. This all increases the rates and impacts of flooding downstream. Logs and debris that have been removed by logging or other forms of deforestation can travel with the water causing an increased amount of damage to houses and buildings as they travel with the water.

Mataniko river flooding

Photo: T.Bransby

There are several important differences between cyclone damage and logging damage to forests. Cyclones remove part of the vegetation from patches of forest. They cause less soil erosion than clear-felling or creating logging access roads. When a forest is cyclone-damaged, the plants regenerate from dormant buds remaining on broken tree stumps, and fruit that germinate on the forest floor.

In a logging operation there are fewer live tree bases remaining. Many types of fruit perish from the heat of the sun. This makes the regeneration of the forest slower. Forest fungi are important for forest mineral cycling. These are also destroyed by sunlight due to soil exposure and high temperature. Species diversity is diminished by logging, and soil erosion can result in even a slower return to the former species richness. Repeated logging reduces the ability of the forest to regenerate to such an extent that seed is no longer available to replace many large-fruited and heat-sensitive species. Fast-growing, heat-tolerant species then dominate. These are sometimes called early- and mid- succession species, because they exploit gaps in the forest (some may also be introduced weeds).

Cyclones also create a patchy clearing effect. The most heavily impacted forest is on exposed ridges, and the less affected area is in the protected gullies or the leeward sides of islands. This provides for a pool of species that then re-establish quickly from the less affected source areas. When there is logging damage, the whole ecosystem is almost fully removed, leaving few places from which the forest can reproduce itself rapidly. Logging roads and machinery often brings many weeds, which can interfere with how the forest regenerates following tree removal.

Deforestation and degradation also have negative impacts on local communities, including a loss of kastom and an increase in conflicts over land rights and resources.

- → *Logging causes changes the soil and increases temperatures making it difficult for forests to regenerate*
- → *Logging introduces weeds and pests*

Plastics

Photo: Sparkle Motion/Flickr

Each year, millions of tonnes of rubbish enter the world's environment. The majority is plastic - bottles, bags, containers, straws, lids and wrappers. Plastics in our environment cause huge problems. Unlike paper, glass or other naturally based products, plastic never truly breaks down, they just break into smaller and smaller pieces. This means that every piece of plastic that has ever been thrown into our environment is still there today. Once in the environment, these plastics continue to cause problems. For example, it has been estimated that 90% of seabirds and over 50% of sea turtles have eaten plastics.

Plastics are a global problem but the solution is local. Plastic packaging is a recent craze - a fast fix. It's unnecessary, unsustainable and must become unacceptable. We must change our habits and break the deadly cycle.

How can you help?

Reduce, reuse, recycle!

We can prevent many plastics ending up in our environment through some simple measures. Firstly - try to **reduce** the amount of plastic you buy. You might be able to use some alternative natural resources to plastic bags and bottles and this will save your money as well as the environment. Try to **reuse** as many of the plastic items as you can (e.g. refill water bottles) rather than buying new ones. If facilities are available, **recycle** plastics rather than throwing them to the garbage, and finally if plastics must be thrown away make sure they are placed into **rubbish bins** rather than on the streets or into our oceans and waterways.

Honiara's Mataniko River is polluted with plastics but there are ways we can improve it.

Photo: P.Nomad

Invasive Species

Photo: fame.org.au

'Invasive' species are the single biggest threat to Pacific Island environments. Sometimes when a species is introduced from another country it can become a lot more successful that it would normally be in its natural environment. Often this is because the predators and parasites that keep populations in control are not present in the new environment. Invasive species can also have other adaptations (e.g. high rates of breeding and poisonous defences) that allow them to quickly take over on Pacific Islands.

Luckily, Solomon Islands do not yet have many invasive species compared to other Pacific Islands. However, some of the species that have already become established are among the world's worst invasives. These include the cane toad, giant African snail, common myna and water hyacinth.

Giant African snails are a serious pest of agricultural crops and one of the world's worst invasive species

Photo: T.Lavery

Water hyacinth

Photo: Wikimedia Commons

What makes a species invasive?

It is difficult to predict which species will become invasive and different species can become invasive in some countries whereas in other countries they may not. However, there are groups of species the frequently become invasive no matter where they are introduced. Successful invasive species tend to have some characteristics in common:

- → usually they are adaptable to different environments;
- → they are tolerant of the disturbances caused by humans;
- → fast growing;
- → successful at dispersing to new locations;
- → they can have poisons or toxins that help them avoid predators; and
- → have high rates of reproduction - able to produce many offspring and can breed year round.

Issues and threats

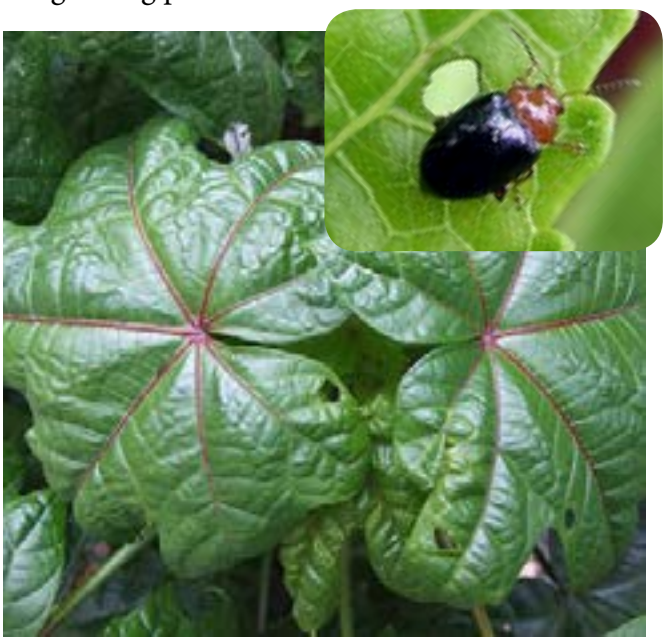
Harmful to gardens and the environment

Introduced species can be harmful to the native species in our environment and the garden plants and domestic animals we rely on for food. Invasive vines and other plants can smother the natural forests and out-compete native plants.

Introduced animals can prey upon native animals in our forests and even cause extinctions. Extinction of the kukuvojo on Choiseul for example is thought to have been caused by introduced cats.

There are also many examples of introduced species that can cause big problems to the plants and animals that humans rely on for food. The slippery cabbage beetle (*Nisotra basselae*) that causes great damage to slippery cabbage is believed to have been introduced by accident from PNG with pollinators that were introduced for palm oil.

More recently, the Asiatic rhinoceros beetle has been introduced. This species is a serious pest of coconut palms, attacking the growing fronds and can kill the palms when they attack and feed on the growing point.



How can you help?

Don't spread weeds and pests

Invasive species can easily spread between islands. This is often assisted by people, whether they realise it or not! People like to transport different varieties of garden plants (like banana suckers) and flowers between islands. Sometimes the garden plants can contain hidden pests and the flowers grow better than expected and expand quickly into forest areas.

You can help prevent this by checking garden plants thoroughly for pests (especially things like giant African snails) before taking them somewhere new. Also, if you would like to take a plant with nice flowers to a new place, take a good look at where it is growing first. If it is covering large areas, growing extremely quickly and people are having trouble keeping it in the garden, this is probably a good sign it will take over in the new place.

- → ***When transporting plants between islands be very certain they do not contain pests like giant African snail***
- → ***Introducing new plants or animals to an island where they do no already exist can have unpredictable consequences. Many can damage the environment and food supplies***

Asiatic rhinoceros beetle is a serious pest of coconuts and recently arrived in Solomon Islands.

Weeds

The term 'weed' is often used to refer to introduced plants that grow uncontrolled and interfere with the natural environment or gardens. Weeds are often plants that have been introduced intentionally either as garden plants (for example they may have nice flowers) or for agriculture (e.g. many grasses are introduced to improve the food available for cattle and other livestock).

Some examples of plants that are weeds in Solomon Islands and other parts of the Pacific include sensitive plant, African tulip and Singapore daisy

Introduced vs invasive

In Solomon Islands there are some species that were introduced by people from other parts of Melanesia thousands of years ago (like the cuscus and wild pig). Some people may consider these species are now a natural part of the Solomon Islands environment, others might consider them invasive. The impacts of a species must be considered when we decide if a species is invasive.

→ *Some introduced species like the pig are an important food source for people.*

→ *Pigs were probably introduced by people to Solomon Islands thousands of years ago. Is this long enough to consider this introduced species native?*

Climate Change

What is climate change?

Climate change refers to the environmental and weather changes that the earth is currently experiencing. In recent decades, the planet has been heating up at a much faster rate than ever before and oceans are becoming more acidic. Although the temperature changes are relatively small, they can cause big changes in climate and the natural environment.

Most scientists around the world now agree that the changes in climate the world has been experiencing in recent decades is largely caused by humans. This has been mostly through increases in certain gases (often called greenhouse gases) like carbon dioxide and methane. These gases help to trap heat from the sun that would normally be radiated back into our atmosphere from the earth.

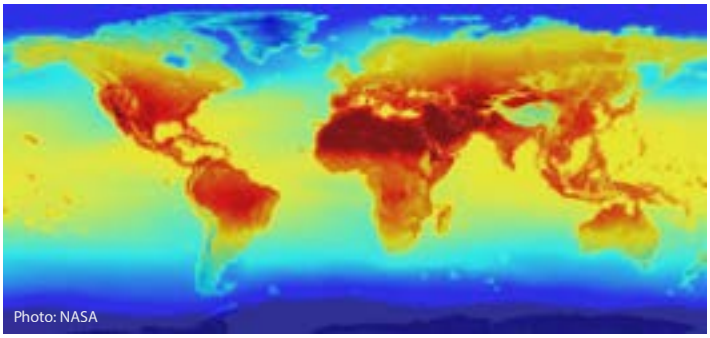


Photo: NASA

How will it affect us?

It is difficult for us to predict exactly how Solomon Islands biodiversity will respond to climate change, and what the most significant impacts will be. The increasing temperatures will likely cause some big changes in rainfall, the spread of weeds and pests, fires and gardening. It will also cause sea-levels to rise and areas of land near the coastline may be submerged under water. The higher sea temperatures, changes in ocean currents and changes in ocean chemistry will combine to affect marine ecosystems.

On land, the temperature increases will probably cause impacts to a wide range of species. This includes changes to ranges and population sizes (e.g. some species may need to migrate to higher altitudes where it remains cooler). Changes in the timing of breeding and migration, length of growing season, and pest and disease outbreaks may also occur.

Global action is needed

It will take an effort by all countries around the world to reduce the impacts of climate change. The most urgent priority is to reduce the amounts of greenhouse gases that are being produced. Conserving areas of forest is also important. Forests absorb carbon dioxide from our atmosphere and trap it in their timber. By doing this they can help to reduce the amounts of greenhouse gases.

Photo: USEPA

Conservation

Conservation is not a new thing

People living traditional ways of life in Solomon Islands paid close attention to the natural environment and often managed it wisely. They knew when to use resources in moderation, or when a wrong practice would damage a resource for later use. Some tambu areas in the forest were conservation areas just like the parks or reserves used in other parts of the world today.

Local reserves

Local tribal groups and land owners can organise to protect their own resources, and there are wonderful examples of this in Solomon Islands. Traditional land owners can also preserve parts of their land which have natural or cultural importance by not developing them in ways that would damage their values.

Global partnerships

Deterioration of the environment and the extinction of species is a global problem that even wealthy countries are facing. There are many conservation ideas that various Solomon Island communities can share with each other, and scientists can learn many things from Solomon Islanders about how to properly manage natural resources and care for the environment. Solomon Islanders can also build knowledge through partnerships with conservation organisations and universities. The global problem of biodiversity loss will benefit from these global partnerships where we can work together towards a common goal of helping the environment.

Zaira Community Resource Management Area, Vangunu

Solomon Islands Conservation Organisations

There are some fantastic examples of conservation in Solomon Islands where local landowners have formed organisations to manage their natural resources and develop alternative income sources to logging and mining. Just a few examples of these organisations are provided below, there are many more in Solomon Islands.

The **Solomon Islands Community Conservation Partnership (SICCP)** is an organisation that works across the Solomon Islands. SICCP undertakes its own projects and also helps other smaller organisations with administration, funding and scientific research. The organisation seeks to assist conservation in Solomon Islands through the use of Community Conservation Agreements (CCA). CCAs are agreements that provide communities and other landowners with benefits and capacity-building in exchange for their participation in the conservation of important areas and species. **www.siccp.org**

Tetepare Descendents Association (TDA) has received international recognition for its conservation programs. Experts from around the world, including renowned ornithologist and author Jared Diamond, have commended the work on the island. A dazzling variety of plants and animals make their home in the island's 120 square kilometres of primary lowland rainforest – some of the last remaining in Melanesia. **www.tetepare.org**

The **Anarvons Community Marine Conservation Area (ACMCA)** is a marine protected area in the Arnarvon Islands. Since establishment, the ACMCA has resulted in a doubling of the number of Critically Endangered Hawksbill turtle nests that are laid each year. The ACMCA was started with help from The Nature Conservancy. **www.nature.org**

The **Natural Resources Development Foundation (NRDF)** is a local organization which was established in 2003 to address the problem of the ongoing exploitation of forests resources by foreign logging companies.

NRDF believes that natural resources are beneficial to the well being of Solomon Island people and their environment. The organisation helps provide opportunities to communities in the Solomon Islands to protect their natural resources for current and future generations. NRDF promote and support, sustainable forest management (SFM) by local communities, as an alternative to large-scale destructive forest harvesting. They are also active in forest conservation, restoration & reforestation, livelihood projects, training and capacity building and last but not least in supporting landowners in their legal fights against illegal logging operations. **www.nrdfsolomons.org**

The **Kolombangara Island Biodiversity Conservation Association (KIBCA)** was begun to encourage sustainable management of Kolombangara Island's forest and marine resources and cultural heritage by indigenous Kolombangarans. The organisation also seeks to contribute to improvements in islander quality of life through sustainable development projects. Imbu Rano lodge is a fantastic resource jointly coordinated by KIBCA. It is a lodge situated at 400m altitude on the edge of the Kolombangara crater adjacent to primary forest and is a great place from which researchers and ecotourists can enter the Kolombangara bush. **www.kolombangara.org**

A guide to

Some of the forest animals of Solomon Islands

Frogs

Images: P.Pikacha, J.Richmond & S.Travers

Language name: _____

English name: Elegant sticky-toed frog

Scientific name: *Batrachylodes elegans*

Distribution: Solomon Islands and Bougainville

Habitat: Lowland and upland forest, it lays its eggs in sheltered locations on the ground (e.g. under leaves and branches).

Language name: _____

English name: Fauro sticky-toed frog

Scientific name: *Batrachylodes vertebralis*

Distribution: Solomon Islands and Bougainville

Habitat: Lowland and mid-altitude forest, palm forest gardens and plantations. It lays its eggs in vegetation above the ground.

Language name: _____

English name: Solomon Islands palm frog

Scientific name: *Palmotarappia solomonis*

Distribution: Bougainville, Choiseul and Santa Isabel

Habitat: Lowland, montane and mid-montane rainforest. It calls from on top of tree leaves.

Language name: _____

English name: Torakino sticky-toed frog

Scientific name: *Batrachylodes trossulus*

Distribution: Bougainville, Choiseul, Santa Isabel

Habitat: Lowland rainforest and can also live in disturbed (logged) forests. Lays eggs in hidden positions on the ground.

Language name: _____

English name: Solomon Islands eyelash frog

Scientific name: *Ceratrobatrachus guentheri*

Distribution: Solomon Islands and Bougainville

Habitat: A common species that inhabits the forest floors in lowland rainforest, and degraded areas. It lays its eggs in hollows at the bases of trees.

Frogs

Language name: _____

English name: Warty webbed frog

Scientific name: *Discodeles bufoniformis*

Distribution: Solomon Islands and Bougainville

Habitat: Lowland rainforest, degraded forest and plantations >300m altitude. Most common near streams and rivers.

Language name: _____

English name: Giant webbed frog

Scientific name: *Discodeles guppyi*

Distribution: Solomon Islands, Bougainville and New Britain

Habitat: Occurs next to streams and rivers in lowland rainforest and sometimes in caves.

Language name: _____

English name: Torokina wrinkled ground frog

Scientific name: *Platymantis aculeodactylus*

Distribution: Bougainville, Choiseul, Santa Isabel

Habitat: Lives amongst fallen leaf litter in lowland rainforest and lays its eggs on the ground.

Language name: _____

English name: Solomon wrinkled ground frog

Scientific name: *Platymantis solomonis*

Distribution: Solomon Islands and Bougainville

Habitat: Found in a wide range of habitats including rainforest, secondary forest, gardens and coconut plantations. It lays eggs on the ground.

Language name: _____

English name: Solomon Islands giant tree frog

Scientific name: *Platymantis guppyi*

Distribution: Solomon Islands and Bougainville

Habitat: Closed-canopy forest. It lives in trees between 2 and 20m from the ground and probably lays its eggs in the trees.

Frogs

Language name: _____

English name: Unidentified ground frog - Choiseul

Scientific name: *Platymantis* sp.

Habitat: This frog was found on Choiseul in 2014 and scientists think it may be a new species. It demonstrates there are many new species to be discovered in Solomon Islands.

Language name: _____

English name: San Cristobal frog

Scientific name: *Papurana kreftii*

Distribution: Solomon Islands and Bougainville

Habitat: Found in a number of different habitats - lowland rainforest, grasslands, swamps and plantations. It lays its eggs in pools of water.

Language name: _____

English name: Solomon Islands tree frog

Scientific name: *Litoria lutea*

Distribution: Papua New Guinea, Bougainville and Solomon Islands

Habitat: It appears to spend most of its life in trees in primary lowland forests. It lays its eggs above the water mark in hollow trees and the tadpoles then drop into the water.

Language name: _____

English name: Weber's wrinkled ground frog

Scientific name: *Platymantis weberi*

Distribution: Solomon Islands and Bougainville

Habitat: Primary and secondary growth forest, degraded coastal plantation and garden habitat within villages.

Language name: _____

English name: Treasury tree frog

Scientific name: *Litoria thesaurensis*

Distribution: Mainland New Guinea, New Britain, New Ireland, Bougainville and Solomon Islands

Habitat: A common species in both forests and disturbed areas. It is found gathering around pools of water during rain, in villages, forests and beside roads. It lays floating eggs in the pools of water.

Images: J.Richmond & S.Travers

Reptiles

Language name: _____

English name: Prehensile-tailed skink

Scientific name: *Corucia zebrata*

Distribution: Solomon Islands and Bougainville

Habitat: World's largest skink. Arboreal and nocturnal, shelters during the day in large hollow trees and strangler figs (abololos).

Language name: _____

English name: Green-bellied tree skink

Scientific name: *Emoia cyanogaster*

Distribution: Bismarck Islands, Solomon Islands, Vanuatu

Habitat: Common in forests and gardens. This skink prefers shrubs and low vines where it is very active in the daytime hunting for insects among the low growing vegetation.

Language name: _____

English name: Solomons blue-tailed skink

Scientific name: *Emoia pseudocyanura*

Distribution: Solomon Islands

Habitat: A partly arboreal species that prefers forest edges such as gardens and villages. It prefers some tree cover to be present.

Language name: _____

English name: Pacific blue-tailed skink

Scientific name: *Emoia caeruleocaudata*

Distribution: Philippines, Indonesia, New Guinea, Solomon Islands, Vanuatu, Fiji

Habitat: Uses both open habitat and forest with dense canopy cover. It is common in forest clearings and gardens at forest edges.

Language name: _____

English name: Yellow-throated skink

Scientific name: *Emoia flavigularis*

Distribution: Solomon Islands

Habitat: Common in thicker, less disturbed areas of forest where it can be seen on the forest floor, especially in areas where sunlight penetrates through the canopy.

Reptiles

Language name: _____

English name: Pacific black skink

Scientific name: *Emoia nigra*

Distribution: Bismarck Islands, Solomon Islands, Vanuatu, Fiji, Samoa, Tonga

Habitat: An active, large skink that can be found in a wide variety of habitats including gardens, forests and seaside vegetation.

Language name: _____

English name: Green-blooded skink

Scientific name: *Prasinohaema virens*

Distribution: New Guinea and Solomon Islands

Habitat: This skink is entirely arboreal, it lives on trees and woody vines and creepers. It is a forest dweller and rarely enters cleared areas.

Language name: _____

English name: Elegant forest skink

Scientific name: *Sphenomorphus concinnatus*

Distribution: Solomon Islands

Habitat: A ground-dwelling species that occurs in forests and semi-cleared areas. It prefers forest with a good canopy and plenty of leaf litter. It is commonly observed in sunlit areas of the forest.

Language name: _____

English name: White-striped cape skink

Scientific name: *Eugongylus albofasciolatus*

Distribution: New Guinea and Solomon Islands

Habitat: This skink is common but is mostly active at night and is therefore not seen as frequently as other skinks.

Language name: _____

English name: Emerald skink

Scientific name: *Lamprolepis smaragdina*

Distribution: Philippines, Indonesia, New Guinea, Solomon Islands

Habitat: This skink is almost entirely arboreal. Its preferred habitat is large and small bare-trunked trees in semi-cleared areas where it feeds upon a variety of arthropods, flowers and fruits.

Reptiles

Language name: _____

English name: Western crocodile skink

Scientific name: *Tribolonotus pseudoponceleti*

Distribution: Buka, Bougainville, Choiseul

Habitat: Coastal regions up to around 1200m altitude. Sometimes found in disturbed areas but typically prefers forests.

Language name: _____

English name: Solomons tree dragon

Scientific name: *Hypsilurus macrolepis*

Distribution: Makira Ulawa Province

Habitat: Prefers denser forest areas but also cleared areas and gardens on forest edges, arboreal.

Language name: _____

English name: Ring-tailed gecko

Scientific name: *Cyrtodactylus salomonensis*

Distribution: Solomon Islands

Habitat: This gecko is arboreal (lives mostly in trees) and prefers less disturbed forest where it can hide during the day in hollows or under loose bark.

Language name: _____

English name: Poncelet's crocodile skink

Scientific name: *Tribolonotus ponceleti*

Distribution: Bougainville, Shortland, Choiseul, Santa Isabel

Habitat: A burrowing species that is nocturnal and shelters during the day underneath logs and fallen timber.

Language name: _____

English name: Sago gecko

Scientific name: *Gekko vittatus*

Distribution: India, Indonesia, Palau, New Guinea and Solomon Islands.

Habitat: A common gecko in forests, gardens and houses in Solomon Islands.

Reptiles

Language name: _____

English name: Solomons ground boa

Scientific name: *Candoia paulsoni*

Distribution: Indonesia, Papua New Guinea, Solomon Islands

Habitat: widespread of the snakes in the Solomons. It occurs abundantly in a variety of habitats from forests to cultivated areas and human habitations

Language name: _____

English name: Solomons krait

Scientific name: *Salmonelaps par*

Distribution: Solomon Islands

Habitat: Occurs mostly in forested areas and usually close to streams and rivers where it hunts for frogs and lizards.

Language name: _____

English name: Stump-toed gecko

Scientific name: *Gehyra mutilata*

Distribution: tropical Oceania, New Guinea, Sri Lanka, Japan, Philippines, Mexico.

Habitat: An arboreal species (prefers trees) that is commonly found on the walls of houses. This gecko often sheds its skin when captured.

Language name: _____

English name: Solomons tree snake

Scientific name: *Dendrelaphis salomonis*

Distribution: New Guinea and Solomon Islands

Habitat: A common snake that occurs in forests and garden areas. It occurs both on the ground both (terrestrial) and in the trees (arboreal).

Language name: _____

English name: Brown tree snake

Scientific name: *Boiga irregularis*

Distribution: Indonesia, New Guinea, Australia, Solomon Islands

Habitat: Nocturnal and arboreal but also forages along the ground at night. Shelters in hollow trees and palm crowns.

Images: T.Lavery

Mammals

Language name: _____

English name: **Solomons bare-backed fruit bat**

Scientific name: *Dobsonia inermis*

Distribution: Solomon Islands

Habitat: This is a common species in lowland forests across Solomon Islands. During the daytime it roosts in large groups inside caves.

Language name: _____

English name: **Solomon tube-nosed bat**

Scientific name: *Nyctimene vizcaccia bougainville*

Distribution: Solomon Islands (not including Malaita and Makira)

Habitat: Lowland forests and disturbed areas. During the daytime this species roosts individually in dense vegetation.

Language name: _____

English name: **Island tube-nosed bat**

Scientific name: *Nyctimene major*

Distribution: New Guinea and Solomon Islands

Habitat: Lowland forests and disturbed areas. During the daytime this species roosts individually in dense vegetation.

Language name: _____

English name: **Rousette bat**

Scientific name: *Rousettus amplexicaudatus*

Distribution: Indonesia, New Guinea, Solomon Islands

Habitat: Disturbed and undisturbed forests and gardens. During the daytime Rousette bats roost in large groups inside caves. They are often found in the same caves as Solomons bare-backed fruit bats.

Mammals

English name: Guadalcanal monkey-faced bat

Language name: _____

Scientific name: *Pteralopex atrata*

Habitat: Inhabits lowland forests of Guadalcanal Island and probably roosts in large hollow trees. Monkey-faced bats have strong teeth that allow them to eat hard foods like ngali nuts and cut nuts as well as a range of other forest fruits. They seem to prefer primary forests that have not been logged but can also be found in disturbed areas (like gardens) that occur next to primary forest.

Distribution: Guadalcanal

Food: fruits and hard materials like nuts

Conservation Status: Endangered

Forearm Length: 139 - 147mm

English name: New Georgia monkey-faced bat

Language name: _____

Scientific name: *Pteralopex taki*

Habitat: The New Georgia monkey-faced bat lives on New Georgia, Vangunu and Kolombangara Islands. It is one of the smaller species of monkey-faced bat that roosts in hollow trees in small groups of 3 - 10 individuals. They prefer primary forest but may be able to survive in logged forests if enough large hollow trees and abololos are left as habitat.

Distribution: Vangunu, New Georgia and Kolombangara

Food: Feed at night on fruit and nuts

Conservation Status: Endangered

Forearm Length: 111 - 119mm

Mammals

English name: Lesser flying-fox

Language name: _____

Scientific name: *Pteropus mahaganus*

Habitat: Mainly inhabits lowland forests and areas adjacent to the coastline. It has been captured as high as ~700m altitude on Choiseul and also in areas of ultrabasic forest on Santa Isabel. Little is known about the ecology of this species. Its small molar teeth indicate it probably eats mostly nectar from the flowers of trees. It has most frequently been recorded feeding on the flowers of coconut palms.

Distribution: Buka, Bougainville, Choiseul, Santa Isabel

Food: Coconut flowers, nectar, some fruits

Conservation Status: Vulnerable

Forearm Length: 141 - 153 mm

English name: Dwarf flying-fox

Language name: _____

Scientific name: *Pteropus woodfordi*

Habitat: Dwarf flying-foxes are commonly seen along the coastlines of smaller islands feeding on the flowers of coconut palms. They will also visit village gardens to feed on flowering plants and fruits. This species roost in small groups inside hollow trees and abololos in lowland forest. Roosting trees can be shared by other species of flying-fox like the New Georgia monkey-faced bat.

Distribution: Western Province, Guadalcanal, Malaita, Ngella, Russell Islands.

Food: Coconut flowers, nectar, fruits

Conservation Status: Vulnerable

Forearm Length: 89 - 93 mm

Mammals

Language name: _____

English name: **Solomon flying-fox**

Scientific name: *Pteropus rayneri*

Distribution: Solomon Islands (does not occur on Malaita or Rennell)

Habitat: Solomon flying-foxes often roost in big groups close to the coast (e.g. Kukudu on Kolombangara and Viru Harbour on New Georgia). They can also sometimes be found in small groups in caves and fig trees. They probably find most of their food in primary forests and gardens close to the coast.

Language name: _____

English name: **Island flying-fox**

Scientific name: *Pteropus solomonis*

Distribution: Solomon Islands

Habitat: This species roosts in small groups underneath limestone overhangs or individually in the forest canopy. The island flying-fox eats a variety of fruits and nectar.

Language name: _____

English name: **Pacific flying-fox**

Scientific name: *Pteropus tonganus*

Distribution: Solomon Islands (Malaita, Makira, Rennell, Bellona, Temotu), Vanuatu, Fiji, New Caledonia, Tonga, Samoa

Habitat: This is a very widespread species in the Pacific. It can often be seen flying during the daytime and feeds on a variety of fruits and flowers in coastal areas.

Language name: _____

English name: **Northern blossom-bat**

Scientific name: *Macroglossus minimus*

Distribution: Indonesia, Australia, New Guinea, Solomon Islands

Habitat: A widespread species that is common in forests and disturbed areas. It can often be seen in early evenings foraging among bananas and heliconias. During the daytime it roosts individually among dense foliage.

Mammals

Language name: _____

English name: **Giant leaf-nosed bat**

Scientific name: *Hipposideros dinops*

Distribution: Solomon Islands

Habitat: Roosts within caves close to the coastline. The Giant leaf-nosed bat perches on vegetation and flies out to capture insects.

Language name: _____

English name: **Large-eared sheath-tailed bat**

Scientific name: *Emballonura dianae*

Distribution: Solomon Islands (Guadalcanal, Santa Isabel and Malaita), and Papua New Guinea

Habitat: This species roosts in large limestone cave systems and often shares these with other species like Solomons bare-backed fruit-bat and diadem leaf-nosed bat.

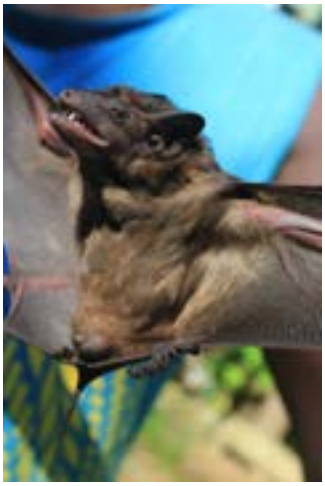
Language name: _____

English name: **Lesser sheath-tailed bat**

Scientific name: *Mosia nigrescens*

Distribution: Solomon Islands, Papua New Guinea, West Papua, Indonesia

Habitat: Lesser sheath-tailed bats can often be seen roosting in small groups under the flat leaves of bananas and heliconia plants. Under the leaves they are protected from rainfall and wet weather. They will also roost in limestone caves that are present within areas of lowland forest.



Language name: _____

English name: **Bare-rumped sheath-tailed bat**

Scientific name: *Saccolaimus saccolaimus*

Distribution: This is a widespread species but it is difficult to capture so there are many gaps in the known distribution. In Solomon Islands it has only been found on Guadalcanal. It also occurs in New Guinea and parts of Indonesia, Philippines, Malaysia, Thailand, Burma, Bangladesh and India.

Habitat: This is a high-flying species that prefers drier conditions and habitat types like those found around Honiara.

Mammals

English name: southern common cuscus

Language name: _____

Scientific name: *Phalanger orientalis breviceps*

Habitat: The southern common cuscus was introduced to Solomon Islands by people approximately 6000 years ago. It is a common species and can be found in both primary and secondary forests. During the day it rests in hollow trees or strangler figs.

Distribution: New Guinea, Bismarck Islands and Solomon Islands.

Food: Leaves and fruit.

Conservation Status: Least Concern

English name: Pacific rat

Language name: _____

Scientific name: *Rattus exulans*

Habitat: Pacific rats are often found among village environments where they enter houses and kitchens. They are also a significant pest in gardens, especially sweet potatoes. This species is also common in the forest and occurs in lowland areas and montane peaks. It was introduced to Solomon approximately 2000-3000 years ago when the ancestors of Polynesian people first arrived.

Distribution: Southeast Asia, New Guinea, Solomon Islands, Vanuatu, Fiji, New Caldeonia, New Zealand

Food: Seeds and vegeation

Conservation Status: Least Concern

Birds

Images: T.Lavery & P.Pikacha

Language name: _____

English name: **Yellow-throated white-eye**

Scientific name: *Zosterops metcalfi*

Distribution: Bougainville, Choiseul, Santa Isabel

Habitat: Forest (especially secondary forests) and gardens. Forms small flocks, sometimes with other species and is active in the canopy and mid-storey.

Language name: _____

English name: **Blue-faced parrot finch**

Scientific name: *Erythrura trichroa*

Distribution: Indonesia, Australia, New Guinea, Solomon Islands, New Caledonia, Vanuatu

Habitat: Forests and secondary forests from lowlands to high altitudes. It is most common in montane forests.

Language name: _____

English name: **Brown fantail**

Scientific name: *Rhipidura drownei*

Distribution: Bougainville, Guadalcanal

Habitat: Montane forests usually above 700m altitude. It occurs in the understorey, mid-storeys and canopy.

Language name: _____

English name: **Black-faced pitta**

Scientific name: *Pitta anerythra*

Distribution: Bougainville, Choiseul and Santa Isabel

Habitat: Primary forests and areas of mixed primary and secondary forest usually between altitudes of 400 and 600m.

Birds

Language name: _____

English name: **Guadalcanal honeyeater**

Scientific name: *Guadalcanaria inexpectata*

Distribution: Guadalcanal

Habitat: Found in montane forests and forages in fruiting and flowering trees.

Language name: _____

English name: **Yellow-bibbed lory**

Scientific name: *Lorius chlorocercus*

Distribution: Guadalcanal, Malaita, Makira

Habitat: Lowland and montane forests. It is most common at mid altitudes and is sometimes found in coconut plantations.

Language name: _____

English name: **Variable dwarf kingfisher**

Scientific name: *Ceyx lepidus*

Distribution: Manus, Bismarck Islands and Solomon Islands

Habitat: Lives in old growth forests, and secondary forests up to 1400m altitude. It often occurs in parts of the forest that are close to streams.

Birds

Language name: _____

English name: **Crimson-rumped myzomela**

Scientific name: *Myzomela eichhorni*

Distribution: Kolombangara, New Georgia, Vangunu, Vella Lavella, Gizo, Tetepare, Gatokae

Habitat: In forests, coconuts, gardens and villages. It is most common in the mountains and often visits ant plants.

Language name: _____

English name: **Black-headed myzomela**

Scientific name: *Myzomela melanocephala*

Distribution: Guadalcanal, Savo and Ngella

Habitat: Forests, forest edges and sometimes gardens. Common in the canopy and sub-canopy and often visits ant plants.

Language name: _____

English name: **Meek's lorikeet**

Scientific name: *Charmosyna meeki*

Distribution: Bougainville, Santa Isabel, Kolombangara, New Georgia, Guadalcanal, Malaita

Habitat: Mostly occurs in montane forests above 1000m altitude. Sometimes visits lowland forests and coconuts. It can usually be seen in small flocks around flowering trees.

Birds

Language name: _____

English name: **White-capped monarch**

Scientific name: *Monarcha richardsii*

Distribution: Vella Lavella, Kolombangara, New Georgia, Vangunu, Gatokae, Ranongga, Rendova

Habitat: Primary forests and old secondary forests in the lowlands. It is active at all levels in the forest.

Language name: _____

English name: **Kolombangara Monarch**

Scientific name: *Symposiachrus browni*

Distribution: Vella Lavella, Kolombangara, New Georgia, Vangunu, Gatokae, Ranongga, Rendova

Habitat: Primary lowland forest understorey and subcanopy.

Language name: _____

English name: **Variable goshawk**

Scientific name: *Accipiter hiogaster*

Distribution: Admiralty Islands, Mussau, Bismarck Islands and Solomon Islands

Habitat: Usually lives along the edges of lowland forests.

Language name: _____

English name: **Pied goshawk**

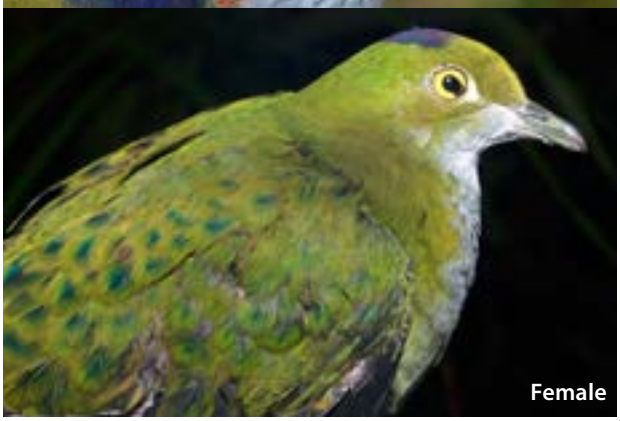
Scientific name: *Accipiter albogularis*

Distribution: Solomon Islands and New Ireland

Habitat: Forest habitats, coconut plantations and parkland areas with scattered trees.

Birds

Male


Female

Language name: _____

English name: **Superb fruit dove**

Scientific name: *Ptilinopus superbus*

Distribution: Australia, Indonesia, New Guinea, Solomon Islands

Habitat: Lowland forest, including degraded areas. This species is usually found singly or in pairs and feed on fruiting trees such as figs.

Language name: _____

English name: **Red-knobbed imperial pigeon**

Scientific name: *Ducula rubricera*

Distribution: Bismarck Islands and Solomon Islands

Habitat: Lowland forest, disturbed areas, plantations and gardens close to forests. It is most common in lowland areas and can form small flocks in the forest canopy.

Language name: _____

English name: **Mackinlay's cuckoo-dove**

Scientific name: *Macropygia mackinlayi*

Distribution: Bismarck Islands, Solomon Islands and Vanuatu

Habitat: Forests, gardens, secondary regrowth forest, mangroves and mountains.

Birds

Language name: _____

English name: **Olive-backed sunbird**

Scientific name: *Nectarinia jugularis*

Distribution: Southeast Asia, Australia, New Guinea, Solomon Islands

Habitat: Prefers open areas like villages, gardens, coconut plantations, mangroves. Most common along the coastline.

Language name: _____

English name: **Blyth's hornbill**

Scientific name: *Aceros plicatus*

Distribution: Bismarck Islands and Solomon Islands

Habitat: Old growth forests. Usually in pairs or small flocks where trees are fruiting and can often be seen flying high over the forests and seas.

Language name: _____

English name: **Oriole whislter**

Scientific name: *Pachycephala orioloides*

Distribution: Solomon Islands

Habitat: Denser forests, rarely in heavily disturbed areas. It is common at many altitudes.

Birds

Language name: _____

English name: **Midget flowerpecker**

Scientific name: *Dicaeum aeneum*

Distribution: Bougainville, Choiseul, Santa Isabel, Guadalcanal, Malaita

Habitat: Forests and areas with scattered trees from the lowlands all the way to the highest altitudes.

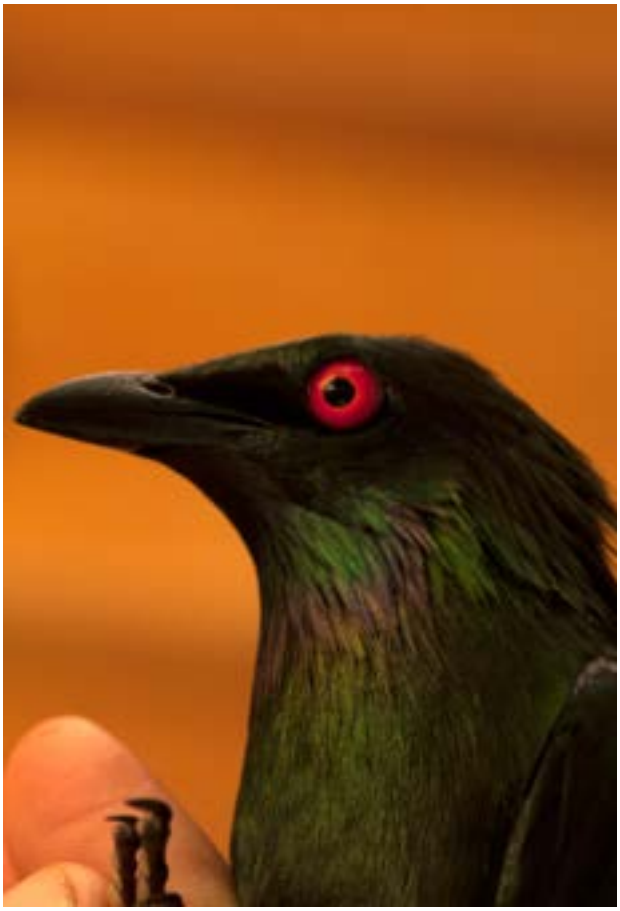
Language name: _____

English name: **Mottled flowerpecker**

Scientific name: *Dicaeum tristrami*

Distribution: Makira

Habitat: Most common in disturbed forests and forest edges. Most common in montane areas.



Language name: _____

English name: **Metallic starling**

Scientific name: *Aplonis metallica*

Distribution: Indonesia, Australia, New Guinea, Bismarck Islands, Solomon Islands

Habitat: gUncommon in closed forests. Typically prefers disturbed forests, forest edges and gardens. It is most common in lowland areas.

Glossary

Adapt	Actions taken to help communities and ecosystems cope with climate change.
Adult	Mature, sexually active organism able to contribute to future generations.
Aerate	To expose something to the action or effect of air or to cause air to circulate through.
Algae	Plant found in marine and freshwater environments.
Appendage	Limb of an animal such as arm, leg, fin or wing.
Arthropod	An invertebrate with an exoskeleton, segmented body and jointed appendages (legs).
Atmosphere	The blanket of gases that surrounds the earth and keep the temperature within limits suitable for animal and plant life.
Biodegradable	Something that when put into the environment can break down in a matter of weeks or few months.
Biodiversity	The different types (species) of living things in an area.
Biological	Something that is alive or related to the study of living things.
Bioluminescence	The production of light by a living thing.
Biomass	The weight of something that is living.
Camouflage	The use of colour and or structures by an animal or plant to conceal themselves.
Carbon	An important element that all living things need for energy and structure. Photosynthetic organisms get carbon from carbon dioxide gas, animals get carbon from food.
Carbon dioxide	A gas that plants use in photosynthesis to make food. It is in the air and dissolved in water. Humans have increased carbon dioxide in atmosphere and this is causing climate change.
Carnivores	An animal that eats other animals.

Chlorophyll	A green pigment that plants use to absorb sunlight during photosynthesis.
Climate	A term for long term trends or average in weather such as rainfall, temperature, humidity and wind.
Climate change	A term for the weather and environment changes the earth is currently experiencing.
Colony	Group of animals living together (e.g. flying-foxes).
Deciduous	Usually refers to trees or shrubs that lose all their leaves at a certain time of year.
Ecology	The interactions between living things and the environment.
Ecosystem	A general term to describe the living things and processes occurring in an area.
Ectotherm	Animals whose regulation of body temperature depends on external sources, such as sunlight or a heated rock surface (amphibians and reptiles are ectothermic animals).
Endemic	Something that is limited to a particular locality or region.
Endotherm	Animals that maintain a constant body temperature independent of the environment (mammals and birds are endothermic)
Epiphyte	A plant that grows upon or is attached to another plant for physical support. The epiphyte takes its moisture and nutrients from the air, rain, and debris accumulating around it.
Erosion	The action of water or wind that removes soil and rock from one location and transports it to another location.
Estuaries	The area near the mouth of a river or creek where fresh and salt water mix. The water in an estuary is partly salty because the high tides bring in sea water.
Expansion	When something gets bigger in size.
Extinction/extinct	The end of an organism or of a group of organisms (e.g. a species).
Fecundity	The capacity to reproduce can be measured by how many eggs are produced by females.
Fertilised	When a male and female gamete join. e.g. egg and sperm joining.

Food web or chain	A diagram showing the eating relationships between organisms in an ecosystem. An organism is connected to another by a line if they consume or are consumed by it.
Fragile	Something that can break easily.
Genus	A category used to classify living things into species
Gestation	The time a baby spends inside its mother before it is born.
Grazing	The process by which animals eat small plants.
Greenhouse gases	Gases like carbon dioxide and methane that have increased in the atmosphere, causing the earth's climate to change.
Habitat	An area where an animal lives.
Herbivorous	An animal that eats plants. Herbivorous fish are those that eat plants.
Hydrodynamics	The movement of water.
Hypothesis	An idea or theory that has not been proven or accepted.
Ingesting	The process of eating food.
Invertebrates	Animals that do not have a back bone (e.g. beetles, snails, worms & crabs)
Juvenile	A young animal before it reaches maturity.
Microscopic	Something that cannot be seen with the human eye and needs a microscope before it is visible.
Mitigation	A human intervention to reduce climate change; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.
Mobilised	Something that is being moved.
Mortality rate	The rate or amount of death in a population.
Moulting	When an animal (e.g. or snake) removes its old skin
Nectar	A sugar-rich liquid produced by plants.
Nitrogen	An important nutrient for plant growth.
Nitrogen fixation	The ability of some cyanobacteria to turn nitrogen gas from the air into forms of nitrogen that plants and animals can use.

Nutrients	Chemicals that plants and animals need to grow. The two most important nutrients for marine life are nitrogen and phosphorus.
Nutritious	Food that contains high amounts of nutrients.
Organism	Something that is alive.
Parasite	An organism that lives on or in another organism from which it obtains all its nutrients.
Phosphorus	An important nutrient for plant growth.
Photosynthesis	A process plants use to convert sunlight and carbon dioxide into food (carbohydrates).
Pollen	Fine particles that flowering plants produce to sexually reproduce.
Pollination	The act of transferring pollen grains from the male anther of a flower to the female stigma.
Predator	An animal that hunts and eats another animals.
Prehensile	An animal's limb or tail that is capable of grabbing or holding something by wrapping around it.
Productive	An area that produces large amounts of something. For example a productive forest can produce a lot of timber.
Propagules	The seeds of mangroves that drop from the trees and float to new areas. They are different from normal seeds because they have already germinated and started growing before leaving parent tree.
Resilience	The ability to prepare for, respond to, and recover from threats with minimum damage to social well-being, the economy, and the environment.
Sediment	A term used for sand, dirt or soil that is in the water or on the bottom of a water body.
Sedimentation	When sediment comes from the water (e.g. river) and covers something (e.g. reef).
Solitary	Something that lives on its own.
Species	Separate types of animals or plants that have been identified as different from another type.
Sustainable	Using something (e.g. resource) in a way that it doesn't finish.

Symbiosis	The relationship between two organisms that live closely together and help each other survive.
Temporal	A pattern or cycle over time.
Terrestrial	Things related to land. A terrestrial animal is an animal that lives on land as opposed to living in the sea.
Transect	A line of a certain length that can be used to measure organisms in the environment.
Turbidity	The cloudiness of water caused by large numbers of individual particles (e.g. soil)
Unsustainable	Using a resource in a way that it finishes (over harvesting).
Vascular System	
Venomous	An animal that can inject a harmful chemical when it bites or stings (e.g. snake or spider).
Vertebrates	Animals that have a back bone (e.g. fish, frogs, reptiles, birds and mammals)
Vulnerable	Something that can easily be effected by an action (e.g. turtle eggs laid on beaches are vulnerable to over harvesting).

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