













Invasive Species in Vanuatu

Pocket Guide



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Environmental Education

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|  |  |  |
| <i>Merremia peltata</i> – Big Leaf Rope | <i>Mikania micrantha</i> – Mile-a-minute | <i>Cassia/Senna tora</i> – Tora |
|  |  |  |
| <i>Solanum torvum</i> – Pico | <i>Sida acuta</i> – Broom Weed | <i>Mimosa diplotricha</i> – Giant Sensitive Plant |
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| <i>Mimosa pudica</i> – Sensitive Grass | <i>Lantana camara</i> – Lantana | <i>Solenopsis invicta</i> – Fire Ant |
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| <i>Acridotheres tristis</i> – Indian Mynah Bird | <i>Achatina fulica</i> – Giant African Land Snail | <i>Rattus exulans</i> – Pacific Rat |

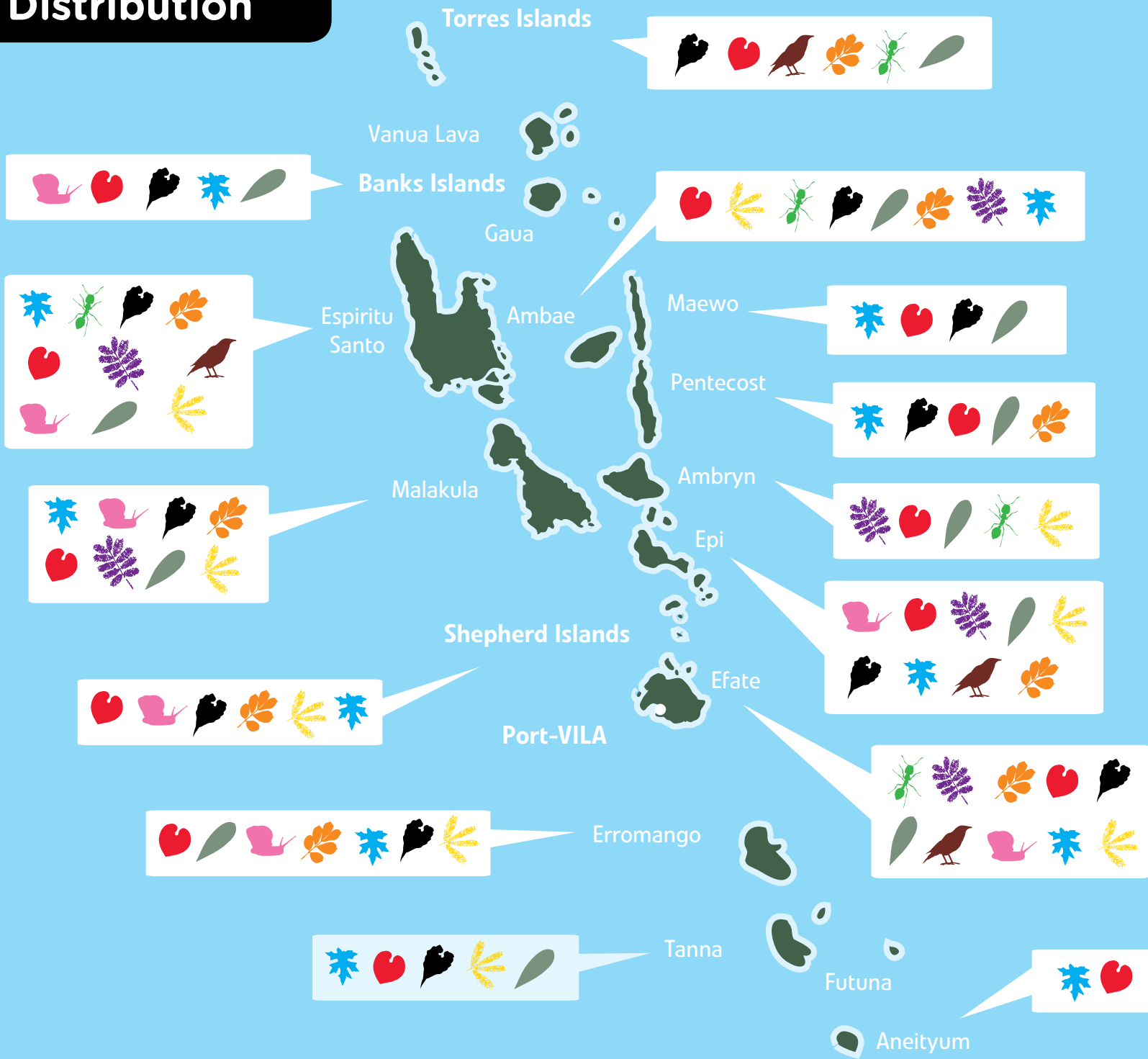
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Distribution



This map shows the distribution of invasive species across Vanuatu. The icons represent different species on each island. These include both flora and fauna. Refer to the key below.

| Key | |
|---|------------------------|
|  | Big leaf rope |
|  | Mile-a-minute |
|  | Pico |
|  | Broom weed |
|  | Giant sensitive plant |
|  | Common sensitive plant |
|  | Indian Mynah |
|  | Giant African snail |
|  | Red imported fire ant |
|  | Tora |

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and importantly the communities at risk, to ensure that knowledge of existing strategies and new technology are shared.

This resource aims to help local farmers and/or communities identify the different invasive species that exist in their communities. The Farmers Pocket Guide is presented in a simple way to help educate farmers about all of these different species and help them to identify and report or control them where necessary.

Live & Learn has produced this booklet as part of the project, 'Testing and modelling preventative measures to limit the spread and ecological impact of invasive species in Small Islands Developing States (SIDS)', funded by the European Union. The aim of this project is to minimise the spread of invasive species across Vanuatu so as to positively impact on biodiversity, communities and food security.

Live & Learn is a non-government, not-for-profit organisation which aims to promote greater understanding of and action towards environmental and human sustainability through education, communication and collaboration.

Purpose of this booklet

The purpose of this field guide is to:

- ◆ Assist farmers and land managers to accurately identify invasive species when they are in the field through providing detailed profiles of invasive species;
- ◆ Assist land managers to make informed decisions about how to manage (reduce) weeds effectively when they are in the field, using an integrated weed management model;
- ◆ Improve skills in effective and integrated weed management.



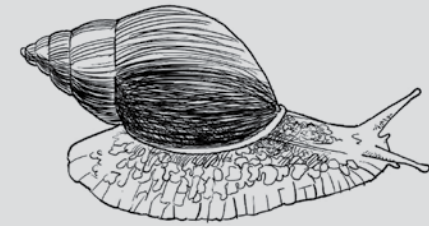
Introduction

Background

In Vanuatu, the impact of invasive species on the forests and related biodiversity is evident. The threat and nuisance posed by invasive species have been a concern for a number of years. However, it is only more recently that invasive species have been given increased attention.

Invasive species in Vanuatu vary from island to island. For instance, the Loru community on Santo has a totally different prioritised list of invasive species compared with Port Resolution on Tanna and Ipota on Erromango. It is therefore important when dealing with invasive species to identify which particular species they are and the threat they pose, and to identify effective management strategies to control and eradicate them.

It is important that management strategies are considered carefully, to avoid repeating past mistakes and causing further environmental damage. A clear example of this is the case of *Euglandina rosea* which was introduced as a control for the Giant African Snail and has now become invasive itself. Management strategies need to be consultative and allow input from all stakeholders, the government, NGO's, donors



Section 1: Introduction to pests and weeds

Importance of pest and weed management

Farmers in Vanuatu know all too well the impacts that pests and weeds can have on agriculture and the natural environment. Agricultural communities rely directly on the yields of their crops and herds for their food sources and incomes. Any setbacks to the yield can impact on incomes and food availability.

Generally speaking, weeds and pests have the following impacts:

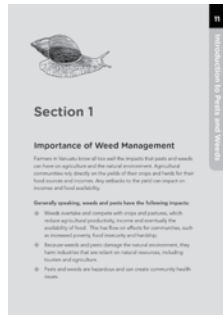
- ◆ Weeds overtake and compete with crops and pastures, which reduce agricultural productivity, income and eventually the availability of food. This has flow-on effects for communities, such as increased poverty, food insecurity and hardship.
- ◆ Because weeds and pests damage the natural environment, they harm industries that are reliant on natural resources, including tourism and agriculture.

Who should use this booklet?

This pocket guide can be used by farmers, agricultural extension officers, environmental professionals, students, community groups, NGOs and other land managers in Vanuatu. Any individual or community group who has an interest in learning about the sustainable management of invasive species in Vanuatu will find this resource useful for identifying species and managing them.

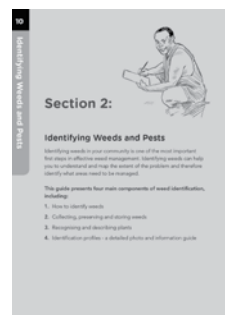
How to use this booklet

This pocket guide is divided into three main sections:



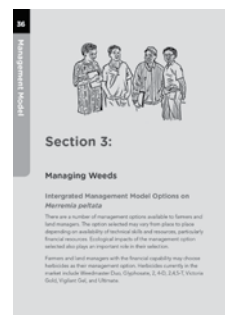
Section 1:

This section provides an overview of the problem of invasive species by explaining the importance of managing their impacts and their distribution across Vanuatu.



Section 2:

This is the biggest section of the booklet. It takes you through the process of how to identify common weeds in Vanuatu. There is also a picture guide to help you visually identify weeds and pests.



Section 3:

This is perhaps the most important part of the booklet as it provides you with information on how to effectively manage weeds and pests in your local community.

Weed and pest distribution in Vanuatu

Vanuatu is an island archipelago consisting of approximately 82 islands. Despite its vast tropical forests, Vanuatu has a limited number of plant and animals species. This makes the challenges and threats brought about by invasive species real and significant.

Animal pests and weeds are spread widely across Vanuatu. Of all plant species, perhaps the most common weed is *Cordia alliodora* (Ecuador laurel or Salmwood from Central America). *Cordia* was introduced as a forestry tree into Vanuatu in the 1970s. It has now become dominant and is considered a serious pest in locations where it was planted, especially on the major islands of Vanua Lava, Ureparapara, Santo, Maewo, Ambae, Pentecost, Malakula, Epi, Efate and Erromango. It is a classic example of an aid programme gone wrong.

Other weeds that are widely spread throughout the Islands include *Merremia peltata* (Big leaf rope), *Mikania micrantha* (Mile-a-minute), *Leucaena leucocephala* (Kasis), *Lantana camara*, *Solanum torvum*, *Mimosa pudica* and *Mimosa rhombifolia*. *These species smother and strangulate other vegetation, thus preventing regeneration.*

Animal pests are also becoming a nuisance across Vanuatu. One clear example of this is *Acridotheres tristis* (Common Mynah), an introduced bird that is becoming dominant on many Islands. Another pest is *Achatina fulica* (Giant African Snail), a major agricultural and garden pest found on a number of the major islands.

The map on the inside front cover shows the distribution of invasive species across Vanuatu. The different colours represent different species on each island. These include both flora and fauna. Please refer to the key.

- ◆ Pests and weeds are hazardous and can create community health issues.
- ◆ Governments often have to spend large sums of money managing invasive species. This reduces the amount of money it has available to spend elsewhere, for example on education, infrastructure and health services.
- ◆ Weeds and pests alter and degrade important 'ecosystem services', such as filtering water and air.
- ◆ Invasive species cause loss of habitat and biodiversity.

It is clear that pests and weeds can affect almost every facet of life in Vanuatu. It makes sense that if we manage pests and weeds effectively we will start to solve many problems in our communities, making them healthier and more resilient.

Invasive species are plants or animals that expand and thrive in an area where they are not wanted. Weeds are invasive **plant** species, which occur both on land and in water, and pests are invasive **animal** species. They cause significant harm to the natural environment, communities and the economy.

1. How to identify weeds

There are a few main ways to identify weeds, including:

Recognise it yourself

If you are an experienced land manager and know your country well, you may already know what types of weed exist in your community and where they are located. You are an important source of knowledge in the community and can help to tackle this problem with your knowledge.

Ask an expert

Depending on where you live, you may be able to seek expert advice from an agronomist, extension officer or a botanist. If you have access to these support services you should use them. The key to successfully working with experts is to supply them with good quality specimens and sufficient information about the plant, including details of the area from which it was collected and if possible, supplementary photographs of the plant growing in its habitat (if you don't have a camera, it doesn't matter).

Compare specimens to photo guides

Many people don't have a lot of plant knowledge or access to experts who can help them. If this is your case, you can try to identify weeds yourself, or with other community members. Section 2 contains a photo guide to common weeds in Vanuatu which you should use if you want to attempt to carry out identification yourself.

Note: Plants can also be identified using a plant keys, which is systematic process of identifying a plant by matching/eliminating it against pre-prepared anatomical information. These are commonly used by plant experts or enthusiasts. See page 15 for further information on plant anatomy.



Section 2:

Identifying weeds and pests

Identifying weeds in your community is one of the most important first steps in effective weed management. Identifying weeds can help you to understand and map the extent of the problem and therefore identify what areas need to be managed.

This guide presents four main components of weed identification, including:

1. How to identify weeds
2. Collecting, preserving and storing weeds
3. Recognising and describing plants
4. Identification profiles - a detailed photo and information guide

When collecting specimens, remember to:

- ◆ Collect a sample of all parts of the plant – the seeds, leaves, stems, pods fruits and flowers (if possible). It is important to supply representative portions of the plant for correct identification, particularly flowering parts and seed pods.
- ◆ Only collect what you need.
- ◆ Attach a tag to the plant with a code number or relevant information (you may like to include information such as date of collection, location of collection).

Safety first! Don't taste or touch any plant that you are unfamiliar with. Some plants are poisonous and others cause stings and skin irritations.



2. Collecting, preserving and storing weeds

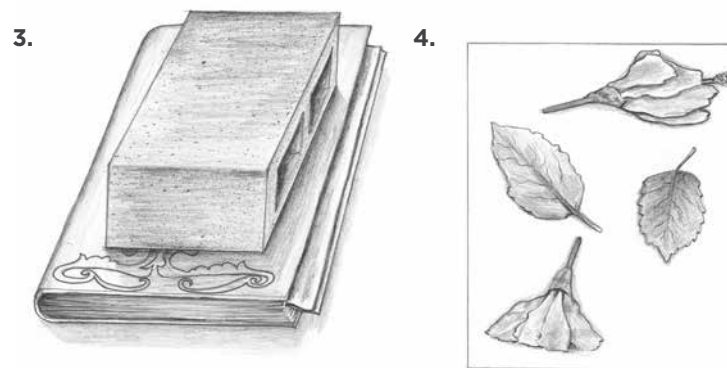
This section is a simplified guide on how to collect, preserve and store weeds for identification and record keeping. Collecting, preserving and storing specimens should be carried out if you cannot identify the weed 'in-situ' (i.e. in its natural location) and where you need the help of experts or others to identify the species. You may also want to collect and preserve specimens as a type of record-keeping system.

Collecting specimens

Before collecting specimens, check with local community leaders whether or not specimens can be collected. If the plant is in a private property then you will have to seek permission from the owner of the property. Collecting specimens from national parks or municipal areas requires permission from the municipality or local government authorities concerned.

Materials recommended for successful plant collecting include:

- ◆ A digging implement such as a mattock or spade to ease small plant specimens from the soil, leaving the roots and other underground organs intact; try not to just pull the plants from the soil;
- ◆ Secateurs or a small saw for removing branches from trees and shrubs;
- ◆ Plastic bags, rubber bands, non-gloss newspaper and permanent markers and tags to mark and tie onto individual specimens;
- ◆ A notebook for recording details;
- ◆ Camera and GPS for recording plants and their habitat in-situ (only if you have one);



3. Recognising and describing plants

This section is important as it will help farmers identify different parts of plants as well as their habit and anatomy.

When we identify plants, we describe them according to their habit and anatomy. Plant habit is the form or shape a plant takes (for example a tree or a vine). Plant anatomy refers to the different parts or organs of the plant and the roles they play in the plant's survival.

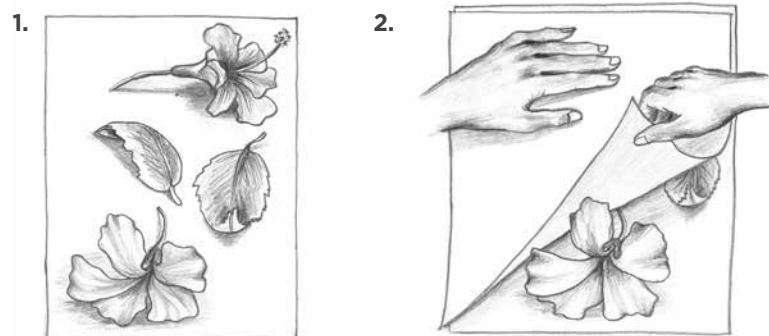
To begin identification, use the plant identification profiles in Section 2. Match the characteristics of the specimen which you have collected – its habit and anatomy plus any other features - against the pictures and information. If the specimen you have collected does not match any of the weeds presented, you will need to consult other plant identification guides or a local expert. The weed profiles presented in Section 2 are the most common and problematic weeds in Vanuatu so most of the time you should be able to find what you are looking for.

Preserving and storing specimens

Once you have sampled a specimen you need to preserve and store it, unless you can get it to an expert within 12-24 hours. If an expert is close by, placing the specimen in a plastic bag or container should be sufficient until the expert can take it from you. It is also useful to preserve and store specimens as a type of record-keeping system for future reference.

One of the easiest and most common ways of preserving plants is to dry and press them. This can be done fairly easily and you don't need a lot of equipment. Plants are best preserved straight after they are collected, although you can store them in a plastic bag or container for about a day after collection. The main idea with this technique is to remove all moisture so that the original colour of the plant is preserved.

Place specimens between two pieces of absorbent paper, such as non-glossy newspaper. Place the paper parcel containing the specimens on something flat and hard, like a piece of cardboard or timber. Then, place another firm piece of timber on top. Alternatively you can place the newspaper in the middle of a big book. Finish by placing something heavy on top, like a rock or a block. You will have to change the newspaper a few times in the first week, or more during a time of high humidity. Leave for a few weeks until the specimen is dry and flat. Store the dried specimens in a container or sealed bag until they are ready to be identified or used (i.e. for educational purposes).





Grasses: Grasses are small plants, which often have long narrow leaves that typically grow from the base of the plant.

Pictured right: Grass



Herbs: Herbs are small plants which have no woody growth and their leaves and stems die after the end of each growing season or after they have flowered or fruited.

Pictured right: Tora, Sicklepod herb



Succulents: Succulents are plants which are categorized by having thick fleshy tissues designed to store water, giving them the ability to survive longer in drought conditions. They are native to dry or semi-dry regions and deserts where high temperatures and dry conditions prevail.

Pictured right: Aloe vera plant from the Aloe family, a common succulent in Vanuatu

Plant habitat

Plants come in a wide variety of forms, shapes and sizes. The most common include:

Trees: Trees are tall, woody, perennial plants (plants that live for more than two years) that furnish us with two of life's essentials - food and oxygen.



Pictured right: *Canarium indicum* tree (Nangai tree)

Vines:- Vines are a type of plant that has a growth pattern of climbing and trailing, usually with stems or runners.



Pictured right: *Merremia peltata* (Big Leaf Rope)

Shrubs and Bushes: Shrubs and bushes are smaller than trees, usually under six meters in height. They are popular for beautification in parks, flower gardens and for adding colour to landscape.



Pictured right: *Solanium torvum* (Pico)

4. Weed and pest Identification profiles

This section provides images and information about the most common weed and pest species that occur across Vanuatu. This information will help if you are attempting to identify species yourself or with others from your community or group.

Plants and animals are named in different ways depending on the situation. No one way is better than another. However it is good to be aware of the different systems.

Botanical/Scientific names: This is the internationally recognised scientific system of assigning two names to a species, the first name being the genus and the second name being the species. Western scientists and experts prefer this system.

Common names: Names given to plants and animals by the general, non-scientific community.

Local names: Local names given to species by local communities, these can be used in a local community context because everyone understands what is being discussed. Outside of a local community, it is probably better to use the scientific or common name.

For example:

| | | |
|-----------------------------|---------------|--------------|
| <i>Merremia peltata</i> | Big leaf Rope | Big lif rop |
| (Botanical/Scientific name) | (Common name) | (Local name) |

For each species profile in this section, all three names are provided.

Plant anatomy

This section looks at the basic external features of plants, called the plant organs. These include the leaves, roots, stems, flowers and fruit. Understanding plant anatomy is essential in identifying plants because plant identification information often describes the different anatomical features of a plant.

Leaves are the main plant organ, which facilitate the essential processes of photosynthesis and transpiration. Leaves also protect the plant and keep it cool. Leaves come in all shapes, sizes and colours and can be an important way to identify species.



Roots are usually located under the ground surface, anchor the plant to the ground and absorb water. **Stems** transport water and minerals to other parts of the plant. They bear leaves and usually grow upwards.



Pictured right: *Samanea saman* tree (Rain tree)

Flowers contain the plants' reproductive organs and their role is to facilitate reproduction. They are usually colourful and attractive and often scented so to attract pollinators and ward off predators.



Pictured right: Frangipani flower

Seeds are the offspring of the plant, the result of reproduction. The **fruit** is the carrier of the seeds, which helps them to disperse and grow. The structure of fruits and seeds varies widely, and is often related to the method by which they are dispersed.



Pictured right: Nangai seeds

| | |
|---|-------------------------|
| Scientific | <i>Merremia peltata</i> |
| Common | Big Leaf Rope |
| Local (Bislama): Big Lif Rop, Ipota (Erromango): Nusifilau, Port Resolution (Tanna): Tukora, Lorum (Santo): Nwele | |



| | |
|--------------------|--|
| Plant type | Vine |
| Growth form | Climber with underground tubers |
| Leaves and stems | Broad heart-shaped leaves with purple veins underneath. Stems can be up to 20 metres long |
| Flowers | Yellow and creamy white funnel-shaped flowers, 15-30 cm in length. Occur in clusters |
| Fruits and Seeds | Dull brown seeds, capsules about 15 mm long |
| Habitat | Forests, roadsides, hillsides, disturbed areas |
| Impacts | <ul style="list-style-type: none"> • Crawls and smothers or overtakes forest tree species • Smothers and strangulates other vegetation |
| Distribution | Widely throughout Vanuatu below 300 m elevation |
| Country of Origin | Indo-Pacific Region |
| How it spreads | Disturbance of the environment will stimulate growth. Reproduces both by seeds and by rooting from the stem. |
| Management Options | <i>Merremia peltata</i> Management Model is based on an "Integrated Approach" that combines physical removal of the weed with an agroforestry system that utilizes whitewood (<i>Endospermum medullosum</i>) canopy and kumala as a cover crop to suppress regrowth. |

| | | |
|-------|---|--------------------------|
| Names | Scientific | <i>Mikania micrantha</i> |
| | Common | Mile-a-Minute |
| | Local (Bislama): Wan Dei Rop, Port Resolution, (Tanna): Null ta plane, Ipota (Erromango): Nos -talrap | |



| | | |
|---|----------------------|---|
| Description | Plant type | Vine |
| | Growth form | Climber |
| | Leaves /stems | Triangular or heart-shaped with distinct tip and toothed margins. |
| | Flowers | White flowers as dense clusters produce small black seeds (2 mm) with a terminal tuft of white bristles. |
| | Fruits /Seeds | Black linear-oblong seed, 5-angled, 2 mm long. |
| | Physical Description | A vigorous twining vine that roots from nodes on the stems when prostrate. |
| Distribution | | Widely spread throughout Vanuatu below 300 m elevation. It is a major weed in pastures, plantations, stream banks, disturbed forest, along road sides and an intermediate weed in crops and forestry. |
| Country of Origin | | Central and South America |
| Impacts | | <ul style="list-style-type: none"> • Crawls over trees and gardens • Suppresses and prevents reproduction of other species |
| How it spreads | | Seeds are dispersed by wind and germinate easily on moist bare soil. |
| Management Options: Government Control | | <ul style="list-style-type: none"> • <i>Mikania micrantha</i> is currently managed under Post entry–Biosecurity by a rust fungus named <i>Puccinia spegazzinii</i>, commonly known in Vanuatu as laplap leaves rust fungus. The fungus was imported from Papua New Guinea and has proved effective in PNG and Australia. • The fungus has been distributed around Efate and Tanna, particularly in the southern part and middle bush. |
| Cultural Control | | <ul style="list-style-type: none"> • Slash and dehydrate in the sun |

| | | |
|---|---|---|
| Names | Scientific | <i>Cassia tora</i> or <i>Senna tora</i> or <i>Cassia obtusifolia</i> |
| | Common | Tora, Sicklepod |
| | Local (Bislama): Wael Pinat, Port Resolution (Tanna): Wael Pistat, Ipota (Erromango): Wael Pistat, Lorum (Santo): Wael Pistas | |
|  | | |
| Description | Plant type | Herb |
| | Growth form | Erect plant, 1-2 meters tall, 1 meter wide |
| | Leaves and stems | Divided into three opposite pairs of leaflets, round at the end and wedge-shaped at the base, 4 cm long and 2 cm wide |
| | Flowers | Yellow flowers with 5 petals, 1 cm across |
| | Fruits and Seeds | Long, slender curved seed pod, 10-15 cm long, 3-5 mm wide. Seeds 3 mm long, brown and flat |
| Impacts | Agriculture and environmental weed | |
| Habitat | Cleared coastal country, open pastures, roadsides | |
| Distribution | Efate, Tanna, Santo, Malakula, West Ambae, Malo, Aore | |
| Country of Origin | Possible origin in South Asia. Thought to be widely occurring across tropical regions and the Americas | |
| How it spreads | Seeds through livestock | |
| Management Options | Slash and dehydrate in the sun | |

| | | |
|---|--|--|
| Names | Scientific | <i>Solanum torvum</i> |
| | Common | Turkey Berry, Pico |
| | Local (Bislama): Lorum (Santo): Pota (Erromango): Piko, Port Resolution (Tanna): Nawan patikar | |
|  | | |
| Description | Plant type | An upright shrub or small tree usually growing 0.8-3 m tall but occasionally reaching up to 5 m in height. |
| | Growth form | Erect, usually 2-3 meters high, but can be up to 4 meters high. Can grow into impenetrable thickets, with scattered thorns on stems. |
| | Leaves and stems | Oval shaped leaves with a tapered tip and a rounded base, 15-20 cm long. Alternate, lobed with hairy under surface. Its younger stems are green or purplish and densely covered with small star-shaped hairs. Older stems become brown or greenish- brown and eventually lose their covering of hairs. |
| | Flowers | White with yellow centre, occur as clusters in leaf axils. |
| | Fruits and Seeds | Fruits are green berries (yellow when ripe), 10-15 mm in diameter which grow in clumps. They contain many flat, round and brown seeds |
| | Impact | <ul style="list-style-type: none"> • Spines interfere with passage of people and animals • Can become weeds on grazing land |
| Habitat | Open rural disturbed areas, roadsides, plantations, wastelands | |
| Distribution | Efate, Tanna, Santo, Malakula, Pentecost, Epi, Tongoa, Aniwa | |
| Country of Origin | Americas, particularly tropical regions | |
| How it spreads | Birds eat the berries and spread the seeds through their droppings | |
| Management Options | Slash and burn | |

| | | |
|-------|---|-------------------|
| Names | Scientific | <i>Sida acuta</i> |
| | Common | Broom weed |
| | Local (Bislama): Brum wid, Lorum (Santo): N/A, Port Resolution (Tanna): Wetangnign Ipota (Erromango): Uyowi | |





| | | |
|--------------------|------------------|--|
| Description | Form/Type | Herb |
| | Growth form | Shrubby and sprawling, forms a dense thicket |
| | Leaves and stems | Leaves are alternate with toothed edges and hairy on the under surface. |
| | Flowers | Single pale yellow-orange flowers produce a capsule that breaks into segments when mature, each with 2 sharp curves. |
| | Seeds | Small and rough, triangular in shape and up to 1.5 mm long. Green in colour when young and reddish brown or black when dry. |
| Habitat | | Pastures, crops, roadsides. Dislikes dry conditions |
| Distribution | | Efate, Santo, Epi, Tanna, Malakula |
| Impacts | | Environmental weed |
| Country of Origin | | A pan-tropical weed perhaps originating from Central America |
| How it spreads | | Dispersed by adhering to clothing, fur and mud on vehicles. |
| Management Options | | Smaller plants: uproot and dehydrate in the sun. Bigger plants: slash and dehydrate in the sun. The government through the department of Biosecurity has identified <i>Calligrapha panthera</i> (sida beetle) as the biocontrol for <i>Sida acuta</i> (Broom weed). It has imported the beetle from Papua New Guinea, and is having it multiplied and distributed throughout the Islands of Vanuatu. |

| | | |
|-------|---|---------------------------|
| Names | Scientific | <i>Mimosa diplotricha</i> |
| | Common | Giant sensitive plant |
| | Local (Bislama): Waet Nil Gras or Bigfala gras nil, Port Resolution (Tanna): Nikiable Asul, Ipota (Erromango): Neiahakur, Lorum (Santo): Gras nil | |

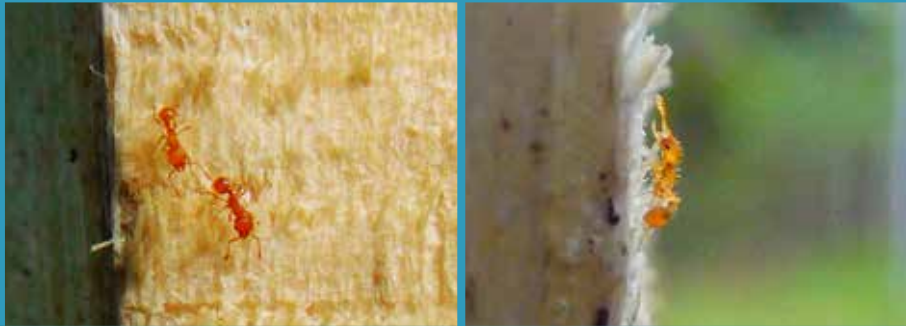


| | | |
|--------------------|------------------|---|
| Description | Plant type | An erect ascending shrub that forms a thicket, root system is strong often woody at base, up to 2 metres tall. |
| | Growth form | Shrubby and sprawling, forms a dense thicket |
| | Leaves and stems | Bright green, feathery. Leaf segments carry pairs of 15-30 very small leaflets (6-12 mm long, 1.5 mm wide), which can be mistaken for the leaves themselves. Leaflets close when disturbed, injured or at night. Stems have sharp hooked prickles, 3-6 mm long. |
| | Flowers | Pale pink, round/ball shaped and fluffy. 12 mm in diameter |
| | Fruits and Seeds | Pods in clusters, about 10-35mm long and 6mm, covered in small prickles. Light brown, flat oval seeds, 2 mm long |
| | Impacts | Preventing reproduction of other species and it forms a dense ground cover when fully grown. Thorns are harmful to human beings. |
| Distribution | | Efate, Santo, Epi, Tanna, Malakula |
| Country of Origin | | Brazil, tropical South America |
| How it spreads | | Seeds spread by attaching to animal fur or clothing. Seed pods can float. |
| Management Options | | Bigger plants - slash; dehydrate in the sun Smaller plants - uproot and dehydrate in the sun |

| | | |
|--|--|---|
| Names | Scientific | <i>Mimosa pudica</i> |
| | Common | Sensitive grass |
| | Local (Bislama): Smol gras nil, Ipota (Erromango): Neiahakur, Tanna: Nikiable | |
|  | | |
| Description | Plant type | Herb |
| | Growth form | Slightly woody at base with trailing habit with thorns and scattered prickles on internodes. |
| | Leaves and stems | Reddish leaflets 12-25 pairs, linear, acute and up to 9-12mm long and 1.5mm wide and sensitive when touched or disturbed are drawn back and folded. |
| | Flowers | Pinkish flowers, ovoid in shape and 9mm in diameter |
| | Fruits and Seeds | Small seeds up to five in one pod, flat and 3 to 5mm in diameter |
| Impacts | Prevents reproduction of other species. Forms dense ground cover when fully grown. Thorns are harmful to humans. | |
| Habitat | Found mostly on well- drained soil, along roadsides, pastures or wastelands | |
| Distribution | Efate, Epi, Santo, Malakula, Tanna and the Shepherds Group | |
| Country of Origin | Brazil | |
| How it spreads | Seeds pods float and are spread by water as well as attaching to fur, clothing and mud on vehicles. | |
| Management Options | Smaller plants are uprooted while bigger plants are slashed and dehydrated in the sun | |

| | | |
|---|--|---|
| Names | Scientific | <i>Lantana camara</i> |
| | Common | Lantana |
| | Local (Bislama): Lantana/ Blakbari | |
|  | | |
| Description | Plant type | Shrub |
| | Growth form | Heavily branched, often forms a dense thicket |
| | Leaves and stems | Leaves egg-shaped, simple. Stems square with short hooked prickles. Can be very toxic if eaten. |
| | Flowers | Tube-shaped four-petalled flowers, arranged in clusters at the end of stems |
| | Fruits and Seeds | Berry-like fruit turning a deep purple colour when mature |
| | Habitat | Grows best in dry pastures, plantations, cultivated and waste lands |
| Distribution | Efate, Tanna, Malakula, Aneityum | |
| Country of Origin | South and Central America | |
| How it spreads | Seeds distributed by birds and other animals | |
| Management Options | Slash and dehydrate in the sun | |

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|---------------|---|---------------------------|
| Names | Scientific | <i>Solenopsis invicta</i> |
| | Common | Little Fire Ant |
| | Local (Bislama): Smol Faea Anis, Port Resolution (Tanna): Faea Anis, Ipota (Erromango): Moleh nom, Lorum (Santo): Nar | |
| Organism type | | Insect |



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| Physical Description | A small aggressive ant, 2-6 mm long, coppery brown head and body with a darker abdomen. Inflicts a painful sting. |
| Habitat | Likes hot dry climates. Occurs across a wide variety of landscapes including coastland, agricultural areas, backyards, forests and water-courses. More likely to establish in disturbed areas. Nests come in various shapes and sizes, can be inconspicuous but can also look like a dome shaped mound (up to 40cm high). No obvious entry and exit holes. Internal structure looks like honeycomb. Ants of a variety of sizes will be present in the same nest. |


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| Behaviour | Aggressive and large in number. High densities mean they can dominate food sources in locality, out-competing other species. Can breed and relocate quickly. |
| Distribution | Vanua Lava,, Mota Lava, Gaua, Mota, Santo, Efate |
| Country of Origin | Coastal East Africa |
| How it spreads | <ul style="list-style-type: none"> Naturally: females can fly up to 2 km for breeding. Human |
| Impacts | <ul style="list-style-type: none"> Out-competes native ants, resulting in significant decline of native ant populations. Reduces the dispersal and reproduction of native plants by out-competing native ants and eating plant seeds. Preying directly on insects for food Reduces the abundance of other species such as birds, small mammals, reptiles and amphibians through stinging, competition and predation. Can infest infrastructure and equipment. Inflicts a painful sting on people, which can cause an allergic reaction. Sting is particularly dangerous for children. |
| Management Options | Bio-security is now using Fipromil, a chemical bait mixed in peanut butter to attract ants. When they consume it, it slowly weakens them until they finally die. Target is to kill and get rid of the queen within the colony. The workers will bring anything including food first to their queen before getting their share. So with Fipromil (peanut butter bait), the workers will bring it to their queen and when she eats it and dies a sudden death then there is no. |

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| How it spreads | Mynahs lay their eggs in tree hollows, in the walls or ceilings of buildings or in the very tops of palm trees. They can breed 1-3 times in a year with 3-6 young per brood. Mating pairs fiercely protect their nests. |
| Impacts | <ul style="list-style-type: none"> • Out-competes native birds by taking over their nests, killing their chicks and destroying their eggs. This results in the decline of native bird species. • Damages and consumes ripening food crops, affecting agricultural productivity and food security • Can carry and spread diseases including parasites and avian malaria • Spreads agricultural weeds |
| Management Options | The Department of Environmental Protection and Conservation (DEPC) introduced a control once only in 2012 during the Independence celebration where a reward was offered to the rural community that killed most Mynah birds. No other control has been initiated since to control Mynah birds in Vanuatu. |




| | | |
|-----------------------------|---|-----------------------------|
| Names | Scientific | <i>Acridotheres tristis</i> |
| | Common | Indian Mynah, Common Mynah |
| | Local (Bislama): Sako, Port Resolution (Tanna): Kaul , Ipota (Erromango): Koul, Lorum (Santo): N/A | |
| Organism type | Bird | |
| | | |
| Physical Description | Body length is from 23 to 26 cm and weighs around 82 to 143 grams while the wingspan are from 120 to 142 mm. Common Mynahs are dark brown with a black head and have yellow bills, legs and eye skin. | |
| Habitat | Prefers warm areas with access to water and also inhabit agricultural areas such as farmlands as well as human settlements. | |
| Behaviour | It 'struts' rather than walks and is generally not afraid of humans. Roosts communally in large numbers in the evenings. | |
| Distribution | Tanna, Efate, Santo, Malakula, Epi | |
| Country of Origin | Middle East, India and Asia | |

| | |
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| Behaviour | Widespread - natural forests, plantations, agricultural areas, shrub land, wetlands, coastland, riparian zones, disturbed areas, urban areas. Often found under logs/pieces of timber, under vegetation, in composts, on fences, between rocks and on tree roots. Prefers warm tropical and humid climates |
| Distribution | Efate, Santo, Malakula, Epi, Tanna, Emae |
| Country of Origin | Coastal East Africa |
| How it spreads | <ul style="list-style-type: none"> • Has a rapid reproduction rate, lays 100-400 eggs at a time. Can quickly spread and take over an area after being introduced. It moves into new countries and regions in cargo – especially shipping containers, pallets and vehicles |
| Impacts | <ul style="list-style-type: none"> • Considered one of the most damaging tropical snail pests due to the large quantity of plant material they can consume its hardiness and fast reproduction rate. • Feeds on agricultural crops and spreads plant diseases, affecting agricultural productivity and food security. • Feeds on native plants causing damage to ecosystems and changes in ecosystem functioning (altered nutrient cycling). • Decline of native gastropod species due to competition for food and habitat. • Spreads nematodes (round worms) which can cause diseases such as <i>Eosinophilic meningoencephalitis</i> – meningitis, a disease of the brain membranes. |
| Management Options | Vanuatu has brought in another species called <i>Euglandina rosea</i> (rosy wolf snail or cannibal snail). It has been discovered, that although <i>E. rosea</i> has indeed attacked the <i>Achatina fulica</i> but there is worrying evidence that this cannibal snail has caused the extinction of numerous native snails in other countries. It has now become invasive itself. Efforts to control this species are ongoing. |

| | | |
|--|--|--------------------------|
| Names | Scientific | <i>Achatina fulica</i> |
| | Common | Giant African Land Snail |
| | Local (Bislama): Afriken Snel, Port Resolution (Tanna): Takieou, Ipota (Erromango): Yelongi, Lorum (Santo): N/A | |
| Organism type | Mollusc | |
|  | | |
| Physical Description | A very large land snail with a reddish-brown shell with pale yellow markings which tapers to a point, usually 5-10 cm long (however can grow up to 20 cm long). Its shell is twice as long as it is wide. Sizes are usually from 15-30cm and weighs 250-450g. | |
| Habitat | Widespread - natural forests, plantations, agricultural areas, shrub land, wetlands, coastland, riparian zones, disturbed areas, urban areas. Often found under logs/pieces of timber, under vegetation, in composts, on fences, between rocks and on tree roots. Prefers warm tropical and humid climates | |

| | |
|---------------------------|---|
| Distribution | Pacific, black and brown rats are found on all the Islands of Vanuatu. In Vanuatu, it has become a serious pest. |
| Behaviour | <p><i>R. exulans</i> feed on seeds, fruit, leaves, bark, insects, earthworms, spiders, lizards, and avian eggs and hatchlings. Polynesian rats have been observed to often take pieces of food back to a safe place to properly shell a seed or otherwise prepare certain foods.</p> <p><i>R.rattus</i> is omnivorous feeding on a wide variety of food, including plants, seeds and nuts, fruits as well as eggs of native birds.</p> <p><i>R.norvegicus</i> is a gregarious animal. They mostly live in groups, play together, groom each other, huddle. They are often territorial and males are aggressive to strange rats. The young burrows</p> |
| Country of Origin | <ul style="list-style-type: none"> • The <i>Rattus exulans</i> originates in the Indo-Malaysian regions. • The <i>Rattus rattus</i> originated in tropical Asia. It spread to the near east in the Roman times, then Europe then across the world. • The <i>Rattus norvegicus</i> originated in north China. It has spread to all continents except Antarctica. |
| How it spreads | The <i>Rattus exulans</i> , <i>Rattus rattus</i> and <i>Rattus norvegicus</i> were introduced into the Pacific Island countries, including Vanuatu by boats arriving from other countries. |
| Impacts | <ul style="list-style-type: none"> • Transmit deadly disease known Hantavirus Pulmonary Syndrome (HPS) by infected rodents through Urine, dropping and or Siliva • Carriers of certain pathogens-Murine Typhus etc • Feeds on Agricultural crops thus affecting agricultural productivity and food security • Damages home by gnawing on doors, walls • Damages clothing and even furniture's |
| Management Options | <ul style="list-style-type: none"> • Trapping • Poisoning • Proofing |

| | | |
|--|---|---|
| Names | Scientific | <i>Rattus exulans</i> , <i>Rattus rattus</i> , <i>Rattus norvegicus</i> |
| | Common | Pacific rat (<i>R. exulans</i>), Black rat (<i>R. rattus</i>), Brown rat (<i>R. norvegicus</i>) |
| | Local (Bislama): Rat, Ipota (Erromango): Lakisi, Tanna: Yasuk | |
| Organism type | | Vertebrate |
|  | | |
| Physical Description | <p>Black and brown in colour with large round ears and a pointed snout and comparatively small feet. Body is thin and long in size reaching up to 15 cm.</p> <p><i>R. rattus</i> commonly known as the black rat. Has a distinguishing long tail. Skin colour ranges from black to light brown. Adults grow up to 32.4 - 46.4 cm long and may weigh about 110 grams to 340 grams.</p> <p><i>R. norvegicus</i> is brown in colour. It is about 25 cm long from the tip of the nose to the base of the tail. Its tail is as long as its body. Adult male weighs up to 350 grams. Adult female weighs 250 grams.</p> | |
| Habitat | <i>Rattus norvegicus</i> prefers moist environment; usually around river banks. Rats are found in city sewage systems and rubbish dumps and other damp places. | |

Herbicides work faster than physical and cultural control. However, they are more expensive and can be hard to access in remote farming islands and communities. They can be detrimental to the ecosystem and the health of the person applying it. Continuous application of herbicides over a long period of time can lead to accumulation of residues in crop plants. The weed species can also build up resistance to it after a while, leading to 'super weeds'. Downstream effect of leached herbicides is another problem where excess herbicides are applied in farms or parks.

For environment conscious farmers and land managers, physical and cultural methods can be used. Hand cutting and weeding are common in most Pacific island countries. The stems and tubers may be uprooted and the whole plant burned or dehydrated in the sun. The weed may be grazed with cattle, small ruminants or horses.

Cultural control is also practised in some parts of Vanuatu. On East Santo forestry plantations of Whitewood (*Endorspermum medullosum*) are observed to suppress the *Merremia peltata* once the forest has established a high canopy density. This method involves selective planting of crops or plants that are as aggressive as, or more aggressive than the target weeds species. In pasture, farming techniques are applied. For example planting dates are altered to give a head start on the pasture. This ensures that the pasture is well established by the time the weed seeds germinate. Properly carried-out pasture management to avoid overgrazing is another cultural practice used by farmers across Vanuatu. Keeping the pasture at a certain height and density will keep weed seeds from germinating and taking over the pasture.

The 'Integrated Approach System' is an alternative. This system has been developed by Live & Learn Vanuatu and is currently being tested on three sites. The system combines physical removal of the weed by cutting, uprooting of the stem and burning of the whole plant followed by agroforestry. The agroforestry component combines high value timber tree species with a root crop as groundcover. The root crop (kumala) provides groundcover in the early years until the forest species builds up sufficient canopy to shed off sunlight.



Section 3:


Managing weeds

Integrated management model options on *Merremia peltata*

There are a number of management options available to farmers and land managers. The option selected may vary from place to place depending on availability of technical skills and resources, particularly financial resources. Ecological impacts of the management option selected also plays an important role in their selection.

Farmers and land managers with the financial capability may choose herbicides as their management option. Herbicides currently in the market include Weedmaster Duo, Glyphosate, 2, 4-D, 2,4,5-T, Victoria Gold, Vigilant Gel, and Ultimate.

Glossary

| Word | Bislama | Definition |
|--------------------------|---|--|
| Agroforestry |  | A mixed land management/ agricultural method which uses trees in combination with cropping and livestock. |
| Biodiversity | | The variety and abundance of all plants and animals that live on the planet or within a specified area. |
| Biological control agent | | A method of managing invasive species which uses other living organisms, such as a disease or an insect, as the control agent. |
| Biotic | | Biological/living environmental factors, for example, native plants, invasive pests. |
| Dehydrate | | All the water is removed from an object in order to preserve or burn it |
| Ecosystem | | The relationships and interactions between the living and non-living things (e.g. soil, water) of a particular area. |

| Word | Bislama | Definition |
|---------------------|---------|---|
| Ecosystem services | | The essential resources and processes that the natural world provides to humans and animals for their survival. For example, plants provide oxygen, wetlands filter polluted water. |
| Environmental weeds | | Weeds that invade native ecosystems and adversely affect the health of native flora and fauna. |
| Fungus | | An organism that has no flowers or green colour, for example. mushroom, mould |
| Habitat | | The home of a plant, animal and other living things, for example, in a tree, on a coral reef. |
| Herbicides | | Chemicals that are applied to weeds to kill them, for example, Glyphosate. |
| Insect | | An invertebrate with six legs and three body parts – an abdomen, thorax and head. |

| Word | Bislama | Definition |
|------------------------|---------|---|
| Pest | | An unwanted animal species, usually non-native, which damages communities, the natural environment and the economy. |
| Parasite | | Small animal or plant that lives on a larger animal or plant and feeds from it |
| Reforestation | | Replanting trees and forests or allowing the forest to grow back naturally where previously it was degraded by activities such as farming, deforestation or natural disasters. |
| Riparian zone | | The strip of land and vegetation that is located adjacent to waterways. |
| Ruderal species | | Weeds that colonise and spread after an area has been disturbed, e.g. after land clearing, slash and burn agricultural technique or a cyclone, for example, <i>Merremia peltata</i> . |
| Run-off | | Water flow that occurs over a catchment area when soil is completely saturated, a normal part of the water cycle. |

| Word | Bislama | Definition |
|--|---------|--|
| Integrated pest/weed management | | A sustainable approach to managing invasive species which uses an appropriate mix of biological, chemical and physical methods to control and manage invasive species. |
| Invasive species | | Plants or animals that expand and thrive in an area where they are not wanted, causing significant harm to the natural environment, communities and the economy. |
| Land degradation | | The decline in health of a landscape through one or more factors which may include deforestation, soil erosion, overstocking, slash and burn agricultural technique and pest/weed invasions. |
| Mollusc | | A type of invertebrate animal with a muscular foot, for example, snail. |
| Native species | | See endemic species. |
| Pesticide | | Chemicals that are used to kill or repel pest animals. |

| Word | Bislama | Definition |
|--|---------|---|
| Siltation | | When soil particles are washed into rivers and other waterways causing them to become cloudy or turbid. |
| Slash and burn agricultural technique | | The clearing, burning and cultivating of the land to make food gardens. |
| Sustainable agriculture | | An alternative farming practice that attempts to balance the needs of farmers and their families with conserving the natural environment. It involves practices such as agroforestry which helps maintain soil fertility and structure. |
| Sustainable development | | Development that meets the needs of the current population without compromising the ability of future generations to meet their own needs. |
| Threatened species | | Plants or animals which are at risk of becoming extinct |

| Word | Bislama | Definition |
|----------------------|---------|--|
| Transpiration | | The loss of water vapour from plants through their leaves. This is a part of the evaporation process within the water cycle. |
| Vertebrates | | Animals with a backbone, for example, fish, pigs. |
| Weed | | An unwanted plant species which damages communities, the natural environment and the economy. |
| Wetland | | A type of environment which is either permanently or temporarily inundated with water. |

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Invasive Species in Vanuatu

Pocket Guide

In Vanuatu, invasive species are impacting on our forests, biodiversity and livelihoods. It is important that land management strategies are considered carefully, to avoid repeating past mistakes and causing further environmental damage.

This booklet can be used by farmers, agricultural extension officers, environmental professionals, students, community groups, NGOs and other land managers in Vanuatu. The aim of this booklet is to minimise the spread of invasive species across Vanuatu so as to positively impact on biodiversity, communities and food security.

The purpose of this booklet is to:

- Assist farmers and land managers to accurately identify invasive species when they are in the field through providing detailed profiles invasive species.
- Assist land managers to make informed decisions about how to manage (reduce) weeds effectively when they are in the field, using an integrated weed management model.
- Improve skills in effective and integrated weed management.



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