Weed Control Manual

This manual has been developed under the Weed Management Action Plan 2016 – 2017. The Action Plan aims to build awareness of the need to ensure that weed management on St Helena is a high priority, so that by 2021 weed management will be "c*oordinated across sectors through implementation of a national Weed Management Strategy which is adequately resourced, supports holistic land management, and is legally enforced through the Environmental Protection Ordinance."*

The activities of all individuals may contribute to the introduction of new weed species, or the spread of existing weeds. All land managers have a role to prevent the spread of weeds to neighbouring properties and to work co-operatively to strive to ensure optimal weed management is achieved.

This manual is for government workers in Roads, Agricultural, Forestry and Environment Sections, landowners, environmental NGOs, farmers, gardeners and all members of the public. It consists of:

- Weed management calendars for Roads, Environment, Landowners, Farming and Forestry.
- Best practice guidelines for the control of bilberry, blue weed, bull grass, African fountain grass, furze, lantana, pheasant tail fern, whiteweed, wild mango, and general broadleaf weeds, grasses, and woody weeds
- Best practice guidelines for disposal of weed material
- General guidelines for spraying

Control in general

General guidelines for weed control are:

- Timing is important, you need to hit weeds before they start flowering: "1 years weed is 7 years seed"
- Don't start without planning for follow-up.
- Look at the big picture: what will happen when the target weed is removed? Worse ones can come in, especially if removal results in disturbed land, and some weeds can be useful in sheltering newly planted endemic species.
- Pick the right method for the job - not just with regards the weed species but also taking into consideration the context. There are two main approaches:
    - Large-scale short-term action with relatively little input: typically for agricultural and pasture clearing.
    - Longer term action, of varying scale and often with high input: typically for conservation work.
- When tackling a widespread weed, start with the outliers. Remove these first, and then focus on the main area of infestation.
- Success can be achieved only by on-going removal. Don't think you can do it with a single one-off treatment. Examples of successful programmes include:
    - Forestry: 1 manual clearing plus 4 chemical treatments per year.
    - Landowners: systematic cleaning of pasture to ensure that the cleaning starts from pastures at higher altitude in order to prevent dispersal of seeds.

Weed management calendars

Where possible time control actions to before plants are flowering to stop them setting seed or fruit. Note that exact timing of control activities will depend on the rains and may vary from the calendars given below, which should be seen as guides only.

Overall

<table>
<tr><th colspan="3">SPRING</th><th colspan="4">SUMMER</th><th colspan="2">AUTUMN</th><th colspan="3">WINTER</th></tr>
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Roads

Main weeds of concern: aloe, bilberry, flax, fleabane, furze, grasses, whiteweed and wild mango.

Weed control by knapsack sprayer, mechanical sprayer, road sweeper and manual removal.

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</table>

Environment

Main weeds of concern: bilberry, buddleia, African fountain grass, fuchsia, furze, pheasant tail fern, tungy, whiteweed and wild mango.

Weed control by targeted chemical control with knapsack sprayers, and manual removal by relatively large labour force, including volunteers. Programme usually longer-term, and includes re-planting of cleared areas with endemic species.

SPRING			SUMMER				AUTUMN		WINTER		
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
Whiteweed control campaign											
Chemical control of: furze, lantana, wild mango											
			Manual control of: pheasant tail fern				Manual control of: furze				
Flax - flowering time varies, watch for signs of flowering and control beforehand											
Chemical control any time in the year ideally before flowering of: bilberry, buddleia, African fountain grass, fuchsia and pheasant tail fern											
Manual control any time in the year ideally before flowering of: bilberry, buddleia, African fountain grass, fuchsia furze, lantana, tungy											

Landowners

Main weeds of concern: bilberry, bullgrass, flax, furze, ink bush, lantana, poppy, thatching grass, whiteweed and wild mango.

Weed control by knapsack sprayer, and mechanised and manual removal, with limited labour force. Large-scale, following a programme of regular repeat treatments.

SPRING			SUMMER				AUTUMN		WINTER		
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
Whiteweed control campaign											
Chemical control of: bull grass, furze, lantana, wild mango											
			Manual control of: pheasant tail fern				Manual control of: furze				
Flax - flowering time varies, watch for signs of flowering and control beforehand											
Chemical control any time in the year ideally before flowering of: bilberry, grasses, ink bush, pheasant tail fern, poppy, and small broadleaf weeds											
Manual control any time in the year ideally before flowering of: bilberry, furze, grasses, ink bush, lantana, poppy, tungy and small broadleaf weeds,											

Farming

Main weeds of concern: blue weed, double gee, everlasting, furze, lantana, nargy weed, nut grass, sow thistle, whiteweed, wild mango and wild turnip.

Weed control by knapsack sprayer, and mechanised and manual removal, with limited labour force. Can be large or small-scale, and follow a programme of regular repeat treatments.

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Forestry

Main weeds of concern: bamboo, bilberry, everlasting, whiteweed

Weed control by knapsack sprayer, and mechanised and manual removal, with limited labour force. Can be large or small-scale, and follow a programme of regular repeat treatments.

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Best practice guidelines for the control of African fountain grass

Scientific name: *Pennisetum setaceum* (*Cenchrus setaceus)*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Flowering can occur at any time after rains							Main flowering period				
Chemical control before flowering, when the plants are green											
Pull up or grub up plants; controlled burning											

Why is it weedy?

In dry and open environments African fountain grass is a highly aggressive, fire-adapted colonizer that readily pushes out native plants. The accumulated dry leaves of fountain grass increase the intensity and spread of a fire. It can live up to 20 years and plants begin to produce seeds within one year.

How does it spread?

Seed heads produce large numbers of seeds which are easily dispersed by wind, water, animals and vehicles. Seeds may remain viable in the soil for six years or longer.

Where is it a problem?

Dry hillsides and cliffs, mainly on west side of the island.

What can I do to get rid of it?

The long-lived seeds of fountain grass make its control extremely difficult. Small infestations may be managed by uprooting plants by hand and destroying the flowering heads in order to prevent seed dispersal. Removal by hand may need to be repeated several times a year as plants can seed several times a year.

- **Pull up** small seedlings by hand.
- **Grub out** larger plants using a pick or shovel. It is important to bag or otherwise destroy the seed heads to prevent further seed dispersal.
- **Controlled burning** of larger established tussocks will destroy above ground plant material and some of the seeds. This has to be followed up by herbicide treatment of the new shoots and young plants.
- **Chemical control** using herbicides:
  Extensive infestations of fountain grass are probably best controlled with the help of herbicides, especially those with some systemic activity. Spraying should only be done on fresh green growth, herbicides won't work if applied to dried leaves.

- **Foliar spray** using glyphosate (eg Roundup) with a sticker. It will take time for the plants to die back, maybe 2 to 3 weeks. Check for re-growth after a month, a second treatment may be required.

What should I avoid doing?

- Strimming is only a temporary measure as plants will quickly respond by sprouting. Strimming can also scatter seed heads and make the problem worse.
- Spraying herbicides onto tussocks protected by a lot of dried yellow leaves; plants must be green and actively growing for pesticides to work.

What can I do to stop it coming back?

- If burning is used for control it must be followed by a treatment such as a foliar herbicide spray to control new growth. African fountain grass is fire-adapted and its many seeds will germinate after fire.
- Any action against African fountain grass must include planning for at least 6 years follow-up treatment (seeds last for up to 6 years in the soil), with a recommended further 4 years monitoring to check for new growth.
- Planting native species after removal may help prevent re-establishment of African fountain grass.

Sources:

- Global Invasive Species Database (2016) Species profile: *Cenchrus setaceus*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=309 on 17-05-2016.
- http://www.cabi.org/isc/datasheet/116202
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Bilberry tree

Scientific name: *Solanum mauritianum*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Flowers and fruits all the year round											
Chemical control any time in the year. Apply control method before the plants set fruit.											
Manual control any time in the year. Apply control method before the plants set fruit. Pulling up small plants is easiest over winter.											

Why is it weedy?

Bilberry grows and matures rapidly, forming dense tall stands which can shade out other plants and take over large areas. Plants produce many well-dispersed seeds most of the year. It is allelopathic (the plants produce toxins that poison the soil) which inhibits regeneration of other plants in the same soil. It can retard the growth of young pine trees. Plants can grow to a height of several metres within 2-3 years and mature plants begin to die after 15 years.

All parts of the plant are poisonous to humans, especially the green berries. The fine hairs on the stems and leaves can be an irritant and can cause respiratory problems, especially when they are dislodged during mechanical clearing operations. The berries can also be a host for fruit flies.

How does it spread?

The seeds are spread by birds and rats which eat the berries. 20-80 berries are borne on each flower head, each of which contains about 150 seeds.

Where is it a problem?

Bilberry does best in areas of high rainfall in upland areas and tolerates a very wide range of conditions.

What can I do to get rid of it?

- **Pull up** all small plants (easiest in winter). Leave on site to rot down. It's important to cut/break off roots to prevent re-rooting into ground.
- **Ring-barking** is effective for controlling small infestations, but is labour-intensive.
- **Chemical** control using herbicides:
    - **Cut and paint** cut stumps with herbicide triclopyr (for example Garlon) in penetrating oil such as kerosene or diesel. The herbicide must be applied to the cut surface immediately after cutting.
    - **Basal stem** application: triclopyr (eg Garlon) in diesel. Ensure wetting of the root crown, exposed roots and stem up to a height of 25cm and all around the stem.

- Large trees with stems more than 3cm in diameter can be treated with **Ecoplugs** (glyphosate) using the dose rate for Group 1 species on the label. Several plugs will be needed for each stem as the plant can seal off sections and restrict the spread of the herbicide.

- **Foliar spray**: triclopyr (eg Garlon) or glyphosate (eg Roundup) on young actively growing plants up to 1m in height. Plants higher than 1m should be slashed and re-growth sprayed when not less than 0.5m high. For larger plants, a re-spray may be required 3 to 6 months later to knock back re-growth.

What should I avoid doing?

- **Felling and slashing** by itself is insufficient as the plants will re-sprout to form multi-stemmed thickets which are more difficult and more expensive to control. As a result, felling and slashing must be accompanied by herbicidal applications.

What can I do to stop it coming back?

- The plant propagates vegetatively when mechanically damaged by cutting or uprooting, and pieces of root remaining in the soil will regrow.
- Cut stems also resprout quickly so hand clearing by cutting or slashing requires a programme of constant follow-up, ideally every 3 to 6 months.
- Bilberry re-seeds profusely in bared sites within 1-2 years but seed is usually short-lived and bilberry rarely invades intact habitat. Maintain shade by planting dense cover and maintain a rolling front of control.

Sources:

- Global Invasive Species Database (2016) Species profile: *Solanum mauritianum*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=209 on 17-05-2016
- http://www.cabi.org/isc/datasheet/50533
- Flowering Plants and Ferns of St Helena. Phil Lambdon, 2012.
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Blue weed

Scientific name: *Ageratum conyzoides*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
								Main peak of flowering			
Chemical control before flowering											
Strim, plough or grub up plants, with follow-up to treat the regrowth from seed											

Why is it weedy?

Blue weed forms a dense carpet of knee-high vegetation of up to 1000 plants per meter square and competes with crops and native vegetation. Blue weed has the ability to emerge in abundance and complete its life cycle in less than 2 months. There is much evidence that blue weed inhibits germination and growth of other plants through chemicals produced by its root and shoot systems.

It is also a disease reservoir of the *Tomato yellow leaf curl Tanzania virus* near tomato farms in Tanzania, and possibly other crop diseases.

The leaves of the plant reportedly have moth-repellent properties, and also medicinal properties.

How does it spread?

Blue weed spread by seed. Seeds are readily dispersed by wind, on clothing and shoes. Up to 95,000 seeds per plant are reported, and it can shed seeds over extended times (5 to 8 months). Seeds viability is less than 12 months.

In fertile wet locations, blue weed can spread vegetatively by layering and can persist for a couple of seasons. Excessive growth will slump over and stems root from where they touch the ground, new shoots are sent up from the nodes.

Where is it a problem?

Blue weed occurs all over the island. It thrives best in rich, moist soils with high humidity and tolerates some shading. It is common in plantations, farms and overgrazed pastures.

What can I do to get rid of it?

As blue weed is a prolific seeder, it is important to destroy plants before they flower.

- Blue weed is shallow-rooted and relatively easy to control using mechanical means such as **strimming, ploughing or grubbing**. There will be regrowth from seed so follow-up is required if this is not done before the plants flower, do either the same treatment again or spray a herbicide on the new young plants.

- **Chemical** control using herbicides:
    - Triclopyr (eg Garlon) application on young plants before they flower, or after strimming to knock down the re-growth. Blue weed is tough so it can take up to 3 weeks for the plants to die.

What should I avoid doing?

- Glyphosate (eg Roundup) herbicides are not as effective on blue weed as triclopyr (eg Garlon) and should be avoided.

What can I do to stop it coming back?

- Blue weed seeds require light for germination so covering them with soil will limit regrowth: plough or dig over the ground if you use strimming or herbicide treatment.

Sources:

- Global Invasive Species Database (2016) Species profile: *Ageratum conyzoides*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=1493 on 17-05-2016.
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Bull grass and Slender rush

Scientific names: *Juncus capillaceus* and *Juncus tenuis*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
							Main flowering period				
Chemical control before flowering											
Grub up and turn small patches											

Why is it weedy?

Bull grass invades short grassy turf of all types. It is very persistent. The leaves are avoided by livestock, and are too tall for wirebirds.

Slender rush also invades grassy turf in damp areas. It is very tolerant of compacted soil.

How does it spread?

Both plants spread from seed, and also creeping rhizomes.

The slender rush has an average seed output of about 30,000 seeds per plant which need light to germinate. Seeds are sticky when wet, making them easily transported on footwear, tyres, feathers and fur. They remain viable for at least 2 years.

Where is it a problem?

Both species are widespread above 400m. Slender rush is less widespread, and tends to occur along roads and tracks.

What can I do to get rid of it?

Bull grass and slender rush are resistant to trampling, cutting and grazing. The trick is to catch them early and keep them down but in the early stages of invasion the plants can be scattered among grasses and hard to spot.

- **Grub-up** and turn small patches. Turning exposes and dries out the roots, preventing regrowth.
- **Chemical control** using herbicides:
  This is the most effective method but herbicide take-up is poor as the leaves are round and shiny. Check treated plants for re-sprouting; you may need to do a second spray.
    - **Foliar spray**:
        - 2, 4-D in the dry season
        - Glyphosate (eg Roundup), spot spray individual clumps

- Tricks to **improve** herbicide treatments:
  - Use a sticker to stop the spray running off the waxy leaves.
  - Slash the tops of the plants to stimulate soft new growth, and then spray a few weeks later. The young leaves will take up more herbicide. Avoid slashing plants which are seeding as this will result in seeds being spread over a large area.

What should I avoid doing?

- Don't mow: bull grass regenerates more quickly from mowing than more desirable forage grasses.
- Exposing soil to light encourages seeds to germinate. You can exploit this by waiting and then spraying the young actively growing plants.
- If livestock are allowed in after mowing or herbicide treatment, the bull grass will germinate and also grow faster than forage grasses, so you get more bull grass and less forage grass. Where possible, leave 6 months after treatment before allowing livestock in.

What can I do to stop it coming back?

- A recommended programme to restore badly invaded pasture has 4 stages:
  1. Spray with a herbicide;
  2. Burn the plants off once they have died and dried. This kills many seeds and exposes the ground to get all the remaining seeds germinated at once;
  3. Spray the newly germinated young plants with herbicide;
  4. Keep livestock away for 6 months, where possible. This will allow the forage grasses to recover and start growing back over the treated area.
- Bag the seed heads and remove from the site, destroy by burning or deep burial

Sources:

- Flowering Plants and Ferns of St Helena. Phil Lambdon, 2012.
- http://jncc.defra.gov.uk/pdf/03B%20Bullgrass%20Impact%20and%20Action%20Sheet.pdf
- http://www.cabi.org/isc/datasheet/115047
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Furze or Gorse

Scientific name: *Ulex europaeus*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Flowers and fruits all the year round											
Chemical control on soft new growth											
Hand-pulling and grubbing-up can be done any time of the year, before the plants flower.											

Why is it weedy?

Furze forms dense spiny thickets and invades pasture land. It contains volatile oils and is highly flammable. It also produces a hotter fire than most weeds. Older stands build up dead vegetation which acts as additional fuel. Furze incursions on pasture reduce grazing capacity. It is unpalatable to cattle. Sheep can be 'trained' to tackle young growth. Only goats will graze mature furze.

Furze can make a contribution to erosion control. As a legume, it also fixes nitrogen in the soil. Furze pollen is used by the island's honey bees.

How does it spread?

Furze spreads by seed which can be carried by soil picked up on vehicles, animal fleeces, animal hooves, birds, rainfall runoff, even ants have been recorded. Plants produce 500-2000 seeds per square metre of cover. Seed cases 'explode' and seed is thrown to a distance of about 5 metres, on steep slopes the downhill 'throw' will be longer. Seed can lay dormant in the soil for up to 30 years. Few seeds are produced by plants less than 3 years old or by plants older than 15 years

Where is it a problem?

Furze prefers areas with more than 450mm (18in) rainfall per year, the mid-altitude areas and is especially common in pastures. It is found all the way up to the peaks.

What can I do to get rid of it?

Tackling furze invasions in the correct sequence will maximise use of resources. Because of its method of spread, small outlier or satellite plants should be controlled first. Larger dense clumps of furze can only expand along their outer edge and thus their spread is more predictable.

New furze plants don't seed until about 18 months after germination. Seeding from re-growth on established plants is much quicker, so in cleared areas deal with regrowth before new seedlings.

- **Hand pulling** young furze seedlings causes minimum disturbance and over the long term will prove to be one of the most cost effective control methods.

- **Grubbing up** larger furze plants is the first stage of a longer control programme. The disturbance of the ground during grubbing will stimulate the furze seed and other weeds in the seed bank to

germinate. Avoid leaving the ground bare after grubbing as this will result in a new furze or other weed bed establishing. Make sure all roots are dug up or it'll come back.

- **Chemical** control using herbicides:

Many herbicides are not very effective on gorse because of the shape of the "leaves" and the thick cuticles on the spines which help prevent absorption of herbicides. All treatments are more effective when applied to soft new growth.

A common approach to control mature furze thickets is to burn (often after desiccation by herbicide) and to spray re-growth and seedlings at least once within one year.

  - **Cut and paint** cut stumps with herbicide triclopyr (eg Garlon) in penetrating oil such as kerosene or diesel. The herbicide must be applied to the cut surface immediately after cutting.

  - A **foliar spray** of triclopyr (eg Garlon). Trials on furze up to 1m high in pasture on St Helena achieved a good kill rate without killing the pasture grass (Kikuyu). After spraying, bare patches of ground should be re-seeded with kikuyu runners to increase ground cover:
    - On young actively growing plants up to 1.0m in height. Apply until the point of run-off. Plants higher than 1.0m should be slashed and re-growth sprayed when not less than 0.25m high. Routine foliar application is recommended in order to minimise re-growth.

- **Biological control:**
  - One species of thrip and one species of mite were introduced in 1995 as biocontrol agents. The thrip didn't survive, and the gorse mite only occurs in a few locations on the island.

What can I do to stop it coming back?

- Furze regrows well after cutting and seeds grow after clearing so a programme of follow-up is required.
- Fire kills a proportion of the seeds in the top 10mm of the soil, and breaks dormancy in the remainder. A synchronous flush of germination follows, and a single application of herbicide can kill both the cohort of seedlings and the adult plants regenerating after fire damage.
- Planting acid-tolerant, fast-growing species in furze thickets may eventually shade out furze without further management efforts. Furze seedlings grow poorly in competition with grasses.
- It has also been stated that a healthy, well-fertilised sward of pasture which is not overgrazed will be more resistant to furze invasion than poorly managed pasture.

Sources:

- Global Invasive Species Database (2016) Species profile: *Ulex europaeus*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=69 on 11-05-2016
- IAS Information Sheet: Furze. Andrew Darlow
- http://www.cabi.org/isc/datasheet/55561

- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Lantana or Wild Currant

Scientific name: *Lantana camara*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
Growth and flowering after rains							Die-back period				
Chemical control											
							Grub-up and hand-pull				

Why is it weedy?

Lantana forms low dense spiny thickets in open unshaded areas and can become the dominant understory plant. It is allelopathic which means it produce toxins in the soil which kill other plants or reduce their growth. Lantana also contains natural insecticides and other toxic chemicals and has been implicated in the poisoning of a number of animals including cattle, sheep and goats. Poisoning mainly occurs in newly introduced young animals without access to other fodder.

Lantana is an artificial hybrid species that has been subject to intense horticultural improvement in Europe since the sixteenth century and now exists in many different forms or varieties throughout the world. It is very robust and highly variable. It is used for herbal medicines, natural insecticide, firewood and mulch.

How does it spread?

Lantana spreads by seed. Mature plants can produce up to 12,000 seeds every year and seeds are thought to remain viable for up to 11 years under natural conditions. The myna bird feeds on lantana berries and has been implicated in the spread. Germination is low if not eaten by birds first. Sheep and goats also disperse the seeds.

Lantana seeds need high light conditions for germination and early growth and seedlings are unlikely to survive beneath parent bushes. Lantana is also able to produce shoots, especially shallow lateral roots, following mechanical damage.

Where is it a problem?

All over the island from sea level up, but rare in the uplands.

What can I do to get rid of it?

The key to good management of lantana is constant vigilance. Repeated control of regrowth is critical to success.

- **Hand pulling** plants is suitable for small areas and fire can be used over large areas. Regrowth can occur rapidly if the rootstock is not removed, and seedling germination where the soil is disturbed.

- **Cutting** lantana can be considered as a management option in the short term. Lantana grows well from cut stumps so the cutting frequency needs to be often enough to avoid the development of dense thickets – this may be up to three times a year.

- **Chemical** control using herbicides:

  Herbicides, especially those that are foliar applied, are most effective when plants are actively green and growing. Herbicides don't work on dried, older plants.

  - **Cut and paint** cut stumps with herbicide triclopyr (for example Garlon) in penetrating oil such as kerosene or diesel. The herbicide must be applied to the cut surface immediately after cutting.

  - **Basal bark** application of triclopyr (eg Garlon) in penetrating oil such as kerosene or diesel. Ensure application of the herbicide to the root crown, exposed roots and all around the stem up to a height of 25cm.

  - **Foliar spray** with triclopyr (eg Garlon) on young actively growing plants up to 1m in height. Routine foliar application may be required, up to three follow-up sprays after the initial control effort. Larger plants can be treated by either cut stump or basal bark application, or cut back and the young regrowth treated with a foliar spray.

- **Biological control:**

  - Three species of bug were introduced between 1971 and 1972, two of which survive and give some control.

What can I do to stop it coming back?

- Revegetation of a treated site is a key component of a lantana management program.
- A typical programme example is cut and paint stumps, follow-up after 3 months with a foliar spray to kill any regrowth.

Sources:

- Global Invasive Species Database (2016) Species profile: *Lantana camara*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=56 on 11-05-2016.
- https://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/l-camara.pdf
- http://www.cabi.org/isc/datasheet/29771
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Pheasant tail fern

Scientific name: *Nephrolepis cordifolia*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
Main spore producing period									Main spore producing period		
Cut and spray with herbicides; spray with herbicides											
			Hand pull or grub-out								

Why is it weedy?

The pheasant tail fern forms dense patches which push out any other plant. It is catastrophic to the endemic species on the peaks. Island-wide control is essential in order to reduce the spore loading in the air, which can help reduce the number of infestations in endangered peaks habitat fragments.

How does it spread?

The fern produces numerous spores that are dispersed through wind and water. It also spreads through its rhizomes/stolons and tubers.

Where is it a problem?

In patches in the uplands, but actively spreading.

What can I do to get rid of it?

- **Hand pulling** or **grubbing up** can be used, however care should be taken that no plant parts are left in the soil that can regrow and that the plants are disposed of properly.
- **Cutting and spraying** the regrowth with a herbicide, a series of follow-up treatments will be required.
- **Chemical control** using herbicides:
    - Plants can be killed with herbicides containing glyphosate (eg Roundup). A foliar application of a 1.5% solution provides good control. Follow-up applications are necessary to control plants regrowing from rhizomes and tubers, this may be required for 2 to 5 years.

What should I avoid doing?

- Avoid leaving any tubers in the ground, these will grow into new plants very quickly.
- Avoid spreading rhizomes, tubers and spores when removing plants.

What can I do to stop it coming back?

- Make sure that all the tubers are removed when hand-pulling.
- Recommended disposal method is to mulch the foliage.

Sources:

- Global Invasive Species Database (2016) Species profile: *Nephrolepis cordifolia*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=1158 on 17-05-2016.
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Tungy

Scientific names: *Opuntia elatior* (red tungy) and *Opuntia ficus-indica* (white tungy)

SPRING			SUMMER				AUTUMN		WINTER		
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
			Flowering and fruiting								
Manual control at any time											

Why is it weedy?

Tungy forms dense prickly thickets in pastures. There are some spineless forms, but these get grazed out and don't become weeds.

The fruits have one of the highest concentrations of vitamin C of any fruit.

How does it spread?

Tungy seed is spread by birds which eat the fruit. The pads can also sprout. The number of viable seeds per fruit can vary from 177 to 357. Although scarification is necessary for germination, the dormancy period is short and maximum germination occurs after 9 months.

Where is it a problem?

The two species of tungy can be found growing together in dry lowland areas, mainly in the north and west of the island.

What can I do to get rid of it?

- Physical removal by **grubbing up** and **cutting down.**
- **Biological control**:
    - The cactus moth, *Cactoblastis cactorum*, was introduced in 1971 and is now widespread, but appears to give little control. *P*lants larger than the 14-pad stage are less likely to succumb to attack by the cactus moth.

What should I avoid doing?

- Make sure that all pads and fruit grubbed-up are collected and disposed of to avoid them taking root and developing into new plants.

What can I do to stop it coming back?

- Deep bury the tungy pads and fruit, with at least 3 foot of soil covering the plant material.

- Alternatively, destroy the pads by cutting them up very small and regularly turning the heap to promote rot.

Sources:

- http://www.cabi.org/isc/datasheet/120784
- http://www.cabi.org/isc/datasheet/37714
- Flowering Plants and Ferns of St Helena. Phil Lambdon, 2012.
- Call Farmer Support at ANRD on 24724 for advice.

Best practice guidelines for the control of Whiteweed

Scientific name: *Austroeupatorium inulifolium*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
		Flowering, then seeding									
Chemical control											
Manual control: main campaign September – November, followed by regular follow-ups											

Why is it weedy?

Whiteweed forms dense thickets. It is a successful under-canopy plant and can occupy whole forestry plantations, making access and forestry work difficult. Whitweed also invades pastures and is unpalatable to grazing animals. Goats that have been forced to graze it have developed liver problems. On road verges it reduces visibility for motorists. Whiteweed frustrates attempts to restore native vegetation. It is well adapted to spreading rapidly through cleared flax areas on the Peaks. It impedes restoration and maintenance work, and when established reduces biodiversity. It does not contribute significantly to erosion control. The pollen can also trigger asthma attacks in people.

How does it spread?

Whiteweed is characterised by prolific wind borne seed production and rapid growth. Each mature plant is capable of producing up to 400,000 seeds, and most seed spreads within a radius of 50m on flat land in normal wind conditions. The seed bank life is estimated to be up to twenty years. Carriage by soil on vehicles, transportation of cut vegetation and rainfall runoff are other dispersal methods.

Where is it a problem?

Whiteweed is found extensively in the central part of the island at higher altitudes (above 500m), with occasional outliers as far down as sea level.

What can I do to get rid of it?

Note that gradual removal of whiteweed and regeneration of the cleared area will be more successful and manageable in the longer term than large scale clearance.

- **Hand pulling** small plants as soon as they are identified causes minimum disturbance and over the long term is proven to be one of the most cost effective control methods.
- **Cutting** whiteweed can be considered as a management option in the short term. Whiteweed grows well from cut stumps but as long as the cutting frequency is often enough to prevent flowering then it will control further spread – this may be more than three times a year.
- Whiteweed have shallow small root systems and **'poking' the roots** with a sharp machete will let you remove the whole plant with minimal disturbance to the soil.
- **Chemical** control using herbicides:

a) **Basal bark** application of triclopyr (eg Garlon) in penetrating oil such as kerosene or diesel. Ensure application of the herbicide to the root crown, exposed roots and all around the stem up to a height of 25cm.

- Large bushes with stems more than 3cm in diameter can be treated with **Ecoplugs** (glyphosate) using the dose rate for Group 1 species on the label.
- A **foliar spray** of glyphosate (eg Roundup) or triclopyr (eg Garlon) will kill plants up to 0.5m high. Larger plants can be slashed or cut back and the new growth sprayed, regrowth can be very quick so be prepared to treat within weeks. Note that whiteweed seedlings spring up very readily below killed plants so follow-up is required.

What should I avoid doing?

- Do not let plants come to flower. Cutting a plant in flower is too late as the seeds will mature on the dead plant.
- Avoid any physical disturbance to the plant when they are bearing seeds as you will be helping to spread them in the wind.
- Avoid disturbing the soil or unnecessarily opening up to light. Whiteweed seedlings do not grow well in low light levels and germination is greatly reduced if soils are left un-disturbed.
- The massive seed bank and rapid growth on disturbed land makes grubbing-up the least preferred option.

What can I do to stop it coming back?

- Typically a site needs to be cleaned twice a year for at least 10 years before the whiteweed population is suppressed.
- Newly treated sites should be revisited annually over a two to three year period as seeds rarely fall alone and germination may not occur in the first year.
- A single treatment (grubbing up, cutting or chemical control) won't give control of whiteweed as it regrows from cut stumps, and seeds sprout from disturbed land. Be prepared to go back at least every 6 months to re-treat the area.
- Recommended disposal methods for plants with seeds:
  - Remove plant heads with seeds for bagging and rotting down
  - Leave in situ to rot down

Sources:

- Global Invasive Species Database (2016) Species profile: *Austroeupatorium inulifolium*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=1445 on 11-05-2016;
- IAS Factsheet – Whiteweed. Andrew Darlow
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of Wild mango

Scientific name *Schinus terebinthifolius*

SPRING			SUMMER				AUTUMN		WINTER		
Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
							Flowering and fruiting				
Chemical control											
									Hand pull young plants		

Why is it weedy?

Wild mango forms dense thickets and pushes out other vegetation. It prefers shade to full sun and grows in a variety of soil types. Seedlings can survive for a long time in the dense shade of an older stand where they grow very slowly, while in openings they grow very fast. Survivorship of naturally established seedlings is unusually high, ranging from 66-100%.

Wild mango trees are allelopathic which means they produce toxins in the soil which kill other plants or reduce their growth. It is also poisonous and the resin can cause skin reactions and dermatitis. Persons sitting beneath *S. terebinthifolius* trees exhibited flu-like symptoms, and sneezing, sinus congestion, chest pains and acute headache. The ingested fruits have a 'paralysing effect' on birds and grazing animals such as horses are susceptible to its effects which can even prove fatal.

How does it spread?

Fruits are eaten and spread by birds and animals such as rats. The age of first seed production may be as young as 3 years. The longevity of the seeds in the soil is generally about 5 months.

Where is it a problem?

Wild mango occurs all over the island.

What can I do to get rid of it?

Wild mango is a difficult tree to kill. It is capable of resprouting after damage from cutting, fire, or herbicide treatment. Resprouting and suckering is often profuse and the growth rates of the sprouts are high, which contributes to the plant's habit of forming dense clumps.

- **Hand pulling** small isolated seedlings as soon as they are identified causes minimum disturbance. This is easiest in winter.
- **Chemical** control using herbicides:

  The use of herbicides is the most commonly used and cost-effective method for controlling wild mango. Herbicides are most effective when applied during the summer months when trees are most actively growing.

- **Cut and paint** cut stumps with herbicide triclopyr (for example Garlon) in penetrating oil such as kerosene or diesel. The herbicide must be applied to the cut surface immediately after cutting.

- **Basal bark** application of triclopyr (eg Garlon) in penetrating oil such as kerosene or diesel. Ensure application of the herbicide to the root crown, exposed roots and all around the stem up to a height of 25cm.

- Large trees with stems more than 3cm in diameter can be treated with **Ecoplugs** (glyphosate), using the highest dose rate on the label.

- **Foliar spray** triclopyr (eg Garlon) young actively growing plants up to 1.0m in height. Plants higher than 1.0m should be slashed and re-growth sprayed when not less than 0.5m high. Several treatments will be required so plan for follow-up.

What should I avoid doing?

- Grubbing up is not recommended as it is difficult to get all the root material and any remaining will re-sprout very quickly.

- Cutting isn't recommended. Wild mango grows well from cut stumps and cutting can also encourage suckering and further spread, making the problem worse in the long term.

What can I do to stop it coming back?

- Cut stems re-sprout very quickly and seedlings exposed with the removal of mature trees will respond very rapidly with vigorous growth. Sprouting is often from the roots and may occur some distance from the treated stump or trunk.

- Seeds are generally not viable after five months following dispersal so the seed bank is not a problem.

- Recommended disposal methods are:
  - Chipping, drying and burning, or disposal in the landfill
  - Plants with fruit – remove plant heads with fruit by bagging and rotting down, the remainder of the plant can be disposed of as above.

Sources:

- Global Invasive Species Database (2016) Species profile: *Schinus terebinthifolius*. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=22 on 11-05-2016.
- http://www.cabi.org/isc/datasheet/49031
- Flowering Plants and Ferns of St Helena. Phil Lambdon, 2012.
- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of grasses in general

Including kikuyu grass (*Pennisetum clandestinum*), *Pasbalum* species, thatching grass (*Pennisetum macrourum*), and others.

Why are they weedy?

Grasses can invade agricultural plots and flower gardens, spread into tarmac roads, take over forestry tracks and unmade roads. They can be a particular problem in conservation areas.

What can I do to get rid of them?

Grass seeds tend to be long-lived which makes them difficult to control.

- **Pull up** small seedlings by hand. This may need to be repeated several times a year as many species can seed several times a year.
- **Grub out** larger plants using a pick or shovel. This may need to be repeated several times a year as many species can seed several times a year. It is important to bag or otherwise destroy the seed heads to prevent further seed dispersal.
- **Chemical control** using herbicides:
    - **Foliar spray** using glyphosate (eg Roundup). For larger species which grow in tussocks it may take time for the plants to die back, maybe 2 to 3 weeks. Check for re-growth after a month, a second treatment may be required.

What should I avoid doing?

- Strimming is only a temporary measure as grasses will quickly respond by sprouting. If they are seeding strimming can also scatter seeds and make the problem worse.

What can I do to stop them coming back?

- Exposing the soil to light by killing grass often results in a rapid germination of any seeds in the soil, both from grass and other weeds such as sow thistle. This is especially a problem if the soil is disturbed by hand pulling or grubbing up. Always have a plan and be ready to plant-up with area with, for example, crops, forage grasses, flowers, or endemic species.

Sources:

- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of woody weeds in general

Including bamboo (*Bambusa* spp), blackberry (*Rubus pinnatus*), buddleia (*Buddleja* species), fuchsia (*Fuchsia* species), ink bush (*Cestrum laevigatum*), poppy (*Populus alba*), raspberry (*Rubus rosifolius*), and many others.

Why are they weedy?

Woody weeds invade pasture, forestry, farms, gardens and conservation areas. They also take over road verges and reduce visibility to drivers.

What can I do to get rid of them?

The method used will depend on the species. Always treat before the plant flowers and seeds or fruits.

- **Pull up** all small plants and leave them on site to rot down.
- **Grub up** larger plants. The disturbance of the ground during grubbing will stimulate any seeds in the seed bank to germinate so avoid leaving the ground bare after grubbing as this will result in a new weed bed establishing.
- **Cutting** can be considered as a management option in the short term. Many woody weeds will grow from cut stumps but as long as the cutting frequency is often enough to prevent flowering then it will control further spread – this may be several times a year.
- **Ring-barking** is effective for controlling small infestations of some species, but is labour-intensive.
- **Chemical** control using herbicides:
    - **Cut and paint** cut stumps with herbicide: triclopyr (eg Garlon) in diesel. Apply to cut surface, all bark and root crown of stumps cut ± 10cm above ground level.
    - **Basal stem** application: triclopyr (eg Garlon) in diesel. Ensure wetting of the root crown, exposed roots and stem up to a height of 25cm and all around the stem.
    - Large trees with stems more than 3cm in diameter can be treated with **Ecoplugs** (glyphosate).
    - **Foliar spray**: triclopyr (eg Garlon) or glyphosate (eg Roundup) on young actively growing plants up to 1m in height. Plants higher than 1m should be slashed and re-growth sprayed when not less than 0.5m high. Repeat sprays may be required.

What can I do to stop them coming back?

- Felling and slashing by itself is usually insufficient as many species plants will re-sprout from cut stems. As a result, felling and slashing must be accompanied by a follow-up of herbicide spray on the young regrowth.

Sources:

- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines for the control of broadleaf and annual weeds in general

Including double gee (*Emex australis*), nargy weed (*Leonotis nepetifolia*), sow thistle (*Sonchus* species), tallow vine (*Commelina diffusa*), and many others.

Why are they weedy?

Broadleaf weeds invade farmers' plots, flower gardens, road verges and conservation areas, displacing other vegetation.

What can I do to get rid of it?

The method used will depend on the species. It is important to destroy plants before they flower. If there are seed heads present, it is important to bag or otherwise destroy them to prevent further seed dispersal.

- **Pull up** small plants and turn them over so that the roots die. This works well for nargy weed.
- Many broad leafed weeds are shallow-rooted and relatively easy to control using mechanical means such as **strimming, ploughing or grubbing**. There will be regrowth from seed so follow-up is required if this is not done before the plants flower, do either the same treatment again or spray a herbicide on the new young plants.
- **Cut and bury** plants, at least 1 foot deep. This works well for tallow vine which is difficult to kill with herbicides.
- **Chemical** control using herbicides:
    - Glyphosate (eg Roundup) application on young plants before they flower, or after strimming to knock down the re-growth.

What can I do to stop it coming back?

- Many annual broadleaf seeds require light for germination so covering them with soil will limit regrowth: plough or dig over the ground if you use strimming or herbicide treatment.

Sources:

- Call the Pest Control Services Officer at ANRD on 24724 for advice on using herbicides.

Best practice guidelines on disposing of cut weeds

Poor disposal, such as dumping green waste over a fence or in the forest is one of the main ways that weeds escape from gardens and start spreading. Some of the ways that you can help minimise the spread of weeds through responsible disposal of green waste include:

- Drying (any weed):
    - Leave weeds in the sun to dry before disposing of them.
    - Rhizomes or tubers can be hung up in trees in dry regions to wither. Then burn them or take them to the Horse Point Landfill site.
- Burning (African fountain grass, bull grass, other grasses, woody weeds):
    - Dry cut weeds and then burn them in a bonfire or simple incinerator made from a 40 gallon oil drum. Be careful not to create a large fire which can go out of control.
- Bagging and rotting down (white weed with seeds, pheasant tail fern, weeds with bulbs and tubers):
    - Dispose of weeds that are already seeding or readily able to reproduce vegetatively, including through suckers and bulbs, by placing them in a black plastic bag, sealing it and 'baking it' in the sun until destroyed.
- Composting (any small weeds, the leafy parts of larger weeds and woody weeds)
    - Remove any problem parts (tubers, rhizomes, berries & fruit) and either take them to Horse Point Landfill site, rot them down in a black bag or dry them for burning, as described above. Compost the other parts of the plant.
    - Cover your compost so that seeds cannot be distributed by wind or animals.
    - Do not compost tubers or roots such as ginger that are likely to re-sprout and are not likely to be killed in compost heaps.
- Mulching and chipping (larger leafy weeds such as ginger, wild mango, other woody weeds):
    - Finely shredding weeds in a garden mulcher before burying or composting will increase the rate of breakdown.
    - Mulched weeds such as ginger leaf makes an excellent slow-release feed for fruit trees.
    - Mulches and wood chip ground covering help suppress new weed growth and hold moisture in.
- Transporting to Horse Point Landfill site (any weed material):
    - All green waste is accepted.
    - Always cover trailers when transporting plant material to prevent seeds and other live plant material falling off.
    - Don’t fill the trailer or truck so full that weeds can fall off.
    - Never transport weeds in full seed or you will just spread seeds across the island.
- Leaving in situ (any weed with seed heads or fruit, any weeds when moving cut plant material would cause damage):
    - Cut weeds can be piled, or left lying as they fall, depending on the situation.
    - Note that rats can use piles of cut plant stems as refuges.

Best practice guidelines for spraying herbicides

ANRD has produced a range of Codes of Best Practice for pesticide use which cover using pesticides on farms, in gardens, along roads and in National Conservation Areas, see http://www.sainthelena.gov.sh/pest-control-service/

Main points are:

- Always read the product label for dose rate, conditions of use and the personal protective equipment required.
- The standard minimum personal protective equipment is: rubber boots, nitrile gloves and coveralls. A face shield is also recommended for mixing the herbicide in the tank.
- Never spray when it is very windy or when it is wet.
- The best time to spray is early in the morning or late in the day.
- Most herbicides only work on growing plants, they need to be lush and green at the time of spraying.
- Most herbicides are applied by spray set at low pressure, and fitted with a solid cone nozzle. This is a different nozzle to what would be used to apply insecticides.
- Spraying drought stressed plants should be avoided as plants in this condition will not absorb sufficient herbicide to kill them.
- Always check the product label. Contact the Pest Control Services Officer at ANRD for advice on any spraying on 24724.

Main herbicides recommended:

Glyphosate (eg Roundup, Roundup Probioactive)

- A general broad-spectrum herbicide which kills a wide range of weeds and is particularly good at annual broadleaf weeds and grasses.
- Has systemic action, absorbed mainly through the leaves. There is little absorption through the roots.
- Binds strongly to soil and can persist for up to 6 months. Water pollution is minimal. Under the right conditions it is also readily degraded by soil microorganisms.
- May be carcinogenic to people, but does not pass easily through the skin.
- Pure glyphosate is low in toxicity to fish and wildlife, but some products containing glyphosate may be toxic because of the other ingredients in them.

Triclopyr (eg Garlon 480, Garlon Max)

- More selective than glyphosate, particularly good at annual broadleaf weeds and woody weeds. It will not kill grasses or conifers.
- Has systemic action, absorbed through the leaves, green stems, and roots.
- Does not bind to soil, and risk of water pollution exists, but sunlight rapidly breaks down triclopyr in water. It is readily degraded by soil microorganisms.
- No evidence of carcinogenic action in people, and not very toxic to people, animals or aquatic organisms.