ALLIGATOR WEED UTE GUIDE

Impacts, eradication, mitigation and management of terrestrial alligator weed (*Alternanthera philoxeroides*)

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Alligator weed is a very serious threat.

It is an aggressive perennial plant that thrives both in aquatic and terrestrial environments.

It spreads via fragments by people, machinery and waterways.

It is poisonous to stock and can cause ill health to people if eaten.

It can reduce pasture production and crop yields.

It can increase expenses for animal health, feed, fertiliser and herbicide.

Terrestrial alligator weed's extensive underground root systems resist herbicide translocation making it difficult to control.

Aquatic alligator weed forms floating mats that obstruct water intake for irrigators and increases flooding to productive land.

It is critical we contain alligator weed's spread in New Zealand; to minimise its costs on production and restrictions to future land use".

Alligator weed, although present in several regions, remains a Unwanted Organism in New Zealand. The law prohibits the breeding, distributing, releasing, or selling of alligator weed in New Zealand

Learn to recognise alligator weed.

Look for a white papery flower head on a stalk over summer.

Incursions occur from soil movements, fragments caught on machinery, fruit bins, beehives or wedged in cloven hooves and from infested drains/waterways.

If you find alligator weed, contact your regional council for support in how to control it.

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Preface.

In August 2022, the Weeds Team at AgResearch, Ruakura and concerned Regional Councils partnered with the Ministry for Primary Industries (MPI) to form the Alligator Weed Working Group (AWWG). The groups aim was to conduct research on alligator weed, focusing on alligator weed on land, where its impacts and management were less known. This is to be delivered in a ute guide for landowners to highlight why we should care about alligator weed and what we can do to manage terrestrial alligator weed, which requires a different approach to alligator weed growing in water.

Alligator weed can look different in different environments so use this guide to identify it and if you think you might have alligator weed, **take a photo and report it to your regional council.**

The AWWG asks landowners to **check and clean** all farm equipment, watch out for fragments caught between fruit bins, in beehive boxing or in machinery to ensure you prevent alligator weeds further spread and protect your property from alligator weed.

Let's **"See you later alligator" and stop alligator weed coming to your property!**

Darion Embling

Chairman of Alligator Weed Working Group, Waikato Regional Council

Alligator weed in New Zealand.

Alligator weed in New Zealand is locally abundant in Northland and Auckland regions, scattered patches in Waikato and Bay of Plenty, with single sites in Horizons, Taranaki, Hawkes Bay and Greater Wellington regions. Alligator weed is not known to be present in the South Island.

- This South American weed is now a problem in 30 countries and is seriously invasive in USA, China, SE Asia and Australia.
- It occupies both aquatic and terrestrial habitats and is difficult to manage.
- It can be difficult to identify as it exhibits different characteristics in different environments.
- Unwittingly spread by humans – mistaken for mukunuwenna or similar looking species.
- Terrestrial alligator weed is dormant during winter but regrows vigorously during warmer months.
- Alligator weed does not set seed in New Zealand.

Photo: Waikato Regional Council

Alligator weed

Clusters of **papery white, clover-like flowers** in summer (Dec to March) on a **peduncle** (stalk) is the most conclusive identification separating alligator weed from other similar looking plants.

Reproduction: Alligator weed reproduces vegetatively, from stem or root fragments. It can regrow from any stem with a node and establish from 5mm root fragments.

Leaves: Are opposite and either pointed or rounded.

Stems: Alligator weed has long horizontal, green to reddish-green stems (stolons). The stems are usually **hollow** which helps identify alligator weed in wetter environments. When it grows in drier terrestrial environments or if the stems are thin (< 3mm) they can be solid.

Roots: The extensive thick root systems of alligator weed maintains terrestrial alligator weed's persistence. Terrestrial alligator weed roots are rhizomatous, and up to 10x the biomass of above ground parts. Aquatic alligator weed roots are fibrous and floating.

Species confused with alligator weed.

The misidentification of alligator weed as *Alternanthera sessilis* (sessile joyweed, mukunuwenna or ponnanganni keerai), a Sri Lankan vegetable, is a common mistake.

Additionally, an aquarium plant *Alternanthera littoralis* can be sold mistakenly under the *Alternanthera sessilis* (var. rubra) name adding to the confusion.

Alligator weed (*Alternanthera philoxeroides*) is related to the native plants, *Alternanthera nahui* (nahui) and *Alternanthera denticulata* (lesser joyweed) and can be confused for these similar looking, related, native species.

Unrelated species mistaken for alligator weed:

- Water primrose
- Water purslane
- Swamp willow weed

Nahui

Distinguished from lesser joyweed by smaller stature, shorter, narrower leaves with less denticulate margins.

Has seeds.

Flowers not on stems.

Lesser joyweed

Closely related to *A. nahui.*

Differs from other *Alternanthera spp* by its slender growth habit and distinctly denticulate (serrated) leaves.

Has seeds.

Flowers not on stems.

Water primrose
(Ludwigia peploides)

Leaves similar to alligator weed but alternate not opposite. Stems are solid and flowers are yellow.

Water purslane *(Ludwigia palustris)*

Smaller green leaves that are opposite but more oval in shape. Flowers are stalkless, single and green.

Swamp willow weed *(Persicaria decipiens)*

Leaves not opposite and can be reddish or green. Flowers are pinkish, clustered, in small cylindrical bunches on a spike.

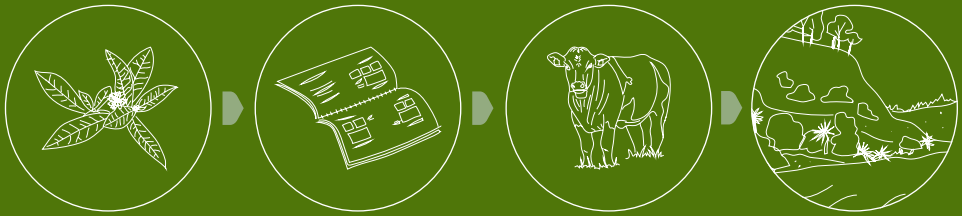
Advertised mukunuwenna or ponnanganni keerai (*Alternanthera sessilis*) is mostly misidentified alligator weed as *A.sessilis* (also called sessile joyweed) is rarely found in New Zealand.

The leaves of this overseas vegetable look similar however, sessile joyweed and native *Alternanthera* species have their flowers attached in the leaf axil (leaf/stem joint) without a flower stalk (peduncle) unlike alligator weed.

Alligator weed

Before you grow or eat it – check if its flower is on a stalk.

What to do if you think you have found alligator weed.



Take a photo.

Check its identification via this booklet, the PlantNet app, iNaturalist or your Regional Council.

Keep stock away.

Contact your Regional Council who can help with its control and disposal.

Alligator weed threatens productive agriculture.

Alligator weed was first found in aquatic locations but has since moved into terrestrial locations.

It can be found in all types of agricultural and horticultural crops, turf and urban environments. But, growth habit may differ in drier environments with smaller leaves and thinner solid reddish stems.

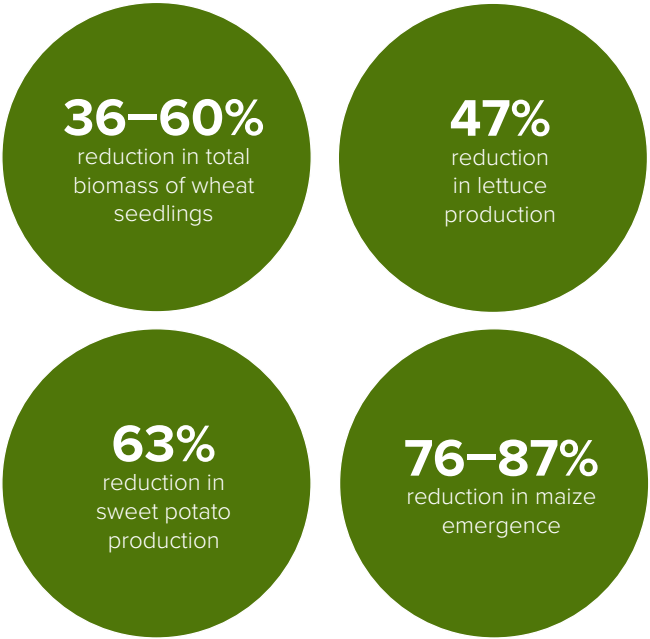
Clockwise from top left (photo credit): Riparian planting; kumara (Waikato Regional Council); kiwifruit orchards (Shane Grayling); urban lawn; maize (Heidi Pene); pasture.

Impacts.

Alligator weed impacts on production

Overseas, alligator weed impact on crops has reported:

A farmer in Northland...
"I'm not cropping 40% of my farm because of alligator weed."



Alligator weed impacts on root crops

Producing root crops when terrestrial alligator weed is present, limits tuber growth and costs more due to increased weed management and fertiliser, and labour costs at harvesting.

Kumara: Upper row: Grown without alligator weed. Lower row: Grown with alligator weed present

A kumara grower in Northland...
"Cropping is impossible if terrestrial alligator weed has established more than 30% of the paddock."

The most effective herbicides for terrestrial alligator weed cannot be used in most crops. A crop break using annual ryegrass and picloram based herbicides to maintain productive ability is required every three to five years. This will add approximately $800/ha to crop production costs.

Alligator weed impacts on pasture

Alligator weed dies back in winter leaving a feed gap and gaps for further weed ingress.

Terrestrial alligator weed roots exude chemicals decreasing ryegrass growth and persistence.

Our research with ryegrass found alligator weed reduces:

- Germination by 82%.
- Delays germination by 7 days.
- Total biomass by 40%.
- Tiller width by 20%

Photo: Frances McKinnon

Alligator weed's financial impacts

Figures are indicative only

Farmer advice is to re-grass if the paddock has greater than 30% alligator weed present due to animal health and production impacts.

Re-grassing as a result of alligator weed ingress costs approximately **$800/ha.**

*Based on two herbicide treatments, cultivation and seed costs and one fertiliser application.

Additional supplement feed while re-grassing is **$540/ha.**

*Based on 2024 AgFirst Waikato dairy herd model parameters.

To control alligator weed in pasture, the available chemical control treatments will damage clover species. **Additional fertiliser treatments 150kg/N per ha will be required to maintain production at additional $75/ha.**

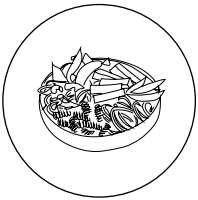
Alligator weed's animal health impacts

- Terrestrial alligator weed is highly palatable to sheep, cattle and horses. Farmers report stock break out to reach alligator weed and preferentially graze it.
- Alligator weed as a feed provides a similar metabolisable energy (ME) to ryegrass over late spring/summer (11.1 MJ/kgDM) and early autumn (11.8 MJ/kgDM) but has a lower neutral detergent fibre (NDF) (25%DM) and so a higher feed in-take potential. Low fibre intake such as alligator weed can contribute to wool pulling behaviour in sheep.
- Alligator weed causes photosensitivity in animals. It contains phototoxic compounds called anthraquinones.
- Alligator weed can bioaccumulate heavy metals from its environment without showing injury to the plant. These can impact animal health and animal value.
- Alligator weed symptomatic stock cannot be sent to the works!
- Farmers report prolonged consumption can lead to stock death!
- Milk production will decline due to photosensitivity affects.

Stock symptoms after consuming alligator weed

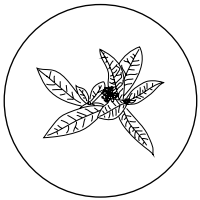
- First 24-48 hrs after exposure: cows are restless, agitated leg movement, sensitive udders. Greater than 48 hrs exposure: dermatitis on non-pigmented and sparsely coated skin develops blisters and hair loss from ears, face or along the spine.
- Calves' exhibit similar symptoms to facial eczema and severe sunburn – such as blisters and swelling. Ear loss has been reported in sheep from photosensitivity.
- Sensitive areas generally have little hair or wool cover such as ears, face, side of udders, and white areas of the animal. Shorn sheep can be affected over the whole body.

Human health impact.



Alligator weed is a risk to human health if eaten.

Heavy metal bioaccumulation in alligator weed occurs in both aquatic and terrestrial sites. This risk is greatest in the roots > then stems > then leaves.



Heavy metals in the soil like lead, cadmium, and arsenic can bioaccumulate in alligator weed, often above human health limits.

Alligator weed's ability to suck up heavy metals and withstand high levels without any outward effect on the plant means you really don't know what you are eating when consuming alligator weed.

In an urban Wellington site, a resident had mistaken alligator weed for sessile joyweed and was growing it in their garden. Tests showed lead levels in the alligator weed leaves to be **seven** times the Australian and New Zealand human health limits.

Human exposure to lead can cause premature birth or low birth weight as well as later problems with development.

The same site also had cadmium levels above human health standards.

Exposure to high levels of cadmium can cause diarrhoea, vomiting, and digestive complaints.

Mitigation and management of terrestrial alligator weed impacts.

Animal health

- Careful animal health monitoring of stock grazing paddocks with terrestrial alligator weed is required.
- Total animal feed should remain at <15% alligator weed to avoid animal health issues.
- Terrestrial alligator weed can be ensilaged for three months to devitalise alligator weed roots and stem fragments but must not contribute over the 15% of total animal feed.
- At risk stock should not be grazed on paddocks containing alligator weed.

Photosensitivity

If animals have fed in paddocks with alligator weed, farmers can mitigate symptoms:

- Provide feed to stock that is free from alligator weed. Symptomatic stock can recover if caught early enough.
- Provide shade to affected animals to reduce photosensitivity impacts.
- For symptomatic animals seek veterinary advice.
- Some farmers report the addition of feed supplements like bentonite helps to prevent and reduce symptoms from alligator weed.

Grazing

Terrestrial alligator weed can be out competed in well maintained, drier soil moisture, pasture systems.

- Manage N inputs. High N environments favour terrestrial alligator weed dominance in pasture.
- Avoid heavy grazing or mowing: both cause terrestrial alligator weed to become low growing making it less visible and harder to spot spray.

Cropping

Cropping becomes uneconomic once terrestrial alligator weed is greater than 30% of the paddock. Use a break crop of annual ryegrass with picloram based or other herbicides to return to productive cropping.

Based on farmer advice follow these tips for a break crop.

1. After harvest, check and clean machinery!
2. Use either a power harrow to break up alligator weed roots or a specialised ‘spader’ to bring up deep roots if required.
3. Roll paddock to promote alligator weed above ground regrowth and treat with paraquat if too much.
4. Sow Tama ryegrass for winter feed.
5. In summer (Nov/Dec), use metsulfuron plus adjuvant, or picloram plus adjuvant. Boom or spot spray alligator weed.
6. Spot spray herbicide again in Feb/March and again later if required.
7. Resow Tama ryegrass or direct drill to thicken pasture if required.
8. Prepare ground for summer crop. Spray any alligator weed regrowth with paraquat before planting crop.
9. Paraquat can be used interrow in kumaras until runners start spreading.

Orchards

In orchards, where mowing and machinery is necessary and chemical options are more limited, weed mat can be used over small areas to minimise the dispersal of alligator weed to other areas of the orchard.

Tips for alligator weed management in orchards are:

- Maintain the edges of the weed matting and watch out for alligator weed around the perimeter of the matting as these plants will continue to feed the root reserves underneath the weed mat.
- Root mass will remain viable under permeable weed mat, so this is not a control option, but can be used to mitigate its dispersal.
- Use glyphosate with adjuvant to defoliate the above ground biomass to deplete root reserves. Spray terrestrial alligator weed three times annually (Nov, Feb and May), if good leaf area is present.

Pests and diseases

Like all weeds, alligator weed **consumes nutrients, water, light and space** otherwise available for productive growth.

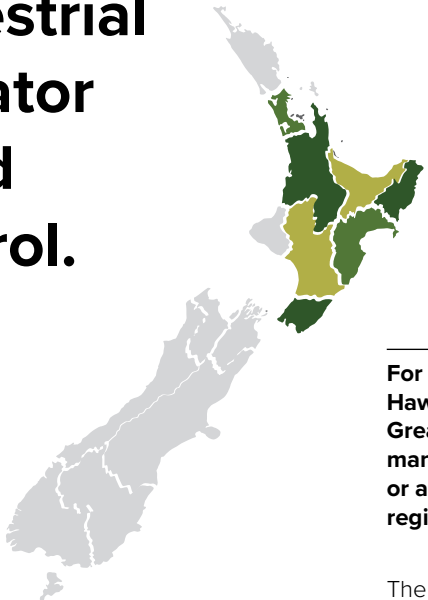
It provides a fleshy habitat for **harbouring pests and diseases.** During AWWG research, terrestrial alligator weed provided habitat to scale, aphids and white fly.

Waterways

Alligator weed can restrict water flow, block intakes for irrigation systems and hydro-electricity production, increase flooding events, provide habitat for mosquitos and disease and smother riparian planting.

Alligator weed is a high-water user – it has been found to use approximately double its biomass weight in water over spring/summer conditions.

Terrestrial alligator weed control.



For Auckland, Waikato, Bay of Plenty, Hawkes Bay, Gisborne, Horizons, Greater Wellington Regional Councils, management of alligator weed (terrestrial or aquatic) requires notification to your regional council.

The location and size of the infestation will dictate the management approach.

Best herbicides to use on terrestrial alligator weed

Metsulfuron with Hasten™ or Expedient® adjuvant is the preferred herbicide treatment for terrestrial alligator weed.

*Glyphosate plus metsulfuron is preferred in aquatic environments.

Based on both above and below ground control the following herbicides, in order of efficacy, are recommended for terrestrial alligator weed control:

	Herbicide	Selective	Grass friendly	Clover safe	Other
1.	Metsulfuron	✓	✓	×	Residual. May affect follow on crops
2.	Picloram	✓	✓	×	Residual. May affect follow on crops
3.	Glyphosate	×	-	-	Non residual, use in horticulture only
4.	Paraquat	×	-	-	Non residual dessicant for rapid knock-down, use in horticulture only

Note the above active ingredients are sold under various herbicide names and that picloram is only sold in combinations.

Depending on the situation and regrowth multiple applications per year are likely over its above ground growing periods (Nov - early May)

Be aware.

The use of metsulfuron and glyphosate together in a tank mix has previously been used however, **we recommend not to mix these two in one application for terrestrial alligator weed** as glyphosate appeared to reduce the efficacy of the metsulfuron in our trials. If wanting to vary herbicides it is better to use these as a ‘double-knock’ but always apply metsulfuron first and then glyphosate 5-7 days later. This allows metsulfuron time to be translocated while still achieving the faster knockdown of the glyphosate.

Elimination of terrestrial alligator weed.

Small infestations
(< 5m²)

Elimination strategy.

1. Mark out the infestation and isolate if possible. Keep stock away.
2. Manual removal of small infestations under the guidance of Regional Council.
3. Backfill with sand to help any regrowth be spotted and more easily removed.
4. Monthly inspect over the growing season. Watering the area in dry seasons can help stimulate regrowth to find and remove missed fragments. Follow up with metsulfuron plus adjuvant Hasten™ or Expedient®, for best results.

Large infestations
(> 5m²)

Suppression/progressive containment strategy.

Excavation is less feasible in larger sites. Chemical control, a suppression/progressive containment strategy should be implemented.

- An intensive herbicide programme is required, with the goal of gradual depletion of alligator weed's root reserves. Treatments should be consistently applied annually to ensure eradication. Once a treatment area is reduced to a smaller infestation size, manual removal can be implemented. Monitoring and spot treatments is required.
- Large areas of alligator weed infested pasture can be made into silage bales and held for three months to devitalise alligator weed fragments. Ensure no more than 15% of total feed contains alligator weed. On occasions, an animal feed test for heavy metals may be advisable. Silage which contains alligator weed can only be feed out on farm not sold!

Intensive herbicide treatment programme

1.

Apply herbicide (boom or spot spray) three times a year over alligator weed's growing season as regrowth appears. This can be reduced to twice a year in the third year of sustained control.

2.

Apply first treatment in November. Apply second treatment in February. Apply a third treatment in May (before frosts).

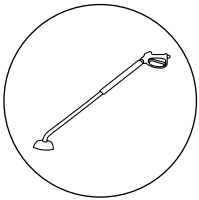
3.

Ensure sufficient regrowth before second and third applications. You need six pairs of leaves, 10cm stem length and 30cm crown width for ensuring sufficient contact of herbicide and depletion of roots.

4.

When the amount of regrowth is small, excavation may be used to speed up the eradication.

Non-chemical control



Although chemical control is the most cost effective at defoliating alligator weed, in some situation's herbicides may not be allowable.

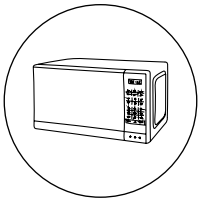
Manual extraction and applied steam technology may be employed for suppression. However, under non-chemical treatment regrowth occurs quickly.

Steam

Steam can defoliate alligator weed upper growth but does little to its roots beneath. Regrowth will occur within two weeks and retreatment would be required every month over the growing season. To improve results with commercial weed steamers:

- Apply Hasten™ adjuvant , to degrade the waxy leaf cuticle, before applying steam.
- Ensure maximum surface contact of steam. Allow 1-2 minutes steam exposure.

Top: 2hrs post steam treatment.; Bottom: 48hrs post steam treatment



Mowing and Mulch mow

Mowing and mulching is **not recommended** as a control method as it leads to high fragmentation and increased dispersal. Our mulch mow trial dispersed fragments several meters from the plant site and led us to abandoning it as a possible control option.

Microwave

Microwaving stems and roots on high for 1-2 minutes (till soft and mushy) kills terrestrial alligator weed. This may be used to destroy one off fragments of alligator weed found on footwear, machinery, etc.

Don’t let alligator weed spread.

People are the most significant factor in the spread of alligator weed.

Alligator weed is dispersed via fragments. New plants establish from any stem (greater than 2cm long) with a node (sometimes without) or any pea sized root fragment.

Alligator weed spreads easily in water where hollow stems and filamentous root fragments float downstream. Small flooding events can move aquatic alligator weed into paddocks where it will establish and grow.

Watch out and check machinery or balers. Small fragments attach to:

- Machinery, or equipment transported between water bodies
- Beehive bases
- Between pallets in orchards
- Shoes when out riparian planting
- Stock hooves.

Northland Regional Council...

“We get farmers ring in to identify alligator weed and wonder where it suddenly came from...usually we find a new water trough or something else just got put in and it came in on the machinery from another farm”.

Internal on-farm biosecurity can sometimes be forgotten...

Alligator fragment in baler machinery. Photo: Frances McKinnon

Watch out for alligator weed...

In hay from other properties.

In damp pastures or after flooding events.

If clearing channels, ditches, or if pulling up alligator weed and leaving on riparian margins be aware it can survive disturbance or moved by fauna to reestablish nearby.

Got a new build?? Movement of fill or landscape supplies from infested catchments can carry alligator weed fragments.

Planting mukunuwenna or ponnanganni keeri in your garden? If the leaves are smooth on the edges, and the flower is attached by a stalk, then it's alligator weed.

On your footwear. Fragments can catch in laces. Wear gumboots and check footwear soles when riparian planting.

In between fruit bins and machinery or from beehive boxing

If fragments are found on machinery, beehives, pallets: a quick zap in the microwave till they are mushy to the touch (2 minutes on high) kills fragments.

Disposal.

Alligator weed is an unwanted organism in New Zealand and so maintains specific disposal requirements

Not for landfill

Do not dump alligator weed in green waste landfills.

Silage

Silage containing alligator weed cannot be sold.

Seek regional council help on disposal, specific to your environment and infestation.

Aquatic alligator weed.

Alligator weed in aquatic environments is quite different from terrestrial sites.

Aquatic plant roots are more filamentous, whereas terrestrial alligator weed has thick tap roots. Management of aquatic sites is complex and requires regional council advice.

Biocontrol – aquatic control only

In the early 1980s Landcare Research (now Manaaki Whenua) released two biocontrol agents - *Agasicles hygrophila*, an alligator weed beetle and *Macrorrhinia endonephele*, an alligator weed moth.

Alligator weed beetle.

Alligator weed moth. Photo: Peter Homan, University of Florida.

Defoliation by alligator weed beetle in a farm pond.

Both biocontrol agents' impact on the weed are constrained to higher temperatures found in upper north regions of New Zealand and to still pond environments only. Neither biocontrol is effective in alligator weed populations where the water is flowing, in regions affected by frost or cooler temperatures, or on terrestrial alligator weed biotypes. Terrestrial alligator weeds plant stems can be too solid for beetles to pupate in or in environments too dry for the beetle's eggs to develop.

Acknowledgements.

All members of the Alligator Weed Working Group (AWWG), which includes:

Waikato Regional Council
Te Kaunihera ā Rohe o Waikato

greater Wellington Regional Council
Te Pane Matua Taiao

Bay of Plenty Regional Council

horizons regional council

KVH

AWWG Parter

agresearch
āta mātai, mātai whetū

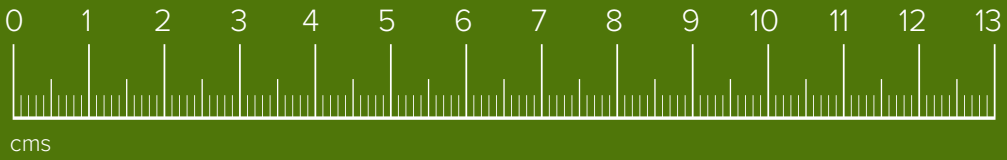
Funder

Ministry for Primary Industries
Manatū Ahu Matua

And In-kind contributor and supporters of the project:

Rural Contractors New Zealand and special mention to Nancy Chaves, from Northland Regional Council.

Acknowledgement to the farmers who shared their stories on terrestrial alligator weed impacts and management.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