Best Practice Guideline:
alien vegetation management

Preamble

Invasive alien vegetation must be removed from environmentally sensitive areas with the least amount of damage to indigenous vegetation, to ensure compliance with the Conservation of Agricultural Resources Act (**CARA**) regulations.

Before any clearing of alien vegetation is initiated, it must be understood that when the programme starts, it must be implemented until completion. There is no value in *ad hoc* clearing, with no follow-up programme.

Management actions:

- Map the extent of invasion as well as density and height of alien species
- Determine costs and priorities and produce a plan of operations detailing Initial control (drastic reduction of the existing population), Follow-up control (control of seedlings and coppice re-growth) and Maintenance (on-going, low-level control) and include targets and timeframes.
- Prioritise the clearing of the most lightly infested areas first
- Prioritise the clearing of highly invasive species which may not have become well established to date
- Prioritise clearing before the burning of a block
- Prioritise clearing within the first season after a burn
- Prioritise follow up clearing
- To restore/rehabilitate areas cleared of alien vegetation
- Keep record of clearing operations and stands

Where should you start?

By removing invasive alien plants from your property, you will help reduce their spread. If your property is very large, and there are many invasive plants present, consider the following as high-priority areas, which should be controlled first:

- The area immediately around buildings, if there is a risk of fire.
- Low-density infestations, to curb the spread of invasive plants into surrounding areas.

- The tops of slopes, watercourses, and steep, long bare slopes, to inhibit the spread of seeds downhill or downstream, where they will infest new areas.
- Sites where initial control work has been completed and regrowth is present, to prevent densification and further infestation.
- Disturbed sites, to prevent new infestations from mass germination of alien seeds in the soil.

Seedlings should be controlled when shorter than 0,5 m to avoid costly control work at a later stage.

Control methods

The following section contains generic guidelines/principles for the removal of alien plants. Specific removal methods for each plant are provided further below.

Invasive alien plant control relies on four main methods - manual, mechanical, chemical and biological control. Long-term success of any programme is best achieved through a combination of these. This is called an integrated control approach.

When using herbicide

Read the labels for specific instructions.

Do

- spray when plants are actively growing,
- ensure that herbicide is mixed according to label application rates,
- ensure correct wearing of safety gear at all times,
- plan the application of herbicides before the operation commences,
- spray when the sun is shining,
- use a drip sheet and keep herbicide in a demarcated area in the veld out of direct sunlight,
- apply spray to the canopy and stems,
- include dye to assist in the identification of areas that have been cleared,
- include a wetting agent should be added to the herbicide mix to allow for better absorption.

Do not

- spray during strong wind, or where there is the slightest evidence of drift,
- spray when it is very hot,
- spray when plants are stressed or dormant,

- spray plants that are over 1m,
- apply herbicide in the rain or on wet, damp leaves,
- allow pregnant women to be directly involved in herbicide operations, or spray near children, animals or water bodies.

Storage

All storage facilities shall comply with the requirements of AVCASA.

Using labour intensive methods

- Always start at the highest point and work downwards i.e. downhill or downstream
- Start from the edge of the infestation and work towards the centre

❖ **Hand pulling**

- Hand pulling is most effective with small (30cm), immature or shallow rooted plants.
- Shake the excess sandy material from the plant, this makes the plant easier to stockpile and lighter to transport

❖ **Chopping/ cutting/ slashing**

- This method is most effective for plants in the immature stage, or for plants that have relatively woody stems/ trunks.
- This is an effective method for non-resprouters or in the case of resprouters (coppicing), if done in conjunction with chemical treatment of the cut stumps.
- **Note**
    - Cut/slash the stem of the plant as near as possible to ground level.
    - Paint resprouting plants (i.e. black wattle, lantana and port jackson) with an appropriate herbicide immediately after they have been cut.
    - Stockpile removed material into piles as prescribed.

❖ **Basal bark**

- Application of suitable herbicide in water can be carried out to the bottom 250mm of the stem. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush.
- **Note**
- If plant is multi stemmed, then each stem needs to be treated.

❖ **Ring barking**

- Remove the bark and cambium around the trunk of the tree in a continuous band around the tree at least 25cm wide, starting as low as possible.
- Where clean de-barking is not possible due to crevices in the stem or where roots are exposed, a combination of bark removal and basal stem treatments should be carried out.
- For aggressively coppicing species pull off the bark below the cut to ground level (bark stripping), to avoid the use of herbicide.
- **Note**
- This method is not used for stands but rather individual large trees

❖ **Bark stripping**

- All the bark shall be stripped from the trunk between the ground level and 1m above ground level.
- Application of suitable herbicide can also be used with this method.
- Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush.

❖ **Frilling**

- Using an axe or bush knife, make a series of overlapping cuts around the trunk of the tree, through the bark into the softwood (approximately 500mm from ground level). The thickness of the blade should force the bark open slightly, ensuring access to the cambium layer.
- Ensure to affect the cuts around the entire stem.
- Apply the herbicide immediately to the cuts by spraying into the frill. The frill needs to be deep enough to retain the herbicide.

Using mechanical methods

❖ **Felling**

- De-branch cut trees and where possible remove all material.
- Where possible large trees are to be felled so that they fall uphill.
- Cut the plant down as low as possible to the ground.
- Apply herbicide immediately (no later than 30mins) to the cambium layer.
- Ensure all the cuts in the cambium layer are treated.

❖ **Bark stripping**

Where bark stripping is used, then all the bark shall be stripped from the trunk between the ground level and 1m above ground level.

- Application of suitable herbicide can also be used with this method.
- Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush.

Using chemical control

- Chemical control of alien plants is not recommended in aquatic systems due to the risk of pollution, but may be used on the floodplain in conjunction with cutting or slashing of plants.
- Chemicals should only be applied by qualified personnel.
- Only herbicide registered for use on target species may be used.
- Follow the manufacturer's instructions carefully.
- Appropriate protective clothing must be worn.
- Only designated spray bottles to be used for applying chemicals.

❖ **Injection**

- Drill or punch downward slanting holes into the tree around the entire circumference of the stem.
- Inject the chemical directly into the plant.

❖ **Foliar spray**

- Use a solid cone nozzle that ensures an even coverage on all leaves and stems to the point of runoff.
- Do not spray just before rain (a rainfall-free period of 6 hours is recommended) or before dew falls.
- Avoid spraying in windy weather as the spray may come into contact with non target plants.
- Spraying dormant or drought stressed plants is not effective as they do not absorb enough of the herbicide.

❖ **Cut stump application**

- This is a highly effective and appropriate control method for larger woody vegetation that has already been cut off close to the ground.
- The appropriate herbicide should be applied to the stump using a paintbrush within 30 min of being cut.
- Stems should be cut as low as possible. Herbicides are applied in water as recommended for the herbicide.

Stacking

- Stacking the cut material in heaps, or in windrows along mountain contours to reduce erosion, facilitates easy access for follow up.
- It also assists in containing the resulting fuel load and therefore the risk of uncontrolled fire.
- Keep stacks well apart to prevent fires from crossing easily, not less that fire meters apart, this is naturally dependant on the size of the stack & the resulting fire intensity when they burn.
- Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.
- Stack light branches separately from heavy timber (75mm and more). Preferably remove heavy branches to reduce long burning fuel loads that can result in soil damage from intensely hot fire.
- Do not make stacks under trees, power and telephone lines, within 30 meters of a fire belt or near watercourses, houses and other infrastructure.

Disposal of plant material

- Plant material should be used beneficially wherever possible, as opposed to disposing it at a landfill site where it takes up valuable airspace.
- Woody and dry material, provided no seeds are present, can be chipped and used as mulch or made available to the local community for firewood.
- Wet material and aquatic weeds should be combined with other organic matter and composted. Alternatively, it may be possible to use it for basket making, animal feed or other uses.
- Material which cannot be used beneficially must be disposed of at a registered and approved disposal site.
- When removing material, take care to remove all debris, including shoots and seeds.

Monitoring

- Follow-up inspections are required in order to establish whether follow-up operations are required.
- It is preferable to follow up on an area and remove all seedlings or treat resprouting plants, rather than treat a new area.

Conclusion

Any land management programme in South Africa will inevitably include an alien plant control program. Alien control programs are essential to protect valuable resources such as economically viable agricultural land, surface and ground water, biodiversity and the beautiful landscapes of our country. An alien control program however requires a high level of commitment, coordination between landowners and authorities, professional planning and implementation and a good dose of common sense. Competent land managers are essential for cost effective and professional implementation programmes. The guidelines provided are compiled from a wide source and will hopefully provide insight to land managers in order for financial and human resources to be effectively used in an integrated control programme.

SPECIES & CARA Category	CONTROL METHODS
Salix babylonica weeping willow CARA 2	Fell the trees and treat the cut stumps with a Triclon 2% solution or a mycoherbicide. Trees can be felled, then burnt, and seedlings sprayed with herbicide. **Biological Control** can be released on regrowth or seedlings.
Melia azedarach Seringa CARA 3	**Foliar Spray** Confront 0.75% Solution. **Cut Stump** Confront 3% Solution. **Frill** Confront 3% Solution. **Basal Stem** Garlon 2% Solution. **Cut Stump** Access 2% Solution.
Solanum mauritianum bug weed CARA 1	Hand pulling can be done. Mature plants can be sawed and herbicide applied to cut stump. Frilling is also another method that can be used with herbicide. **Foliar spray can be done using:** 12.5ml of Starone 200 (Fluroxypyr) mixed with 10l water. Spray onto plants up to 1m tall 0.5l/ha 50ml Mamba (Glyphosate) mixed with 10l water 2l/ha Touch Down (Glyphosate Trimesium) 2l/ha to be used on plants that are 500mm tall. 50ml Garlon 4/Viroaxe (Triclopyr Ester) mixed with 10l water 1,5l/ha **Frill the trunk of large trees** and use the following: 300ml Timbrel 3A (Triclopyr Amine Salt) mixed with 10l water 1,5l/ha 200ml Chopper (Imazapyr) mixed with 10l water 1l/ha **After felling, a cut stump can be treated with:** 300ml Timbrel 3A (Triclopyr Amine Salt) mixed with 10l water 2,25l/ha 200ml Chopper (Imazapyr) mixed with 10l water 1l/ha **Disposal**: Stack and burn. Chip cut material.

SPECIES & CARA Category	CONTROL METHODS
Opuntia ficus-indica prickly pear CARA 1	Seedlings can be hoed, mature plants can be dug out. **Chemical control applications:** Inject into 4 – 12 pre-made holes per plant any of the following: MSMA ll mixed with 1l water and injected at 2ml/dose. Mamba (Glyphosate) 1l mixed with 2l water and injected at 2ml/dose. Touchdown (Glyphosate) 330ml mixed with 10l water and injected at 2ml/dose. **Biological Control** is a very cost effective way of removing this species. **Disposal:** Leave standing until it rots away. It can be burnt in stacks after it has dried out.
Agave americana agave Proposed Invader species	Seedlings can be hoed, or dug out if mature. For **chemical control**, inject 2ml of MSMA into the bowl of the plant - 2l per 1000 plants. **Biological control** is the most cost effective way of dealing with this species. **Disposal:** Leave standing until it rots away.
Pinus pinaster Pine CARA 2	Can be pulled out by hand or hoed. Intermediate sized plants should be cut at ground level, with the root being left behind. Mature pine trees can be cut/sawed. Ring barking or filling can also be used. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily.
Pennisetum clandestinum Kikuyu CARA 2	A herbicide with the active ingredient glyphosate should be used. Plants should be sprayed during their active growing season (summer or autumn dependant on rainfall region). The suitability of using herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. Application of herbicides is more successful in conjunction with mechanical means.

SPECIES & CARA Category	CONTROL METHODS
Eucalyptus spp. Blue gums CARA 1 & 2	Can be pulled out by hand or hoed. Intermediate sized plants should be cut at ground level, with the root treated with herbicides immediately. Mature *Eucalyptus* can be cut/sawed. Herbicides should be applied to the stump as soon as possible thereafter (within 30 mins). The suitability of using herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. Seedlings can be sprayed using 200g/ha Brush Off (Mersulphfuron Methyl) plus 3l/ha Mamba (glyphosphate). Frill the trunk of mature plants, apply a mix of 1250ml Chopper (Imazapyr) & 10l of water at a rate of 6 l/ha. With a cut stump, apply a mix of 1250ml Chopper (Imazapyr) & 10l of water at a rate of 6 l/ha. If the species is known, check the rate on the label. For spot spraying coppice, apply 16l water, 16gms Brush off, 1% Mamba and 0,5% Actipron. Application of herbicides is more successful in conjunction with mechanical means. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily.
Poplar canescens grey poplar CARA 2	Pull out and remove entire root system. Immature and mature plants can be sawed and the stump can be treated with herbicides. The suitability of using herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. For seedlings/immature trees apply a foliar spray of 150ml of Garlon 4/ Viroaxe (Triclopyr Ester) can be mixed with 10l of water and applied at a rate of 2 l per hectare. For stumps that have been cut try 500 ml Chopper (Imazapyr) mixed with 10 l water and applied at a rate of 1.5 l per hectare (Do not apply in riparian zone where water can be contaminated!!!) Large/mature trees that have been cut can be treated with 500 ml Chopper (Imazapyr) mixed with 10 l water and applied at a rate of 1.5l/ha. Cut stumps or frilled trees can be treated with 300ml of Timbrel 3A (Triclophyr Amine salt) mixed in 10 l of water applied at a rate of 1.5 l per hectare. Ecoplugs can be used for trees that are within 10m of a river course. Application of herbicides is more successful in conjunction with mechanical means. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily.

SPECIES & CARA Category	CONTROL METHODS
Arundo donax spanish reed CARA 1	Hand removal, removal of rhizomes is essential to avoid resprouting. **Foliar Spray** can be done using Mamba 10% solution.
Acacia cyclops rooikrans CARA 2	Can be removed by hand. Large/mature trees should be removed by cutting the stem below ground level - follow up in the form of weeding of seedlings when they are 15-40 cm high. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily. Can be used for firewood, charcoal and as a building material.
Acacia longifolia long-leafed wattle CARA 1	Seedlings/saplings can be pulled out by hand if in the seedling stage. With large/mature trees, the stem should be cut cleanly as near to the ground as possible, ensuring buds don't sprout. The suitability of the use of herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. For seedlings, a foliar spray of 60ml of Garlon 4/ Viroaxe (Triclopyr Esterl) can be mixed with 10l of water and applied at a rate of 2l/ha. Cut large/mature trees, the stump can be treated with 60ml of Garlon 4/Viroaxe (Triclopyr Ester) mixed with 10l of water and applied at a rate of 2 l/ha. After cutting the stump or frilling tree, it can also be treated with 300ml of Timbrel 3A (Triclopyr Amine salt) mixed in 10 l water and applied at a rate of 1.5l/ha. Application of herbicides is more successful in conjunction with mechanical means. **Biological control** is available. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily. Can be used for firewood, charcoal and as a building material.

SPECIES & CARA Category	CONTROL METHODS
Acacia saligna port Jackson CARA 2	Can be removed by hand. Large/mature trees should be removed by cutting the stem below ground level; thereafter the stumps should be treated to prevent the formation of shoots and left to dry. Follow up in the form of weeding of seedlings when they are 15-40 cm high is necessary. The suitability of the use of herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. For seedlings a foliar spray of 2-4 l of Mamba (Glyphosate) can be applied as a spot spray (1.5%) at a rate of 2-4 l/ha. A foliar spray of 50ml of Garlon 4/ Viroaxe (Triclopyr Ester) can be mixed with 10l of water and applied at a rate of 1.5 l/ha. Note: Do not use Garlon 4 or Viroaxe if other pioneer grass seedlings are present. A foliar spray of Touchdown (Glyphosate Trimesium) can be applied at a rate of 2-4 l/ha. Immature plants should be treated with a foliar spray of 50ml of Garlon 4/Viroaxe (Triclopyr Ester) mixed with 10l of water and applied at a rate of 3 l/ha. Can be treated with Touchdown (Glyphosate) applied at a rate of 4l/ha. Cut stumps of large/mature trees can be treated with 300ml of Timbrel 3A (Triclophyr Amine salt) mixed in 10 l of water applied at a rate of 1.5 l/ha. A Garlon solution can also be applied to approximately 0.6m length of stump. Application of herbicides is more successful in conjunction with mechanical means. **Biological control** is available, once the fungus has become established in an area; it is preferable not to use any other control measures. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily. Can be used for firewood, charcoal and as a building material.
Acacia mearnsii black wattle CARA 2	Seedlings/saplings can be pulled out by hand. Immature plants can be removed with hand tools. Intermediate sized plants should be cut at ground level, with the root being treated with herbicides. Mature plants can be cut/sawed. Herbicides should be applied to the stump as soon as possible thereafter (within 30 min). The suitability of the use of herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. For seedlings a foliar spray of 150ml Mamba (Glyphosate) per 10l of water can be applied at a rate of 3 l/ha. A foliar spray of 25-75ml of Garlon 4/Viroaxe (Triclopyr Ester) can be mixed with 10l of water and applied at a rate of 0.5-1.5 l/ha. For young trees a foliar spray of 75ml of Garlon 4/Viroaxe (Triclopyr Ester) can be mixed with 10l of water and applied at a rate of 3 l/ha. Cut large/mature trees**,** the stump can be treated with 3 l of Timbrel 3A (Triclophyr Amine salt) mixed in 100 l of water applied at a rate of 1.5 l/ha. Application of herbicides is more successful in conjunction with mechanical means. **Biological control** is available, when cutting down the trees, the stump fungus should be applied to the cut stumps.

SPECIES & CARA Category	CONTROL METHODS
Acacia pycnantha golden wattle CARA 1	Seedlings and immature plants can be removed by hand. The stems of large/mature trees should be cut below ground level; thereafter treated to prevent the formation of shoots and left to dry. Follow up in the form of weeding of seedlings when they are 15-40 cm high. The suitability of the use of herbicide near water should be considered i.e. some herbicides may pollute the downstream environment. For seedlings a foliar spray of 2-4 l of Mamba (Glyphosate) can be applied as a spot spray (1.5%) at a rate of 2-4 l/ha. A foliar spray of 50ml of Garlon 4/ Viroaxe (Triclopyr Ester) can be mixed with 10l of water and applied at a rate of 1.5 l/ha. Note: Do not use Garlon 4 or Viroaxe if other pioneer grass seedlings are present. A foliar spray of Touchdown (Glyphosate Trimesium) can be applied at a rate of 2-4 l/ha. Immature plants should be treated with a foliar spray of 50ml of Garlon 4/Viroaxe (Triclopyr Ester) mixed with 10l of water and applied at a rate of 3 l/ha. Can be treated with Touchdown (Glyphosate) applied at a rate of 4 l per ha. Cut stumps of large/mature trees can be treated with 300ml of Timbrel 3A (Triclophyr Amine salt) mixed in 10 l of water applied at a rate of 1.5 l/ha. A Garlon solution can also be applied to approximately 0.6m length of stump. Application of herbicides is more successful in conjunction with mechanical means. **Disposal:** Cut material can either be stockpiled for removal or used as erosion barriers. Smaller stemmed material can be stacked for burning or chipping. Seed bearing slash that has been chipped must be left to compost (or to allow seeds to germinate) before being used. Stockpiling should be avoided within a flood plain as this could pose a flood risk. It should always be known that stacked material poses a fire hazard and burns easily. Can be used for firewood, charcoal and as a building material.

***Contact PPRU for information, advice and availability of bio-control agents, see contact details below.**

HELPFUL CONTACT NUMBERS

Note: Although these telephone numbers are correct at the time of going to print, they may change from time to time.

Working on Fire

Tel: +27 (0) 21 799 8800

Fax: +27 (0) 21 797 8390

Web Site: www.workingonfire.org

Plant Protection Research Unit (PPRU)

Stellenbosch: Vredenburg Research Centre

Tel: +27 (0) 21 887-4690

Fax: +27 (0) 21 883-3285

Website: http://www.arc.agric.za/

Working for Water

Toll-free number 0800-005-376

Web site: http://www.dwaf.gov.za/wfw/

Department of Agriculture

Durbanville

Tel: +27 (0) 21 976 8136/1759

Fax: +27 (0) 21 976 1889