



Hottentot Fig (*Carpobrotus edulis*) Invasive Species Action Plan

1. Introduction

The risk assessment undertaken as part of the Invasive Species Ireland project prioritised *Carpobrotus edulis* for preparation of an Invasive Species Action Plan. *C. edulis* has negative impacts on native flora and fauna and biodiversity of protected habitats. This species acquired a score of 19 out of a possible 25 from stage 1 of the risk assessment process owing, in part, to its potential impact on protected habitats and species leading to non-compliance with EU legislative obligations under the Habitats Directive.

2. Aim of plan

The aim of this Invasive Species Action Plan is to prevent further spread of *C. edulis* in Ireland and put in place mechanisms to prevent new introductions to the island. This plan sets out actions required for successful implementation and guidance on methods for eradication/control of *C. edulis* populations in Ireland. This can be achieved through the implementation of control options, raising awareness of this species, developing policy and identifying actions needed to deal with further spread.

3. Key priorities

3.1. Prevention of further spread

- Restrict the sale of *C. edulis* and its hybrids through garden centres, supermarkets and other retail outlets.
- Raise public awareness of the economic and environmental impacts *C. edulis* could have in Ireland in combination with education efforts targeted at key stakeholder groups linked to the import and spread of this and other invasive plant species.
- Encourage the removal and proper disposal of domestic plantings and promote the use of native species.
- To inform management by recommending methods to gather accurate baseline distribution of this species. This can be achieved by encouraging recording of the plant by the general public, gardeners, naturalists and agriculturalists.

3.2. Eradication

- Guide the eradication of the plant at its known wild populations.
- Engage with stakeholders to provide advice and help, where appropriate, to eradicate populations in private gardens.

4. Invasion history

This species was initially introduced as an ornamental plant and as a dune stabilisation plant. It can spread by dumping of garden waste, production of seeds and by fragmentation of the plant. Birds are known to facilitate its spread by using plant fragments for nesting material. Rabbits are also known to facilitate the spread of this species.

A native to South Africa, this species has been introduced to many parts of the world. It is a known invasive species in Australia where it fills the same niche and out competes and hybridises with the native *C. rossii*. In Europe, *C. edulis* is known from the Mediterranean region and further north in Germany and Britain.

In 2001, the European Commission approved the LIFE Nature proposal for the *Conservation of areas with threatened flora in the island of Minorca*. In achieving the objectives of this project a large proportion of resources were dedicated to the eradication of *C. edulis* it posed the main threat to the islands endemic and threatened flora. The project focused on mapping the species distribution, experimental eradication plots, elimination of both low density and high density populations and the education and awareness of the general public (European Commission, 2009).

5. Nomenclature

Common name: Hottentot fig

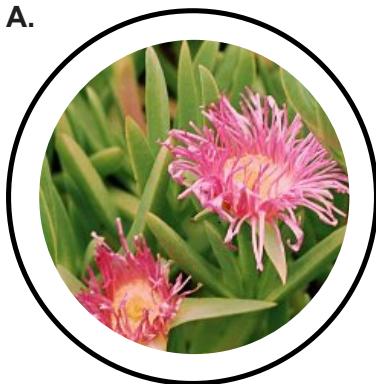
Also known as: Iceplant, Sea fig, Sour fig

Synonyms: *C. acinaciformis*, *C. aequilaterus*, *C. edulis* var. *chrysophthalmus*, *C. edulis* var. *chrysophthalmus*, *Mesembryanthemum edule*

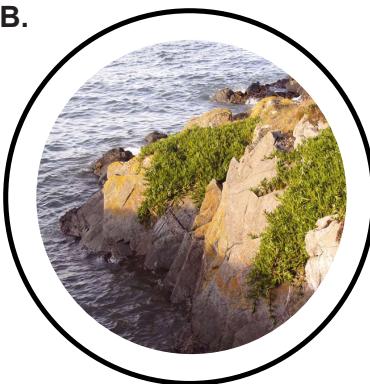
6. Identification features

C. edulis is a robust, flat-growing, trailing perennial herb. It roots at nodes and forms dense mats. The succulent horizontal stems curve upwards at the growing point. The leaves are succulent, crowded along the stem, 60–130 x 10–12mm, sharply 3-angled and triangular in cross-section with tiny serrations along the outermost angle, yellowish to grass green, and reddish when older. Flowers are solitary, 100–150mm in diameter, yellow, fading to pale pink (GISD, 2009). Plants in Ireland are known to have reddish-purple flowers (Habitas, 2009). *C. edulis* has a very dense fibrous root system concentrated in the upper 50cm of the soil, with new roots forming at each node as the plant spreads outward (GISD, 2009).

A.



B.



C.

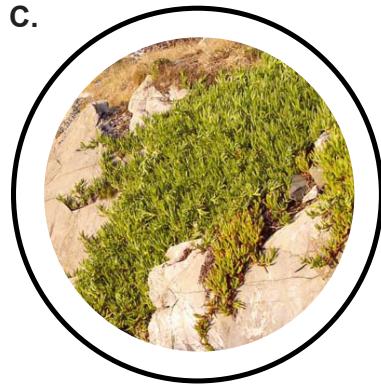


Figure 1: A - Solitary flowers; B and C - Mats of *C. edulis* in Ireland. Photo Credit: A - Paul Hackney, Ulster Museum, B and C - Richard Weyl, Northern Ireland Environment Agency

7. Impacts

C. edulis forms impenetrable mats and competes aggressively with native species, threatening rare and endangered species (DAISIE, 2006). These mats can be up to 20cm wide and over 50cm deep (GISD, 2009). Once it becomes established, it shows a high vegetative reproductive rate, and its growth does not appear to be affected by herbivory or competition (GISD, 2009). It is known to modify soil properties and nutrient dynamics by increasing soil N and organic C and by reducing soil pH (DAISIE, 2006). *C. edulis* can also decrease species diversity by preventing sand movement, which hinders the natural processes of disturbance and change in dune environments (DAISIE, 2006). Hybrids are very vigorous and may lead to intensified invasion (GISD, 2009).

8. Distribution and spread potential

The distribution of *C. edulis* in Ireland is shown in Figure 2. This does not reflect the full distribution of *C. edulis* in Ireland and only accounts for record at a scale of 1km² or greater. *C. edulis* is known from roughly 15 sites spread across the east and south coast of the island of Ireland. These sites have not been reported to the required scale for populating the National Invasive Species Database. There is a need to increase awareness of the level of detail required for records to be included in this dataset to better inform management.

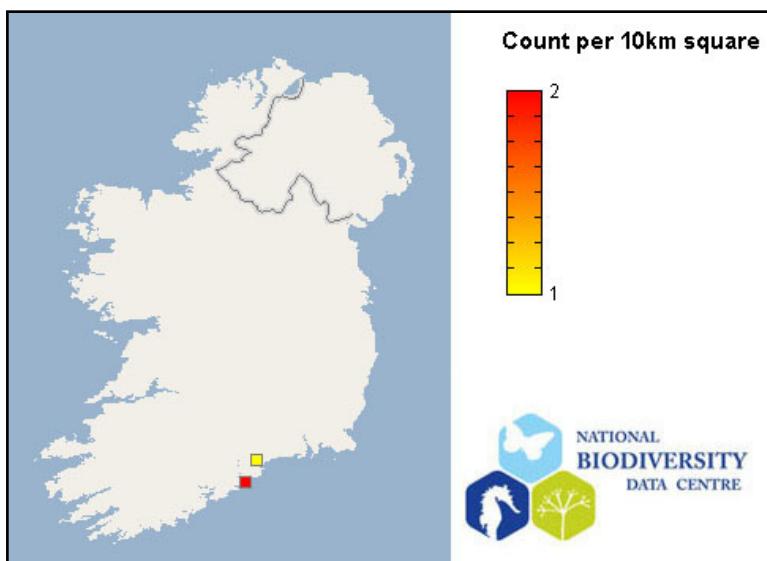


Figure 2: June 2009 known distribution of *C. edulis* in Ireland at scale of 1 km².. For up-to-date maps, please refer to the National Biodiversity Data Centre www.biodiversityireland.ie.

There are no known population from the west and north coasts. The mild climate found on along the east and south coasts of Ireland provides conditions suitable for the spread *C. edulis* and several other invasive members of the plant family Aizoaceae (based on JNCC (2004) predictions for Britain). The range of this species may increase in the future as we see a greater influence of predicted climate change. However, we will continue to see spread along the south and east coast of Ireland and Northern Ireland. Seeds of *C. edulis* can be dispersed over long distances by animals and people (GISD, 2009). Plants can also be spread by birds using fragments as nesting material.

Predictions based on our current knowledge of the habitats most susceptible to invasion and the proximity to current populations will allow us to identify priority areas for control and prevention. If eradication is the ultimate goal all locations must be known. Plants left untreated/removed will facilitate reintroduction. If a site is chosen for *C. edulis* eradication or management other invasive species should be included in the plan, if present.

Action 1. Establish accurate baseline distribution

In order to progress action on the ground, it is essential to have information on its distribution easily available. Recording programmes for invasive species should be encouraged on an annual basis and records should be submitted to the National Invasive Species Database and made readily available through the two biodiversity record centres on the island of Ireland. The biodiversity record centres should be resourced to gather information on invasive species and disseminate this information on request and/or online methods to key stakeholders for example, Local Biodiversity Officers and site managers.

9. Prevention of further spread

Action 2. Enforcement and raise awareness of legislative powers

Legislation is already in place to prevent the release of invasive species in both Northern Ireland and the Republic of Ireland:

Northern Ireland - under Article 15 (2) of The Wildlife (Northern Ireland) Order 1985 (under review) if any person plants or otherwise causes to grow in the wild any plant which is included in Part II of Schedule 9, he shall be guilty of an offence.

Republic of Ireland - under Section 52 (7) of The Wildlife (Amendment) Act 2000 any person who plants or otherwise cause to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora except under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.

Action 3. Amend existing legislation

Legislation should be strengthened to ensure a total ban on import and possession of *C. edulis*. To this end:

- *C. edulis* should be added to Schedule 9 Part II of the Wildlife (Northern Ireland) Order 1985.
- The Minister of the Environment in the Republic of Ireland has power to prohibit the possession or introduction of any species that may be detrimental to native species. *C. edulis* should be brought to the attention of the Minister and the required prohibition enacted.

Action 4. Highlight, support and promote Invasive Species Codes of Practice

A priority action to prevent the spread and release of invasive species is to promote the uptake of the Invasive Species Codes of Practice and support these with literature and information leaflets for both industry and the general public.

Action 5. Public sector bodies adopt Invasive Species Codes of Practice

All public sector organisations should lead by example and adopting Invasive Species Codes of Practice in their relevant work areas. This is a key priority to the success of each of the codes. Government agencies should also incorporate the sentiment of the codes into tenders and procurement procedures and ensure that suppliers are abiding by the codes, where possible.

10. Eradication and management

Action 6. Prioritise sites for eradication across the island of Ireland and initiate programme of measures

C. edulis has a relatively restricted distribution across the island of Ireland (Figure 2). We are still at an early stage of colonisation and action is needed sooner rather than later to prevent widespread economic impacts, loss of biodiversity and a need for large scale and expensive programmes in the future. State agencies and local authorities should prioritise sites for eradication based on a transparent framework to guide a co-ordinated eradication programme. It would be cost effective to undertake this for all the high risk invasive plant species identified in the Invasive Species Ireland risk assessment.

10.1 Data gathering

To support any control or eradication programme it is essential that on site baseline data is collected and collated allowing managers to gauge success or failure of any action taken. For *C. edulis*, it is recommended that data such as coverage, density, slope, substrate, orientation, age of plant/patch, location including a six figure grid reference and any other relevant data such as land owner and previous management of the site.

10.2 Physical removal

One of the most effective ways of dealing with this species is remove by hand. This was employed during the EU Life project *Conservation of areas with threatened flora in the island of Minorca*. Dedicated staff or volunteers are required and issues such as right of access, insurance and training for all personnel will need to be considered by the project manager and/or funders. Technical specialist should be on hand to answer questions, advise and help during the removal.

Often large mats can be simply rolled up but it is important that checks are made to ensure no fragments remain. It is important that all plant material is collected up and not allowed to remain on site or get moved to another site. In theory, this may sound like a simple task but in practice this may end up being quite complicated and possibly expensive. This stage of the Minorca *C. edulis* eradication programme added an unexpected cost. Managers need to ensure compliance with relevant waste legislation. At sites with relatively easy access removal can be done by hand. At more difficult sites where vehicle access is not possible, a more thought out strategy to deal with the removal of material is required. Stakeholder engagement is essential at this point to negotiate access rights for off road vehicles and trailers.

No mechanical control options (i.e. use of machinery) are recommended at this time. This reflects the sensitive nature of the environment in which this species is known to impact on.

10.3 Dealing with waste

In light of this species high capacity to regenerate and the long term viability of seeds, composting of materials should be done carefully with composted material then only utilised in areas not vulnerable to invasion by this species. If possible, removed plants should be mulched off site.

10.4 Chemical control

A broad spectrum herbicide such as glyphosate or 2,4-D plus 2,4-DP products (2,4-dichlorophenoxyacetic acid plus 2-(2,4-dichlorophenoxy) propionic acid) is recommended to control this species. The use of this chemical is complicated by the environment and the protected habitats in which this species colonises. Careful consideration and techniques to minimise the amount of chemical utilised is required. It may be more appropriate to employ this chemical control after manual removal of the plant.

Note: Prior to undertaking any spraying operation in or near water in Northern Ireland the NIEA Water Management Unit must be contacted. It is essential that the user is fully trained to the required pesticide spraying level (e.g. PA1, PA6 aw). The user must fully comply with the Pesticide Product Label. In the UK the use of Pesticides is regulated by the Pesticide Safety Directorate (PSD). The Pesticide Control Service (PCS) of the Department of Agriculture and Food is responsible in Ireland. Historically, several pesticides have been available for use in or near waterbodies in the UK and Ireland. It is expected that certain chemicals will be subject to restrictions in the near future. Please refer to PSD website (<https://secure.pesticides.gov.uk/pestreg/ProdSearch.asp>), the PCS website (<http://www.pcs.agriculture.gov.ie/pest.asp?searchType=functCrop>) or contact the relevant organisation directly for the most up-to-date list of herbicides approved for aquatic use.

10.4.1 Additional considerations on the use of chemical control in terrestrial ecosystems

The Invasive Species Ireland Steering Group has developed policy in relation to the application of herbicides in aquatic environments. This policy does not extend to terrestrial ecosystems but managers are directed to it for reference and information on considerations required especially if embarking on a programme of works on or near an aquatic system. This document is available to download from the Invasive Species Ireland website www.invasivespeciesireland.com.

For terrestrial systems, managers and practitioners should be aware of potential impacts the use of herbicides can have on the environment and on human health and safety. All users and programme managers are required to follow the label of the chosen herbicide. The following are some generic guidelines to be aware of and are not intended to replace manufacturers guidelines:

- Wear appropriate protective clothing as required by manufactures guidelines and health and safety considerations.
- Where there is potential for public access to the site measures to inform the public are required. Signage should be erected to deter access.
- Mists from herbicide sprays on hot days can drift in high winds and may impact on non-target plants and animals.
- Runoff from treated areas may kill non target plants and animals in both the terrestrial and aquatic environments.
- Careless washing of equipment can contaminate soil, drinking water, surface water and ground water.
- Boundaries should be clearly defined to prevent spraying outside the intended area. Clearly defining boundaries will also assist the applicator orientate themselves and ensure even application.
- Managers should always consider techniques to minimise the volume of herbicides allowed to enter into the environment.
- Ensure proper and safe storage of herbicides.
- Ensure proper and safe disposal of herbicides.

If you are unable to comply with the requirements set out here or on the manufactures guidelines, the use of herbicides is inappropriate and should not be considered until compliance can be achieved.

10.5 Post removal considerations

After removal of *C. edulis* it is important to monitor for recovery of the ecosystem and to ensure that the target species or other invasive species do not colonise the cleared site. *C. edulis* leaves behind a layer of debris of dead and decaying organic matter that accumulates under the plant. This tends to be left behind after *C. edulis* is removed. Within the debris are often the dormant seeds of invasive grasses, and these sprout after *C. edulis* removed, benefiting from the accumulation of nutrients in the area that *C. edulis* has facilitated. To avoid this it may be best to selectively remove *C. edulis* to ensure that some is left behind to

stabilise the soil and minimise sand movement into the area. Once the area has been restored to a more natural community, the remaining *C. edulis* can be removed and that area restored in turn (GISD, 2009). This phased approach will ensure the long term sustainability of the site.

11. Resourcing the plans

Action 7. Ensure adequate resources are in place to facilitate implementation of this plan

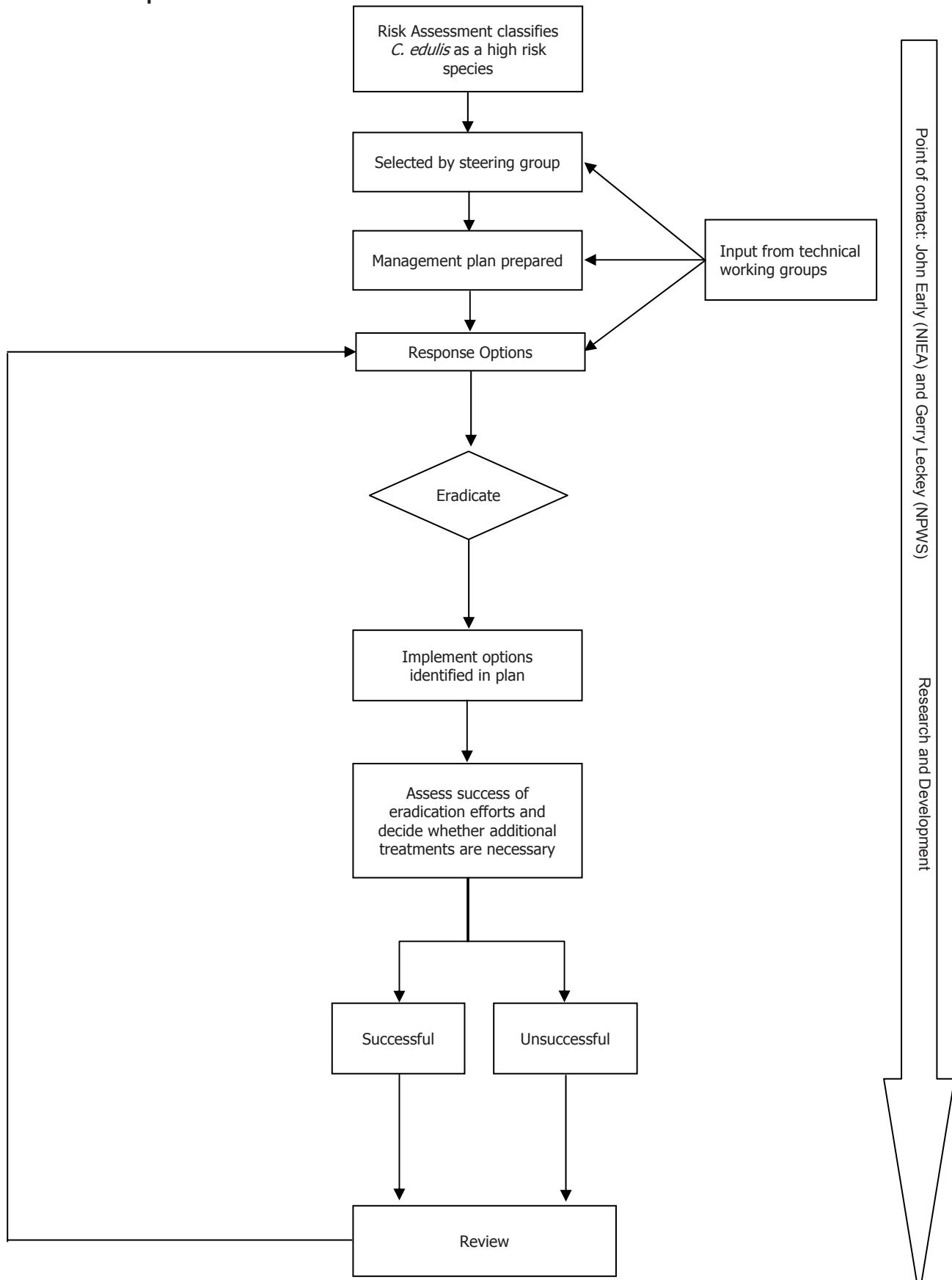
A key lesson from the EU funded Life project highlighted how early action in controlling this species minimises long term impact and costs. In Minorca, implementation of the eradication measures 20 years previous to the actual start-up date would have prevented the current situation and minimised costs greatly. Unlike many other invasive species, money does not need to be the limiting factor in removal of *C. edulis* in Ireland. The limiting factors are largely time and manpower. Physical removal must be undertaken with care since stems can be removed by nesting seabirds such as shags and cormorants and incorporated into nests, exacerbating the problem (National Botanic Gardens, 2009).

At present, it is understood that we are at an early stage of invasion in Ireland. However, in order to give accurate estimates of cost for eradication efforts, a full survey of sites known to have *C. edulis* present should be undertaken. Costs associated with small patches on easily accessible sites will be relatively cheap providing excellent value for money in terms of preventing impacts. The costs associated with cliff sites and other difficult to access areas will be much greater due to the access needs; specialist equipment, training and insurance requirements; and difficulty in disposing waste material off sites.

12. Recommended actions and timetables

No.	Action	Responsibility	Timescale
1	Establish accurate baseline distribution	Government Agencies in partnership with the National Biodiversity Data Centre, Cedar and other stakeholders engaged in the collection of biodiversity data	Annual programme required. Programmes should aim to build on that of the 2009 Invasive Species Survey co-ordinated by the National Biodiversity Data Centre
2	Enforcement and raise awareness of legislative powers	State agencies in partnership with relevant stakeholders	Initiate in 2009
3	Amend existing legislation	State agencies	2009 - 2010
4	Highlight, support and promote the Invasive Species Codes of Practice	State agencies, Invasive Species Ireland, relevant stakeholders	Initiate in 2009
5	Public sector bodies adopt the Invasive Species Codes of Practice	All public bodies	2009
6	Prioritise sites for eradication across the island of Ireland and initiate programme of measures	NPWS, NIEA, local authorities and relevant stakeholders	2009/2010
7	Ensure adequate resources are in place to facilitate implementation of this plan	NPWS, NIEA, local authorities and relevant stakeholders	Immediately after successful completion of Action 6

13. Decision process



14. Template management plan

Use this template to help formulate a management plan outlining how you are going to proceed and what you will need.

Site Manager(s)/Owner(s): _____

Site Name(s): _____

Central grid reference: _____

License to proceed with plan acquired? Yes No

Site details

Address:	
Telephone:	
Email:	
Agencies/persons involved:	
Date:	
Species of concern:	

Invasion history

Date of introduction:	
Original location of introduction:	
Date of first report to competent authority:	
Method of introduction:	
Additional information on introduction event:	

Site information

Total site area:	
Total area colonised:	
Total area of relevant habitats:	

Designation	On site	Near site	None present
Details: Establish if there is a requirement to apply for a license/notify before proceeding with plan.			

Rare and threatened species	On site	Near site	None present
Red Data Book or BAP species:			
Other rare or threatened species:			

Current identified impacts

Impacts	Minimal	Moderate	Severe

Human sensitivities/ vested interests at site

Issue	Human receptor

Identify requirements and best practice for collaboration with stakeholders

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Actions and resources

Management options	Responsibility	Date to undertake

Resources needed	Responsibility	Date to undertake

Monitoring and evaluation

Name of person/s	Date to undertake	Report to	Additional treatments date (if required)

15. Summary of actions needed for effective management

1. Confirm identification of species. Refer to recognised experts to confirm identification, if required.
2. Develop and produce a site specific management plan. Use the template provided in this document to guide you. A key part of this will involve surveying and producing a distribution map indicating the species distribution on the site.
3. Consider all designated sites on or nearby the management area. You may need to apply for a license under nature conservation legislation to proceed and/or undertake an Appropriate Assessment under the terms of Article 6 of the Habitats Directive. Remember that actions taken outside a designated site may have an impact on a nearby designated site and are thus subject to the same considerations.
4. Consider surrounding properties and households. Talk to adjacent land owners and make them aware of the issues and what you plan to do. It may not be possible but always attempt to get their support. Control programmes will have a higher chance of success with support from the local community. Raise awareness of the issues and ensure alerts are placed in appropriate media e.g. the Invasive Species Ireland website.
5. Consider if you can successfully and safely carry out the work or if professional practitioners, with relevant training and certificates should undertake the work. Also consider if the programme can be co-ordinated with voluntary clubs and local societies and ensure their support and understanding of the issues.
6. Ensure safe disposal of plant material, including the cleaning of any machinery or equipment that may be contaminated.
7. Remember relevant health and safety legislation and procedures.
8. Identify if sufficient resources are/will be available to complete the work within the planned timescale. If work will take more than 1 year to complete, ensure you have sufficient funds to complete the work.
9. Monitor for missed plants/reintroduction during site visits. If applicable, ensure new members of staff are aware of the action plan and report sightings.

16. References

DAISIE, 2006. *Carpobrotus edulis*. Available from: [http://www.europe-aliens.org/speciesFactsheet.
do?speciesId=7190](http://www.europe-aliens.org/speciesFactsheet.do?speciesId=7190) [Accessed 11th June 2009].

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gspc/targets/news/carpobrotus.htm](http://www.botanicgardens.ie/gspc/targets/news/carpobrotus.htm) [Accessed 11th June 2009].

The Invasive Species Ireland Project is undertaken, in partnership, by EnviroCentre and Quercus.



www.envirocentre.co.uk



www.quercus.ac.uk

and is funded by the National Parks and Wildlife Service and the Northern Ireland Environment Agency.



www.ni-environment.gov.uk



www.npws.ie

For more information on the Invasive Species Ireland Project please see the website at www.invasivespeciesireland.com