08 AWARD Tech Report Series

A Tool for Drafting Invasive Species Monitoring, Control & Eradication Plans

Enhancing the identification & control of alien & invasive species

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USAID: RESILIENCE IN THE LIMPOPO BASIN PROGRAM (RESILIM) - OLIFANTS

Acknowledgements

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Contents

1 Overview

The RESILIM-O Blyde Restoration Project has highlighted the need to address the negative impact of forestry operations in the catchment on biodiversity and water resources in the Blyde and Klaserie sub-catchments. Various challenges in terms of complying with the requirements of relevant forestry and environmental legislation in terms of sustainable forestry management [SFM] have been identified by restoration and forestry practitioners working in the above sub-catchments.

Direct and indirect impacts from plantation forestry operations in the Blyde and Klaserie sub-catchments of the Olifants Basin are recognised to have significant negative impacts on biodiversity and water resources in these catchments, which undermine resilience. This component of the Resilim O project therefore aims to develop the capacity of target stakeholders to enhance SFM. Developing capacity to improve forestry management to reduce and mitigate the negative impacts of forestry operations on biodiversity and water resource in the Blyde and Klaserie sub-catchments (high biodiversity areas and strategic water resource areas in the Olifants catchment) will contribute to resilience building. Engagement of key stakeholders in the forestry sector in the Blyde and Klaserie sub-catchments highlighted a number of challenges to SFM. Through a social learning process, these challenges were explored with stakeholders to identify capacity constraints underlining these challenges. A capacity development strategy was then developed to address the core capacity constraints.

8 COMPONENTS OF THE CAPACITY DEVELOPMENT STRATEGY

This document addresses component 2 of this capacity development strategy, namely:
Enhancing the Identification and Control of Alien and Invasive Species - Support Tools for Drafting Invasive Species Monitoring, Control and Eradication Plans.

2 Introduction

The National Environmental Management: Biodiversity Act (NEM:BA) (Act No. 10 of 2004) and its accompanying Alien and Invasive Species Regulations (2014, AIS Regs) can be difficult to interpret, which can be a challenge for implementation. The Act and its Regulations stipulate the need and requirements for for drafting Invasive Species Monitoring, Control and Eradication Plans (referred to as "Control Plans"), which can be difficult to understand. In response, this document provides an overview of the legal context and requirements, and a support tool for drafting Plans.

The development of the Control Plans are informed by the requirements specified in the NEM:BA – AIS Regs, 2014. The current Regulations were published in the Government Gazette on 1 August 2014 and came into effect on 1 October 2014. There have since been amendments to the Regulations, with the latest draft amendments out for comment (due mid-2018). The Department of Environment, Forestry & Fisheries [DEFF] is the administering authority for the Act.

NATIONAL ENVIRONMENTAL MANAGEMENT:
BIODIVERSITY ACT 2004 (NO. 10 OF 2004, NEM:BA)

The purpose of the Act is *"To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith."*

Links to the Act, its Regulations and the most recent AIS Lists are provided below:

- NEM:BA (Act No. 10 of 2004): https://www.environment.gov.za/sites/default/files/legislations/nema_amendment_act10.pdf
- NEM:BA - AIS Regulations, 2014: https://www.environment.gov.za/sites/default/files/legislations/nemba10of2004_alienandinvasive_speciesregulations.pdf
- Alien and Invasive Species Lists, 2016: https://www.environment.gov.za/sites/default/files/gazetted_notices/nemba10of2004_alienandinvasive_specieslists2016.pdf

3 Invasive species monitoring, control & eradication plans

3.1 Legislative context

NEM:BA - Section 75 and 76

"75: Control and eradication of listed invasive species

1. Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
2. Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
3. The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.
4. The Minister must ensure the coordination and implementation of programmes for the prevention, control or eradication of invasive species.
5. The Minister may establish an entity consisting of public servants to coordinate and implement programmes for the prevention, control or eradication of invasive species.

76: Invasive species control plans of organs of state

1. The management authority of a protected area preparing a management plan for the area in terms of the Protected Areas Act must incorporate into the management plan an invasive species control and eradication strategy.
2. a] All organs of state in all spheres of government must prepare an invasive species monitoring, control and eradication plan for land under their control, as part of their environmental plans in accordance with section 11 of the National Environmental Management Act.
   b] The invasive species monitoring, control and eradication plans of municipalities must be part of their integrated development plans.
3. The Minister may request the institute[1] to assist municipalities in performing their duties in terms of subsection (2).
4. **An invasive species monitoring, control and eradication plan must include -**
   a] A detailed list and description of any listed invasive species occurring on the relevant land;
   b] A description of the parts of that land that are infested with such listed invasive species;
   c] An assessment of the extent of such infestation;
   d] Aa status report on the efficacy of previous control and eradication measures
   e] The current measures to monitor, control and eradicate such invasive species; and
   f] Measurable indicators of progress and success, and indications of when the Control Plan is to be completed."

Section 75 and 76 of NEM:BA stipulate the requirement to control and eradicate listed invasive species, with Section 76 (4) stipulating the need for and detail of the Invasive Species Monitoring, Control and Eradication Plans (hereafter refer to as "Control Plan") – as indicated in the text box that follows.

The stipulation in the Act is complemented by Chapter 4 (National Framework Document) of the NEM:BA - AIS Regulations (2014), Section 8, which also the requirement to compile Control Plans – as detailed in the text box to follow.

NEM:BA - AIS Regulations (2014): CHAPTER 4 - NATIONAL FRAMEWORK DOCUMENTS

8. Invasive Species Monitoring, Control and Eradication Plans

1. The Minister must-
   a] Within one year of the date on which these regulations come into effect, develop guidelines for the development of Invasive Species Monitoring, Control and Eradication Plans for listed invasive species as contemplated in section 76 of the Act;
   b] Publish the guidelines contemplated in paragraph (a) on the Department's website;
   c] Revies, at least every five years, the guidelines contemplated in paragraph [a].

2. Management authorities of protected areas and organs of state in all spheres of government must:
   a] Prepare their Invasive Species Monitoring, Control and Eradication Plans contemplated in section 76 of the Act based on priorities identified through the guidelines referred to in subregulation (1); and
   b] Submit those plans to the Minister and to the Institute within one year of the publication of the guidelines contemplated in sub-regulation (1).
   c] The Invasive Species Monitoring, Control and Eradication Plans referred to in sub-regulation (2) must be reviewed every 5 years by those organs of state and management authorities responsible for such plans.

There are currently proposed amendments to the AIS Regulations in draft. The draft amendments vary from the existing Regulations, as follows:

- Section 8 (2) (b) proposed draft indicates that the submission of plans needs to be done "*within 5 years of the publication of the guidelines*", as opposed to the one year time frame as stipulated in the 2014 Regulations.
- Section 8 (3) proposed draft indicates that the Plans "must be reviewed where necessary", as opposed to the five year review period stipulated in the 2014 Regulations.

These amendments have not yet been finalised, however it is important to be aware of these potential changes, and to check for updates to the Regulations.

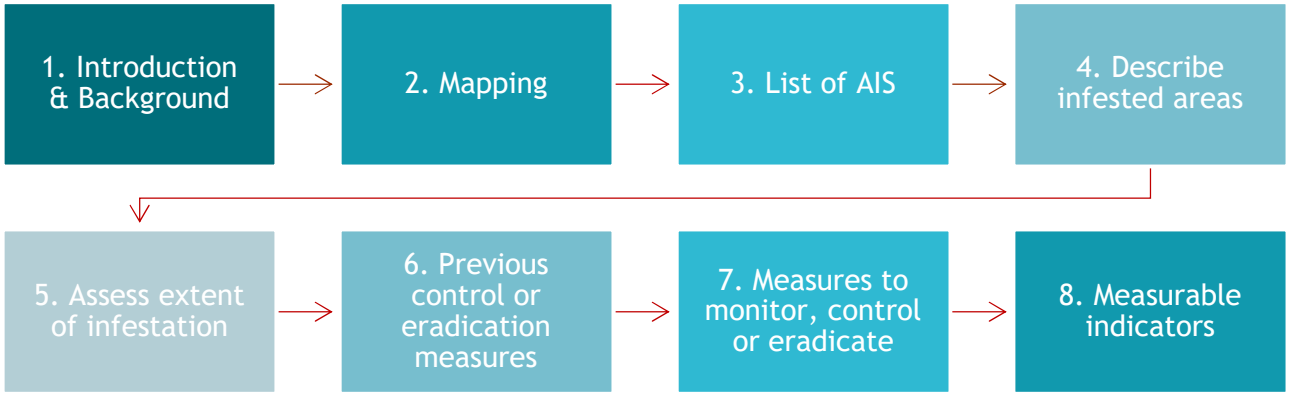
3.2 Support tool for drafting control plans

The Department of Environment, Forestry & Fisheries [DEFF] Environmental Programme Biosecurity Unit (National) developed some guidelines[1] to assist custodians and managers of land in compiling Control Plans. The DEA guideline have been used as the basis for this Support Tool provided, complemented by other resources and existing Control Plans.

Section 76 (4)(a) to (f) of NEM:BA (2004) specifies that the Control Plans must include certain components (refer to the textbox above in sub-section 3: Invasive species monitoring, control and eradication plans legislative context).

The diagram below demonstrates the components that need to be included (as per the Act), with additional suggested components that have been drawn from other guidelines and existing Control Plans. The diagram is followed by a description of each component, providing detail of each, references to information and data sources, as well as recommendations that provide optional additions, examples and approaches used in drafted Control Plans. This Support Tool has been customised to suit the context of the sub-grant project and its stakeholders.

COMPONENTS OF A CONTROL PLAN



3.2.1 Introduction & background

To provide the context for the area (management unit), the following detail should be provided as the foundation of the Control Plan:

- Property description and details (address, name, GPS co-ordinates, size in hectares)
- Map showing property location (with contextual details such as roads, landmarks, administrative boundaries (municipal), place names, province, etc.)
- Landuse (residential, agricultural, urban, reserve, etc.)
- Name and contact details of the landowner(s)
- Control Plan purpose

[1] *https://www.environment.gov.za/sites/default/files/legislations/nemba_invasivespecies_controlguideline.pdf*

- Time frame (realistic implementation considering the size of the management unit, infestation levels, species present, budget, etc.) suggested to range between three and ten years
- Site specific desired results (e.g. remove IAPs plants, restore grasslands, establish indigenous species, etc.)

This could be the first step in drafting the Control Plan as it provides context and vision (desires). The Times frames and desired results are likely to be revised as the other components of the Plan are conducted and populated.

Recommendations

- Existing documents (plans, reports, databases, etc.) that contain the information required should be used as a foundation for populating this section (i.e. Micro-Forests Plans)
- In the forestry sector, it is advised that a Control Plan is compiled at the estate level and championed by the plantation manager, with contribution and guidance from the environmental manager and the silvicultural manager

3.2.2 Mapping

The land area (management unit) should be mapped and divided into logical compartments that are size and structure appropriate to allow for coherent management interventions. Existing area 'compartments' can be used, such as quinary catchment areas, or new compartments can be determined based on zones/area types (e.g. riparian areas, plantations, land-use, etc.). Once defined, the compartments should be given a name or number so that it can be easily referred to. The invasive species in each compartment can then be mapped when the survey is undertaken. This mapping exercise is not a legal requirement but does assist in creating logical management intervention units.

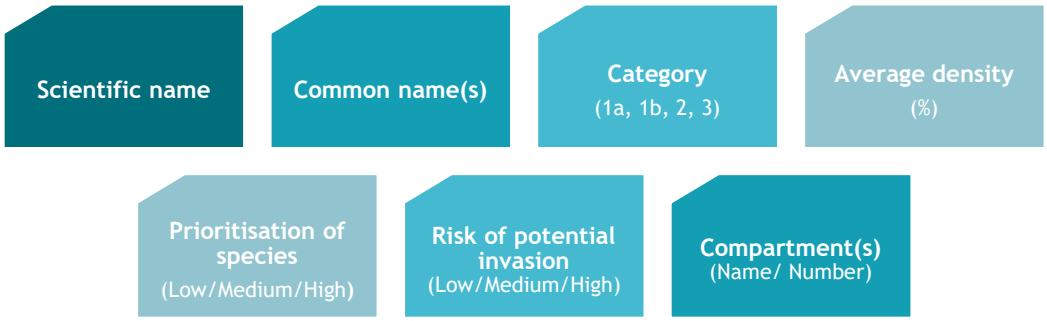
Recommendations

- In the absence of mapping software (e.g. ArcGIS), Google Earth software is a good alternative as it provides regularly updated aerial images and the option to create polygons (to define the management units and its compartments).
  - Alternatively, mapping can be done on hard copy maps or aerial images; or even hand drawn.
- The regional Department of Environment, Forestry & Fisheries – Natural Resource Management Programme [DEFF-NRMP] is mandated to assist with mapping of invasive species when Control Plans are being drafted, through their GIS Unit.
- When digital maps are being used, it is recommended that ground truthing is done to heighten the accuracy of maps, and incorporate updates where necessary
  - Where possible, all those involved in drafting the Control Plan should be involved in this ground truthing process. Alternatively, if resources are limited, they could be involved in ground truthing priority management units
- Where compartments already exist (i.e. forestry compartments), these should be aggregated as far as possible into logical management units.
  - For example, compartments along a riverine or wetland system could be aggregated into a single management unit as these are compartments will be similar in nature, and therefore require similar control measures.
  - Other logical management units could be grassland areas, natural corridors, settlements, plantations, etc.
  - By creating management units in this manner it also enables easier co-ordination with other bodies, such as DEFF-NRMP who focus on clearing or assisting in specific areas (i.e. water priority areas)
- When defining management units, their area should be as large as logically possible as a description of each is required (detailed in sub-sections to follow), which can be a timely exercise if there are too many management units

3.2.3 Compile list of invasive species for the area

As per the Listed Invasive Species under Section 70(1) of NEM:BA, a comprehensive list of invasive species that occur in the area (management unit compartment) must be compiled. Refer to the most recent NEM:BA AIS Regulations AIS Species List[2] for the full list and details. A survey (supplemented by existing information and data) of invasive plants and animals will need to be done in order to compile a list for the management unit compartment.

DETAILS REQUIRED FOR EACH SPECIES



The **average density** (extent of cover) of each listed species can be represented as a percentage of the land that is invaded by the species, as follows:

- Larger tree species – percentage of the tree canopy covered by each species
- Herbaceous species - percentage of land invaded by each species
- Invasive animal and microbial species - presence or absence of a species should be indicated, and if possible, estimated numbers

For the **risk of potential invasion**, species that do not yet occur in the area but which have the potential invade the area (i.e. those on neighbouring areas) should be listed and details. This is an important means of aiding early detection and rapid response.

INFORMATION AND DATA SOURCES

- **NEM:BA AIS Regulations - Alien and Invasive Species Lists, 2016**
  https://www.environment.gov.za/sites/default/files/gazetted_notices/nemba10of2004_alienandinvasive_specieslists2016.pdf
- **Southern African Plant Invaders Atlas:** readily available spatial distribution data
  http://www.arc.agric.za/arc-ppri/weeds/Pages/Geographical-Distribution-of-IAPs-in-Southern-Africa-(SAPIA).asp

2 NEM:BA AIS Regulations - Alien And Invasive Species Lists, 2016: https://www.environment.gov.za/sites/default/files/gazetted_notices/nemba10of2004_alienandinvasive_specieslists2016.pdf

- **National Invasive Alien Plant Survey:** detail on some of the more important woody plant invaders, Kotzé, J.D.F., et al. (2010). Report Number: GW/A/2010/21. Agricultural Research Council: Institute for Soil, Climate and Water, Pretoria. http://wis.orasecom.org/content/study/Data%20still%20to%20be%20sorted/InvasiveAlienVegetation_refs/Kotzeetal.,2010.pd
- **South African National Biodiversity Institute – Regional Mpumalanga Office:** capacity to assist in the identification of invasive species and detail thereof. https://www.sanbi.org/

Recommendations

- Compile the list in a table format.
- Include photographs and/or diagrams of the listed species. Ideally, photographs should be taken in-field, and not extracted off existing databases or the internet. It is important the photographs are clear and close-up (i.e. so that the plant's flowers, seeds, leaves, etc. can be clearly seen).
- Regularly update the list (table) as new information and detail is found.
- Include potential invasions (i.e. species that are not found in a specific compartment, but have the potential to invade) so that they are 'flagged' for future inspections and assessments.
- Make use of communication platforms (Community of Practice (CoP), discussion forums, etc.) to assist in the identification of species.

3.2.4 Describe infested areas

Where management unit compartments are infested, they should be described, detailing aspects such as, but not limited to, the following:

- Biodiversity importance
- Water security
- Fire risk
- Erosion and siltation
- Flooding

Providing this detail assists in prioritising species for monitoring and control. This prioritising assists in planning where resources (budget, herbicides, human capacity, etc.) will be spent to ensure they are used effectively.

INFORMATION AND DATA SOURCES

- Indications of biodiversity and environmental assets available on the SANBI website https://www.sanbi.org/

3.2.5 Assess the extent of infestations

The estimated extent of infestation of each AIS should be quantitatively expressed (approximate square kilometres (km^2), hectares (ha), number of individuals, or squared meters (m^2)). The method of quantifying approximate infestation should be documented and replicable so that future measurements can adopt the same method to allow for easy comparison.

This assessment is important for determining the:

- expansion or contraction of infestation per species;
- severity of the impacts that species have on an invaded area; and
- requirements for controlling the infestation

INFORMATION AND DATA SOURCES

- Indications of biodiversity and environmental assets available on the SANBI website https://www.sanbi.org/

Recommendations

- In the absence of digital mapping facilities and databases, estimates can be determined using Google Earth or on hard copies maps.
- The regional Department of Environment, Forestry & Fisheries– Natural Resource Management Programme (DEFF-NRMP) is mandated to assist with mapping of invasive species when Control Plans are being drafted, through their GIS Unit. This mapping can be used to assess the extent of infestations.
- There are no specifications on how (methods and categorisation) infestations should be assessed – and therefore these may differ in each case. The methods and categorisation used should be clearly documented so that they can be replicated in future assessments.
- Methods for conducting visual assessments of vegetation density are available online
  - For example – Guidelines for Monitoring Weed Control and Recovery of Native Vegetation (Auld, 2009) – see Page 11 – What to Measure?

3.2.6 Efficacy of previous control or eradication measures

A brief history of previous, completed eradication and control measures in each management unit compartment, per species, should be documented. Importantly, the successes and limitations of past measures should be documented so that future measures can build on those experiences.

Recommendations

- Compiled in a table format, indicating the species type, scientific and common name, past measures, current state, successes and/or limitations, and nature of records (where information was sourced from).
- Upon review of the Plan, this section should be updated with the most recent methods and experiences.
- Existing databases or documents containing this information should be used (i.e. Micro-Forest Plans).

3.2.7 Measures to monitor, control or eradicate listed invasive species

This is the most important section of a Control Plan as it details the current and planned measures to eradicate, control and monitor AIS infestation. Measures should be defined for prevention, early detection and rapid response, and containment and control. This detail should be provided as an annual plan of operation and for a minimum of five year period.

The current and planned measures should be determined based on the specific context, taking into consideration the:

- Size of the management area;
- Number of invasive species present;
- Characteristics of the species (severity of impact, control measures); and
- Extent of species infestation.

To detail the plan for current and planned control measures, the following should be determined:

- Prioritisation of invasive species for management;
- Management objective per species;
- Quantifiable target for control actions (i.e. not all species can be completely eradicated due to re-infestation from neighbouring areas, extent of the infestation, etc.);
- Time frame to reach target.

It is important that a monitoring programme be put in place from the onset to document the:

- Change of infestation of targeted species over time;
- Success/downfall of the control measures being adopted;
- Benefits of control measures (i.e. impact on ecosystem services (e.g. streamflow), biodiversity assets),

INFORMATION AND DATA SOURCES

There are a range of resources online that provide guidance on control measures, including those that can be found on the DEFF website.

- Also see Wittenberg, R., and Cock, M. J. W. (2001). Invasive Alien Species: A Toolkit of Best Prevention and Management Practices. CAB International, Wallingford, UK. https://www.cbd.int/doc/pa/tools/Invasive%20Alien%20Species%20Toolkit.pdf

Recommendations

- In detailing the control measures, a range of practices should be strategically combined to achieve the defined goals. "Control methods could include biological control, fire, suppression by indigenous or other vegetation, predation, chemical control, mechanical control, labour-intensive clearing, and the use of heavy machinery" (DEA, 2015).
- Make use of a data storage system to safely store and allow access to generated data (control measures, state of infestations, etc.).
- Develop a logical and replicable evaluation system/method for monitoring change.
- Adapt/change control measures and monitoring techniques as insights are gained.

TABLE 2: EXAMPLE OF DETAILED CONTROL METHODS PER SPECIES PER MANAGEMENT UNIT COMPARTMENT (DEA,2015)

GROUP	SPECIES NAME	COMMON NAME	CONTROL METHODS	SOURCE FOR CONTROL METHODOLOGY
Plants	*Acacia mearnsii*	Black wattle	Chainsaw removal of large trees with immediate arboricide treatment of cut stumps. Knapsack spraying of coppice and seedling regeneration.	Working for Water Programme's approved methods for the control of *Acacia mearnsii*.
	Chromolaena odorata	Triffid weed	Manual removal of all young plants found, ensuring all roots are removed.	Working for Water Programme's approved methods for the control of *Chromolaena odorata*.
Birds	*Anas platyrhynchos*	Mallard Duck	Walk-in/Swim-in duck traps followed by euthanasia of all captured birds.	Provincial Conservation Agency to provide traps and expertise. Removal to be in accordance with humane standards.

- Based on the extent and type of infestations, as well as the characteristics (water, biodiversity, etc.) of each management unit, the units can be prioritised for AIS management. This prioritisation (and categorisation through defining the characteristics) of assists not only with internal planning and action, but provides an avenue for external resource input and assistance.
  - For example, assistance and resource inputs from DEFF-NRMP could be allocated to management units that have been prioritised because of their water supply and security importance (thus aligning with DEFF-NRMPs focus).
  - In this manner, the Control Plan acts as the vehicle for directing input and resources in priority areas so that the gains of investments are secured

3.2.8 Measurable indicators of progress and success

Measurable indicators, with practical time frames, should be determined from the onset so that the progress of the Control Plan can be accurately assessed. A logical means of doing so is to set annual targets per indicator and compartment – for example, the canopy cover of a tree species in a specific compartment should be reduced by 25% in Year 1, 50% in Year 2, 70% in Year 3, 90% in Year 4 and 95% in Year 5 (final target). It is also important to indicate budget allocations.

Indicators should be updated regularly to account for actual measures undertaken, change in the state and nature of infestations, new invasions, climatic changes and events, budget and resource changes, etc.

An indication of when the Control Plan is to be completed should be determined from the onset. The review time frame of Control Plans is currently regulated to be done every five years, however this Regulation is under proposed amendment. It is recommended that in drafting a Control Plan, a regular review period is specified from the onset.

Recommendations

- *It is recommended that 'SMART' goals be determined to guide management.*

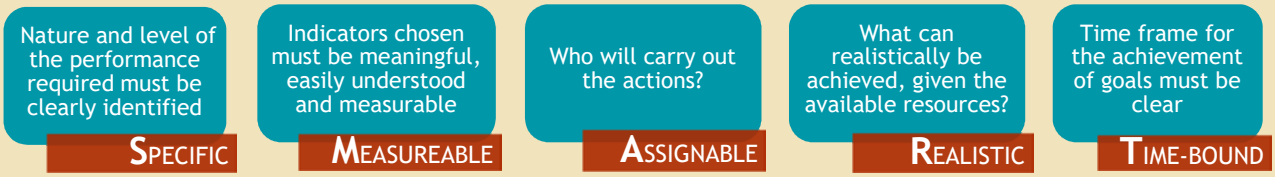


TABLE 2: AN EXAMPLE OF SMART GOALS FOR THE CONTROL OF LISTED INVASIVE SPECIES IN THE MANAGEMENT UNIT COMPARTMENT (DEA, 2015)

GROUP	SPECIES NAME	COMMON NAME	SPECIFIC GOAL	MEASURABLE GOAL	ASSIGNABLE GOAL	REALISTIC GOAL	TIME-BOUND GOAL
Plants	*Acacia mearnsii*	Black wattle	Reduce total area infested to less than 100 ha,	Area systematically cleared to less than 100 ha.	Work to be done through EPWP Wage Incentive, managed by the Parks & Gardens Branch.	Budget secured to ensure that approximately 100 ha of invading black wattles can be cleared per year by the EPWP team.	Infestation down to 400 ha by end of Year 1; 300ha by end of Year 2; 200 ha by end of Year 3; to less than 100 ha by end of Year 4.
Plants	*Chromolaena odorata*	Triffid Weed	Local extirpation within first season of its arrival	Early detection surveys of the entire land parcel at least once a year and the immediate removal of all establishing plants before the species can flower	Managed by Early Detection capacity through EPWP.	Major communication drive to ensure land-owners help with the early detection of the species in the area.	Annual assessments and reports on findings. Immediate treatment of any incursions of triffid weed,
Birds	*Anas platyrhyn-chos*	Mallard Duck	Local extirpation of existing population	Entire population to be captured within first six months of the programme and removed. Annual surveillance and immediate removal of any new arrivals thereafter.	Work to be undertaken by Parks & Gardens staff.	Careful engagement with public to gain understanding of need for this action. Staff capacity and training to do the work.	Removal in first six months. Annual surveys thereafter.

Monitoring and Evaluation (M&E) of the Control Plan

The defined SMART Goals form the foundation of the M&E of the Control Plan. The M&E plan should include the following components:

- Methods of data collection
- Frequency of data collection
- Data storage process
- Data analysis process and method
- Frequency of analysis and reporting
- Frequency of Control Plan updates/review

3.3 Useful links

The following is a list of useful links (guidelines and drafted Plans (general and as per the Regulations) for compiling Control Plans.

- Department of Environmental Affairs (DEA). September 2015. Guidelines for the Monitoring, Control and Eradication Plans for Listed Invasive Species by Management Authorities of Protected Areas and Organs of State. DEA: Biosecurity Unit.

  https://www.environment.gov.za/sites/default/files/legislations/nemba_invasivespecies_controlguideline_0.pdf

- Stafford. L., and Geartner, M.(2015). Guidelines for Compiling Invasive Species Control Plans on Private Land. City of Cape Town: Environmental Resources Management Department and C.I.B. DSTF – NRF Centre of Excellence for Invasion Biology.

  https://www.wateradmin.co.za/groenland/private%20land%20is%20control%20plan%20manual%202015.pdf

- Cape EAPrac. (February 2016). Invasive Alien Plant Management Plan for 'The Hill' Residential Development. Prepared for Liberty Lane Trading 111 (Pty) Ltd. Report reference KNY339/05.

  https://www.cape-eaprac.co.za/projects/KNY339%20The%20Hill/BAR/F%20Alien%20Management%20Plan.pdf

- Stellenbosch Municipality (September 2016). Alien Invasive Plants Management Plan. Updated version of Plan compiled by Koen, L.

  https://www.stellenbosch.gov.za/documents/municipal-policy/planning-and-development/4550-alien-invasive-plants-management-plan-sept-2016/file

- Hoare, D. (May 2016). Alien and Invasive Species Management Plan - N2 Wild Coast Toll Highway, Eastern Cape. Prepared for CCA Environmental Consulting and SLR Consulting.

  https://slrconsulting.com/media/files/documents/App-D_Alien-and-Invasive-Species-Management-Plan.pdf

- Hoare, D. (April 2013). Alien Invasive Plant Management Plan (Draft). Prepared for Longyuan Mulilo Maanhaarberg Wind Energy Facility. De Aar, Northern Cape.

  http://www.sahra.org.za/sahris/sites/default/files/additionaldocs/12.%20Appendix%2011%20Alien%20Invasive%20Plant%20Management%20Plan_0.pdf

- Auld, B. (July 2009). Guidelines for Monitoring Weed Control and Recovery of Native Vegetation. NSW Department of Primary Industries, State of New South Wales.
  https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/299360/Guidelines-for-monitoring-weed-control-and-recovery-of-native-vegetation.pdf

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The Association for Water and Rural Development

AWARD is a non-profit organisation specialising in participatory, research-based project implementation. Their work addresses issues of sustainability, inequity and poverty by building natural-resource management competence and supporting sustainable livelihoods. One of their current projects, supported by USAID, focuses on the Olifants River and the way in which people living in South Africa and Mozambique depend on the Olifants and its contributing waterways. It aims to improve water security and resource management in support of the healthy ecosystems to sustain livelihoods and resilient economic development in the catchment.

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About USAID: RESILIM-O

USAID: RESILIM-O focuses on the Olifants River Basin and the way in which people living in South Africa and Mozambique depend on the Olifants and its contributing waterways. It aims to improve water security and resource management in support of the healthy ecosystems that support livelihoods and resilient economic development in the catchment. The 5-year programme, involving the South African and Mozambican portions of the Olifants catchment, is being implemented by the Association for Water and Rural Development (AWARD) and is funded by USAID Southern Africa.

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