GREATER SIMONSBERG CONSERVANCY MANAGEMENT UNIT CONTROL PLAN

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Greater Simonsberg Conservancy Management Unit Control Plan

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Executive Summary

This document sets out a plan for dealing with alien plant invasions in the Greater Simonsberg Conservancy (GSC), an area of 9050.7 ha including 33 farms which is situated along the slopes of the Simonsberg Mountain in Stellenbosch. The area includes 33 private landowners which have committed themselves to protect precious fragments of critically endangered Swartland Shale Renosterveld and Mountain Fynbos. The plan has been developed with the support of the Working for Water programme of the Department of Environment Affairs because they use a water catchment as a logical unit for planning control measures for invasive alien plants (IAPs).

This document describes the rationale and necessity for a plan and the process that was followed in developing it. It provides information on the:

- Current state of the catchment including key aspects of the environment, land-use and land ownership
- A summary of the current state of alien plant invasions
- The goal of IAP control in the catchment developed with stakeholders
- The criteria used to the prioritise control operations
- The budgets and resources, and the partnerships that will be needed to achieve those goals over a 20 year period
- The last section of the document provides information on a range of useful topics for public entities or private land owners embarking on clearing programmes.

The components of an effective invasive alien plant management as well as links to information on capacity (training) and resources, communications and advocacy, legal requirements and additional sources of information. A list of useful literature is also provided. Links to a number of websites (resources) including WfW training matrix.

The catchment has been delineated into 189 compartments of which 4413 ha have been invaded to some degree and are scheduled for treatment. All the pertinent information for each compartment such as the water flows (runoff), accessibility, slope and the age of the veld is stored within a geo-database. The information on historical and current invasions, previous control treatments and their costs is stored for each of the treatment units (NBALs) is stored in the same geodatabase. There is also a cross-link identifying which NBALs fall within each compartment so this information can be summarised at the compartment level. The geodatabase allows for all this information to be easily retrieved and presented at a compartment level and this information to be loaded into the Automated Management Unit Control Plan Generation Tool (MUCP Tool).

A multi-criteria decision making process, the Analytic Hierarchy Process, was followed to develop a goal for invasive alien plant control operations in the catchment, to develop the criteria needed to achieve the goal, and to assess the relative importance of these criteria by allocating weights

(ranking) to them by means of pair-wise comparisons. The last step in the process was to identify the datasets that enabled objective comparisons to be made between compartments with regard to particular criteria. During this process the stakeholders identified the following goal for the plan:

To clear invasive alien plants from the mountain and the water source areas by 2020

We have developed a set of budget scenarios for this plan using a computerised planning system called the Management Unit Control Plan (MUCP) tool. It schedules treatments of invasions in the catchment over the next 20 years based on the priorities that have been identified by the stakeholders in the plan. The CSIR has worked closely with the developers and NRM to modify the MUCP tool to meet the current needs of NRM. We have used the Great Simonsberg Conservancy as to case study for understanding the modifications needed to operationalise the MUCP tool and produce a workable plan.

The schedule generated by the MUCP tool takes into account the current state of the invasions, benefits of the clearing, treatments that are required and the resources provided in its budget. The tool allows the stakeholders to vary the resource budgets to evaluate whether the goal is feasible or not and to set a more realistic goal where necessary. The tool does not generate a detailed annual schedule of annual operation however there is an Annual Plan of Operations tool which serves that purpose.

The MUCP tool generates treatments schedules for an optimal budget, as if funds were limited, and four budget scenarios which are set by the user. We selected two realistic budget scenarios with ceilings of R 1.25 million and R 2.5 million and extracted and summarised the compartment treatments and annual budgets per compartment for the next 15 years. Since it is impossible to eradicate every invading plan, the aim is to achieve a maintenance level of <1% canopy cover. In the case of the R 1.25 million this would take 14 years and for the R 2.5 million scenario 7 years.

All this is for the pre-fire state, somewhere in here we need to deal with the fire and the consequent shift in priorities to controlling seedling regeneration especially of the Acacia speciesw – See page 37

We believe that it is seen as essential to have a lead agent or project implementation committee per catchment who drives the implementation of the plan. In cases where Working for Water is the funding agency this should be achievable with either themselves or an implementing agent taking the lead. However if there are multiple funding sources, the position of the lead agent would need to be negotiated. Lastly this plan needs to be regularly reviewed and revised depending on progress made each year and whether or not an event such as a wildfire that changes the treatment option occurs.

Acknowledgements

Derek Malan, the previous technical manager for WfW in the Western Cape (now retired) who was the prime mover within WfW to focus on a systematic, area and priority based, catchment-level approach to clearing invasive alien plants rather than the current, largely unsystematic approach.

Anthony Robinson of Handmade Connections who we have worked closely with to modify the pro-type MUCP tool into a flexible and robust operational planning tool.

The authors wish to acknowledge the following persons for their valuable contributions: Adele Toua the manager of the Greater Simonsberg Conservancy as well as individual members the conservancy for their active participation in drawing up this plan.

Andrew Wannenburgh of the Department of Environment Affairs' Chief Directorate: Natural Resources Management (NRM) for providing information on updated costs and the mapping for the invasive alien plants clearing programme

Aadelia Moerat who suggested that we test the MUCP approach using one of NRM's Land User Incentive projects, and for the support she and her staff have given us during the compilation of the plan.

CapeNature for supplying us with the latest information on the latest status of alien plant invasions and fire history of the land that they manage within the Greater Simonsberg Conservancy.

The participants in a workshop held to formulate the goal for the management plan and identify the criteria that would be used to prioritise the clearing operations.

MTO Cape for providing us with the compartment data for the Wolvenkloof plantation near Backberg Estate.

Photographs included in this report were taken by Greg Forsyth

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Glossary

APO	Annual Plan of Operations – a plan setting out the work that needs to be done by an organisation over a calendar or financial year
CapeNature	Western Cape Nature Conservation Board
CARA	Conservation of Agricultural Resources Act
CMS	Catchment Management System
DEA	Department of Environmental Affairs
DWAF	Department of Water Affairs and Forestry
Ecological Reserve	The amount of water that is required to maintain the health and integrity of a river's ecosystems so that is can supply people with good quality water
GIS	Geographical Information System
IAP	Invasive Alien Plants – plants that have been introduced from outside an area, generally overseas, and have now spread from where they were planted
LandCare	LandCare programme of the Western Cape Department of Agriculture
LUI	Land user incentive scheme
MTO	Mountain to Ocean Forestry – the private company that managed the state plantation areas and is in the last stages of withdrawing. It merged with another company to become CapePine in about 2010.
MUCP	Management Unit Control Plan
NBAL	Natural Biological Alien – the code for the management treatment unit (polygon)
NEM:BA	Natural Environmental Management: Biodiversity Act
NQF	National Qualifications Framework
NRM	Natural Resources Management Programme – a set of programmes within DEA which manage natural resources
PIC	Project Implementing Committee
PPRI	Plant Protection Research Institute
Safcol	South African Forestry Company Ltd – the state forestry corporation responsible for managing state forest land and managing private company leases
SANBI-ISP	South Africa National Biodiversity Institute which runs an invasive species programme (ISP) specifically aimed at finding and eradicating newly invading species
SAPIA	South African Plant Invaders Atlas
TCTA	Trans Caledon Tunnel Authority
TMS	Table Mountain Sandstone – the dominant rock type forming the mountains around Franschhoek; gives rise to nutrient-poor, sandy soils
WCWSS	Western Cape Water Supply System
WESSA	Wildlife and Environment Society of South Africa
WfW	Working for Water Programme – a programme specifically aimed at managing invasive alien plants to reduce their environmental and social impacts, especially on water resources
WIMS	Working for Water Information Management System which stores information on the location and characteristics (e.g. area, slope, IAPs) of each of the treatment units (NBALs) and the treatments applied to it.

1 INTRODUCTION

This document sets out a plan for dealing with alien plant invasions in the Greater Simonsberg Conservancy (GSC), an area which is situated along the slopes of the Simonsberg Mountain in Stellenbosch. The area includes 33 private landowners which have committed themselves to protect precious fragments of critically endangered Swartland Shale Renosterveld and Mountain Fynbos. The plan has been developed with the support of the Working for Water programme of the Department of Environment Affairs because they use a water catchment as a logical unit for planning control measures for invasive alien plants (IAPs).

This document describes the rationale and necessity for a plan and the process that was followed in developing it. It provides information on the:

- Current state of the conservancy including key aspects of the environment, land-use and land ownership
- A summary of the current state of alien plant invasions
- The goal of IAP control in the catchment developed with stakeholders
- The criteria used to the prioritise control operations
- The budgets and resources, and the partnerships that will be needed to achieve those goals

The plan is based on spatial management units we have termed compartments. The boundaries of these units are clearly locatable on the ground and include water courses, roads and tracks, ridgelines, and boundary fences and other permanent features. This means also that each compartment, or potions of it, can be clearly linked to individual land owners or management bodies. Each of the compartments will be given a priority for treatment and will be used to monitor and evaluate progress against the plan. This document does not set out a detailed schedule of the operations because that is done by a computerised planning system called the Management Unit Control Plan (MUCP) tool which schedules treatments of invasions in the catchment over the next 20-25 years. The schedule generated by the tool takes into account the current state of the invasions, benefits of the clearing, treatments that are required and the resources provided in its budget. The tool allows the stakeholders to vary the resource budgets to evaluate whether the goal is feasible or not and to set a more realistic goal where necessary. This is important because the goal needs to be challenging but achievable to ensure that people are motivated to rise to the challenge. In addition to the control operations, the plan also needs to provide for: (a) the prevention of new invasions by ensuring, as far as possible, that no new invaders are introduced to the area; (b) surveys to identify new invaders; and (c) rapid action to eradicate those invaders wherever possible.

The overall goal for this plan was developed in 2015 in collaboration with a group or people who represented stakeholders in the Greater Simonsberg area, based on the information on the state of the catchment presented in this report. The overall goal is that:

By 2020 we will have cleared invasive alien plants from the mountain and water source areas to improve water supply as ecosystem service.

The participants in this workshop also developed a set of criteria that would be used to prioritise control measures in the Greater Simonsberg Conservation area.

1.1 Why manage invasions?

Invasions of alien plant species in South Africa are recognised as a major threat to biodiversity, water resources and land productivity (De Lange and Wilgen, 2010; van Wilgen *et al*., 2008). Recent estimates are that some 8 750 taxa have been introduced, 660 of these have become naturalised and about 559 have been listed as invasive (NRM, 2014; Wilson *et al*., 2013). The total amount of water that is lost because of invading alien plants is estimated to be at least 2.9% of the volume of water that flowed in our rivers prior to European colonisation (Le Maitre *et al*., 2013). In volume terms, this is 1 444 million m^3/year - a quantity that is hard to grasp. A typical household of 4 people uses around 1000 litres per day or about 365 m^3/year (1 000 litres = 1 m^3). This means that invading alien plants use enough water to supply about 10 million households for a year. In the Western Cape the Berg and Breede Rivers are the most heavily invaded and the water losses are estimated to be around 6%. If left unchecked the extent and density of the invasions, and thus the impact on water resources, could increase significantly resulting in the loss of much of the available water in certain catchment areas, including the Simonsberg conservancy.

1.2 A brief history of alien plant management in the Greater Simonsberg conservancy catchment

It is important to understand the history of alien plant clearing in the Greater Simonsberg conservancy because, while this plan needs to continue and complete the clearing that has been done, it will involve a wider group of implementers and direct efforts towards clearing the areas that are considered most important for the whole area. Efforts to clear alien plants first began in 2004, when a group of five private landowners around the Klapmutskop (Delheim, Elsenburg, East Hill, Le Bonheur and Warwick) formed the Klapmutskop Conservancy under Cape Nature's Stewardship Programme. This has eventually transformed into the Greater Simonsberg Conservancy (since 2009?) where over 4 866 ha of farmland is currently managed according to conservation principles. GSC members are actively involved in clearing of invasive alien plants and rehabilitating them to fynbos. With assistance from Landcare and WFW, conservancy members were able to clear over 478 ha of alien invasive plants around the lower lying areas surrounding the mountain. Most of the high lying areas are managed by CapeNature have only received an initial treatment and some high altitude areas have not been treated at all. In some areas the clearing or follow operations have not been effective because the different agencies involved have not co-ordinated their operations properly. One of the aims of this plan is to try to coordinate all the efforts so that they can be as effective as possible.

1.3 Working for Water

The Department of Water Affairs and Forestry's Working for Water (WfW) programme was initiated in 1995 with two main aims: (i) to control and monitor invasive alien plants (IAPs) to reduce their impacts on water and other natural resources; and (ii) to provide unemployed or previously disadvantaged people with work for a period and to develop their skills to improve their employment prospects (van Wilgen *et al*., 1998). During 2013 the Working for Water programme was relocated in the Department of Environment Affairs Natural Resource Management programmes (NRM, 2014). The environmental and social imperatives of the programme include: (i) augmenting water security; (ii) improving ecological integrity; (iii) restoring the productive potential of land; (iv) promoting the sustainable use of natural resources; and (v) investing in the marginalised communities of South Africa.

The programme has grown during the past 20 years and is now one of the largest environmental programmes in the world. Until recently its actions were confined to supporting actions that helped to control and eradicate invasive alien species. The recently published regulations (DEA, 2014) under the National Environmental Management: Biodiversity Act (NEM:BA) (DEA, 2004) now enable it to exercise its legal powers to deal with invasive alien species and their management. However, the primary focus of the programme is on educating people about the negative impacts of invasions and enabling them to take action themselves, rather than prosecuting them. One of the requirements of the new legislation is that organs of state must compile plans to deal with all the invasive alien species in a particular area (section 76 of NEM:BA). This plan is aimed at meeting those requirements and providing the inhabitants of one such area, the Greater Simonsberg conservancy, with a systematic approach to controlling invasive species.

The threats posed by IAPs are addressed in section 76 of the NEM:BA Act which requires all organs of state to prepare invasive species monitoring, control and eradication plans for land areas under their control. The wording and the context make it clear that these plans are for specific areas of land, namely area-based, site-based or site-led plans (Downey and Sheppard, 2006; NRM, 2014). The focus of these plans is on characterising, prioritising and effectively managing the invasions. A good example of regional[1] level prioritisation is the one developed for the Western Cape by Working for Water (Forsyth *et al*., 2012). This plan focuses on one of the high priority catchments identified in that study.

The programme has also developed a number of ways of supporting control measures against invasive alien plants. They provide funds and resources in a number of ways:

- Direct involvement in the management of the clearing teams where they provide all the resources and oversee the operations;
- Indirect involvement through the funding of:
    - Control operations managed by implementing agents; in the case of this conservancy this includes:
        - CapeNature for the higher lying areas.

[1] The WfW programme has 9 regions corresponding more or less with the different provinces.

        - Working on Fire for the steep areas which require specialised safety precautions and skills, such as rope-work.
    - Land-user incentives (LUIs) where groups of land-owners apply for funding to carry out control operations on their land. These initiatives can also include way of using the material (biomass) from the clearing to produce products and rehabilitation of degraded land and river systems.
    - Other inputs such as providing herbicides and advice to land-owners.
- Support for the introduction and maintenance of biological control agents for invasive alien plants in the catchment, as well as research into agents for invasive aliens plants which do not yet have effective agents.

A key aim of this plan is to find ways to use all of these options to optimise the efficacy and efficiency of the management of the invasions in this catchment. This plan is aligned with the national strategy and the regional priorities of the Working for Water programme. These include ensuring that the benefits of the clearing are maximised, in this case by protecting water resources in upper areas of the Simonsberg to ensure maximum productivity on wine farms.

1.4 Managing invasive alien plant species

Management of invasive species is a complex task, whether it involves managing all the species found in a particular area, as done by Working for Water and other agencies, or managing invasions by single species (DEA, 2014, 2004). It is complex because it involves motivating and co-ordinating a range of land owners and land management agencies (each with their own agendas) and dealing with invasions by mixtures of species, each with different treatment requirements, in a range of environments from river banks to mountain tops. The plan also needs to allow for unpredictable events such as wildfires and floods which create opportunities for the spread and regeneration of invading alien plants. The plan also must include monitoring procedures to measure and record progress and the evaluation of that progress against the objectives so that the plan can be adapted when progress is not satisfactory.

The Act and regulations require that all state organs, from national departments to local municipalities, must control declared invader species on their land. Everyone who is a land owner must have at least a list of the invaders on their land and a plan to deal with them. The only way to do this effectively is for all the land owners to combine their efforts and resources and become actively involved in controlling invasive alien plants. Treatment operations are labour intensive and many species require herbicides for effective control which makes these operations very resource intensive and expensive, so cost sharing is essential to ensure that the available resources are used to maximum effect. We deliberately followed a participatory approach to developing this MUCP by consulting with stakeholders to ensure that they: (a) develop a common understanding of the rationale for controlling invading alien plant species, actively participate in its implementation, and coordinate activities to achieve goals.

2 SITUATIONAL ASSESSMENT

The section provides a description of the Greater Simonsberg Conservancy as a background to the plan and to provide the context for it. The area covers 9050.65 ha of farmland (33 farms) on the slopes of the Simonsberg mountain of which 4413 ha are infested with alien invasive plants.

2.1 Location and elevation

The Greater Simonsberg area is located between the towns of Stellenbosch, Paarl and Franschhoek and includes the Simonsberg, Skurweberg and Klapmutskop mountains. Being detached from the other mountain ranges in the winelands region, Simonsberg forms a prominent 1399 m high mountain. It lies in the highly regarded wine producing area of Stellenbosch and is characterised by high-lying sites and soils with high potential. These soils comprise a mixture of sandstone, decomposed granite and shale soils with good drainage.

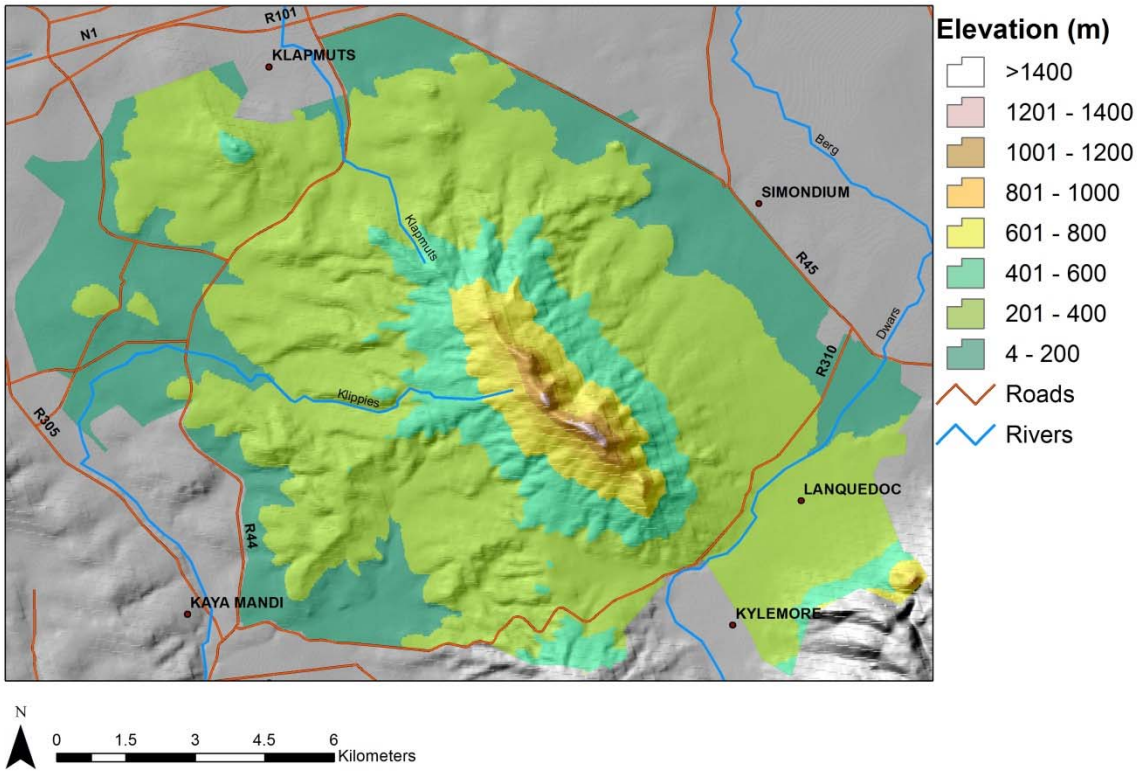


Figure 1: *Locality map for Simonsberg conservancy showing main topographical features.*

2.2 Mean annual rainfall

Much of the rain falls on the upper slopes and peaks of the Simonsberg mountain where the mean annual rainfall is estimated to exceed 1 600 mm/year. Since most of the water is sourced from the mountain areas and relatively little from the valley bottoms it means that invasions in the mountain areas can, potentially, have a much greater impact on water than those in the valley bottoms.

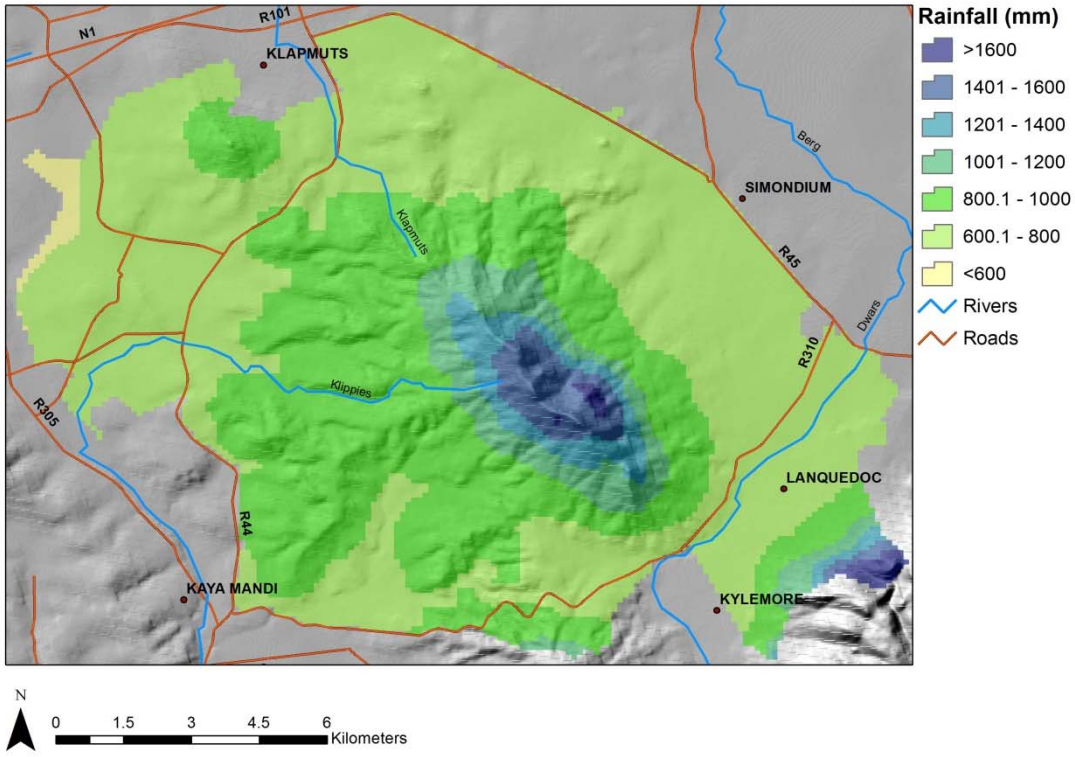


Figure 2: *Mean annual rainfall for the Simonsberg area ranging from 560 to > 1600 mm per year.*

2.3 Terrain and slope

Given the rugged nature of the mountains, it is not surprising that a large part of the area is characterised by steep to very steep slopes (Figure 3, Table 1). This is important because steep areas like this are difficult to work in, especially when carrying the equipment needed to deal with large trees such as pines. The WFW programme has identified that slopes ≥ 35° need to be worked by the high altitude team of Working on Fire because they need rope skills to ensure their safety. The steep slopes also have significant implications for the cost of clearing because these skilled people rightly cost more per hour and the time required to reach these areas adds significantly to the cost.

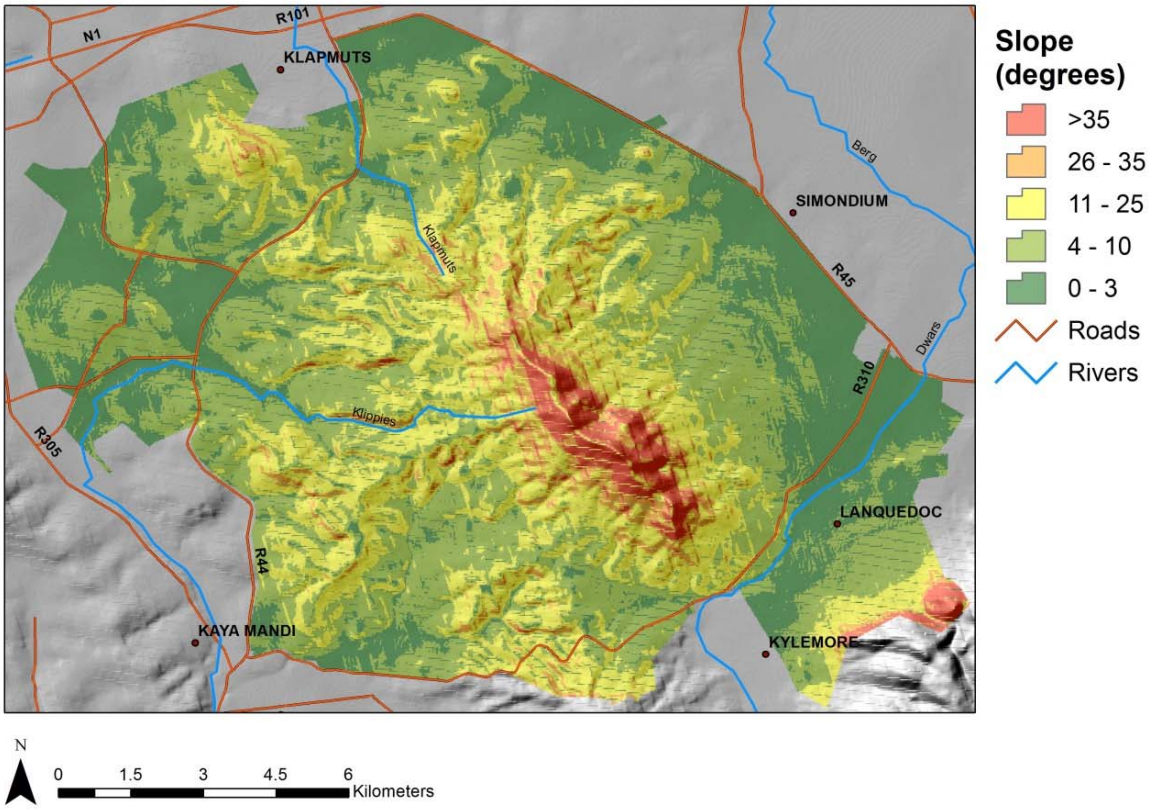


Figure 3: *Distribution of Working for Water slope classes in the Simonsberg area.*

Table 1*: The relative importance of different Working for Water slope classes in the Greater Simonsberg area.*

Slope class (degrees)	Hectares	% of total area
0 – 3	4005.2	26.5
3 – 10	5958.2	39.4
10 – 25	3939.2	26.0
25 – 35	777.0	5.1
≥ 35° (high attitude – rope work)	448.6	3.0

2.4 Land use and transformation

The mountain areas have retained most of their natural vegetation because the combination of the rugged terrain and infertile soils has protected most of the Kogelberg Sandstone and Boland Granite Fynbos from agricultural or urban development (Figure 4, Table 2). The botanically significant Klapmutskop supports a 300 year old yellow wood forest (Podocarpus elongates) while elsewhere in the conservancy precious fragments of critically endangered Swartland Shale Renosterveld and Mountain Fynbos is to be found. The Boland Granite and Cape Winelands Shale Fynbos occur on the lower slopes and the relatively fertile soils have resulted in its conversion for agriculture, leaving only limited natural remnants. Very little of the Swartland Alluvium Fynbos, which occurred on the deep sands of the valley bottoms now remains, and it is classed as a Critically Rare ecosystem in terms of the NEM:BA Act

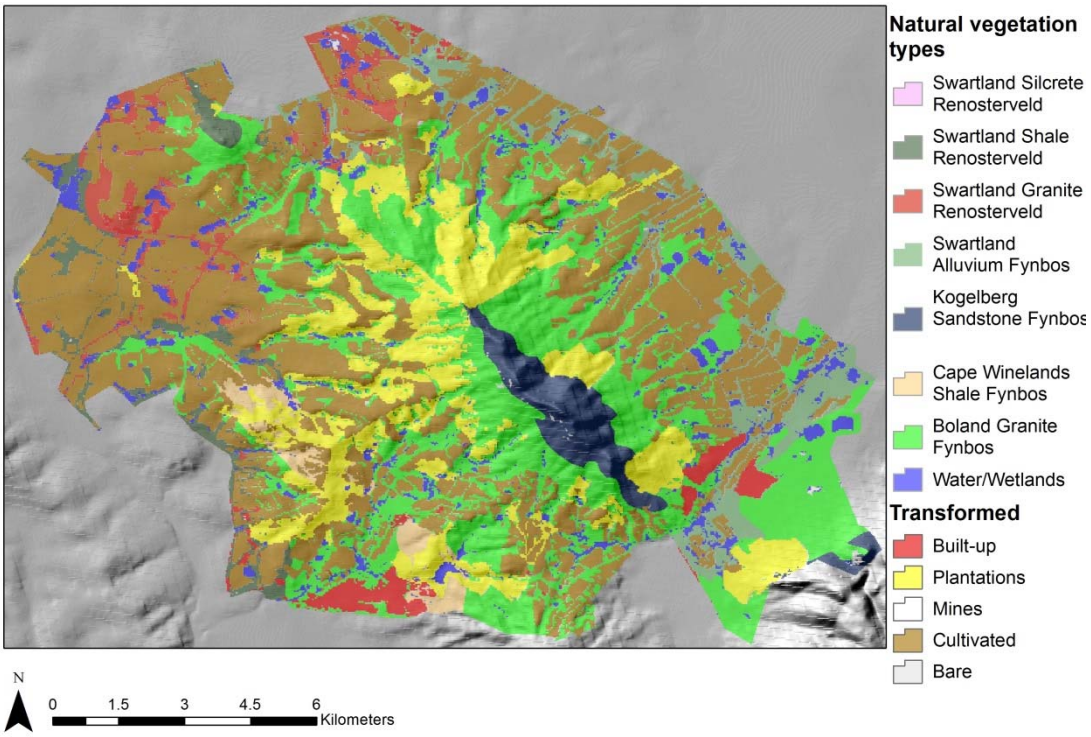


Figure 4: *The extent of natural and transformed land in the Greater Simonsberg conservancy.*

About 56 % of the area has now been transformed either by conversion into plantation areas, or by cultivation, primarily for viticulture although some farms produce fruit and olive products. The urban areas include small settlements like Johannesdal, Pniel and Idas Valley. This plan includes invasions of the natural areas and farmlands but excludes those occurring in the urban areas of the conservancy.

***Table 2:** Land **cover** by category in the Greater Simonsberg Conservancy*

Category	Description	Area (ha)	Area (%)
Agriculture	Cultivated vines	4765.14	27.591
	Cultivated commercial fields	1453.77	8.417
	Cultivated orchards	695.16	4.025
	Cultivated commercial pivots	17.91	0.104
Other	Bare none vegetated	23.31	0.135
Natural	Boland Granite Fynbos	4274.37	24.749
	Cape Winelands Shale Fynbos	233.37	1.351
	Swartland Granite Renosterveld	464.31	2.688
	Kogelberg Sandstone Fynbos	537.66	3.113
	Swartland Alluvium Fynbos	844.02	4.887
	Swartland Silcrete Renosterveld	1.26	0.007
	Swartland Shale Renosterveld	426.33	2.468
Forestry	Plantation / Woodlots clearfelled	11.43	0.066
	Plantation / Woodlots young	116.19	0.673
	Plantations / Woodlots mature	2239.92	12.969
Water	Mines water seasonal	0.09	0.001
	Water permanent	169.47	0.981
	Water seasonal	122.31	0.708
	Mines water permanent	4.68	0.027
	Wetlands	515.97	2.988
Urban	Urban built-up	14.13	0.082
	Urban commercial	27.27	0.158
	Urban industrial	20.16	0.117
	Urban school and sports ground	2.43	0.014
	Urban township	134.28	0.777
	Urban residential	115.56	0.669
	Urban smallholding	40.41	0.234
Grand Total		**17270.91**	**100**

2.5 History of clearing and current state of invasion

The first efforts to eradicate alien invasive plants in the Simonsberg area began in 2006 after the discovery of a forest of Breede River Yellow-wood on Klapmutskop. This encouraged a group of private landowners to enter into a partnership with Cape Nature to begin clearing away the alien plants that had invaded large areas of Klapmutskop. These efforts sparked alien plant clearing programmes on other farms in the Simonsberg area which then eventually led to the establishment of the Greater Simonsberg conservancy. In 2009, a full time conservation officer was employed to manage the conservancy. Funding for alien plant management and restoration efforts are received through Landcare and DEA. Over 478 Ha of alien invasive plants have been removed with the assistance of funding from Landcare. Conservancy members also actively engage in clearing

initiatives on their land and are supported by Landcare and WfW by covering labour cost and providing herbicides. During one such clearing operation, a small patch of indigenous silver trees was discovered in 2008 on the farm Uitkyk. Since then 300 hectares has been set aside for conservation, including a substantial portion that falls within the Greater Simonsberg Conservancy, supporting one of the largest remnants of critically endangered Swartland Shale Renosterveld. Although much headway has been made to control alien vegetation in the conservancy many areas have not been cleared at all while in other areas there has only been one treatment. The areas that have received the most treatments are all located in the area managed by Cape Nature at the top of the mountain (Figure 5).

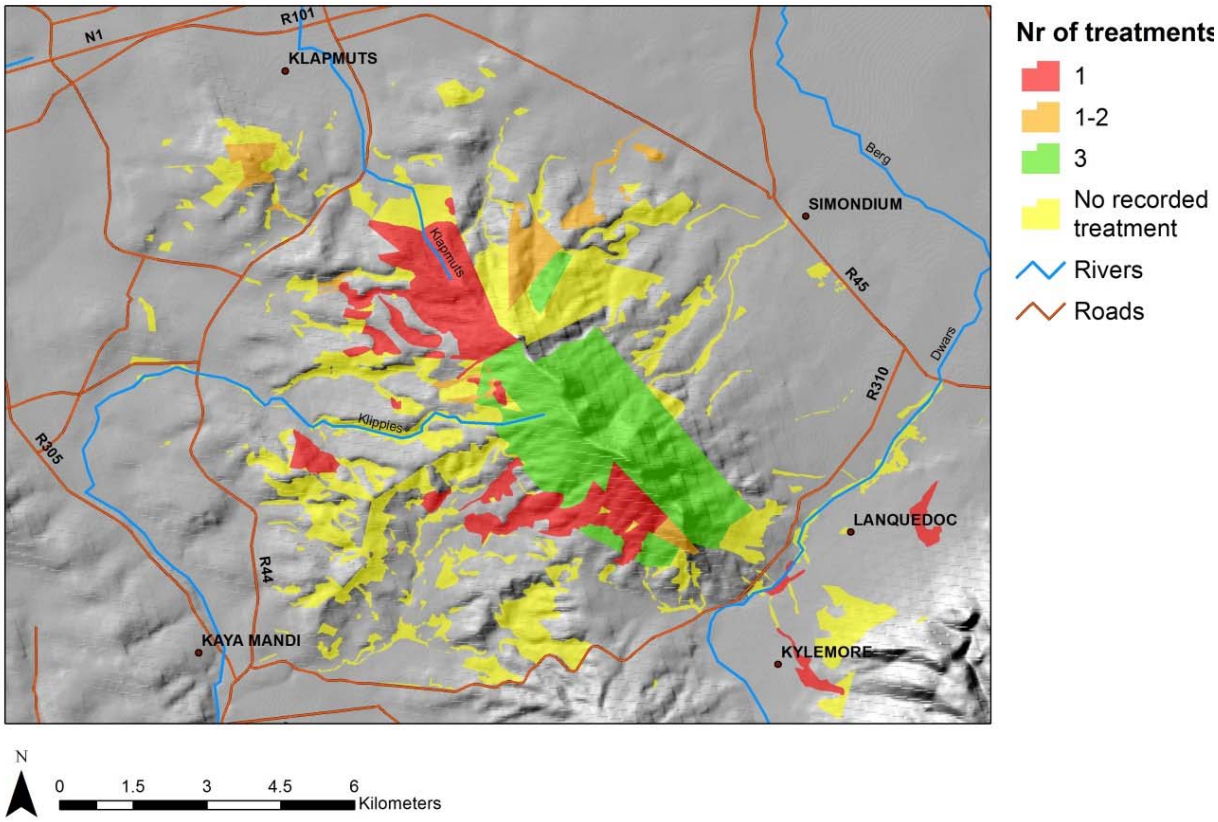


***Figure 5**: The invasive alien plant treatment status for natural and previously afforested areas in the Greater Simonsberg Conservancy.*

Even if only the dominant species are considered, the conservancy has been invaded by at least 14 different species (Figure 6, Table 3). In the high lying areas of the catchment the invasions are dominated by Pine species, particularly *Pinus pinaster* and *P. radiata*, which comprise nearly 25% of the invaded area (Table 3). *Eucalyptus species are* dominant on the middle slopes of Simonsberg especially in the north and eastern part of the conservancy towards Pniel. The Australian *Acacia* species are probably the most problematic species as they form extensive (Table 3 and 4) and dense stands and require many follow-ups to deal with their ongoing recruitment from long-lived seed

banks (Campbell, 1993; Stirton, 1978). *Acacia mearnsii* (Black wattle) is the most important species and is mainly found in the lower areas along the rivers and dense stands occur especially on the western parts of the Simonsberg conservancy.

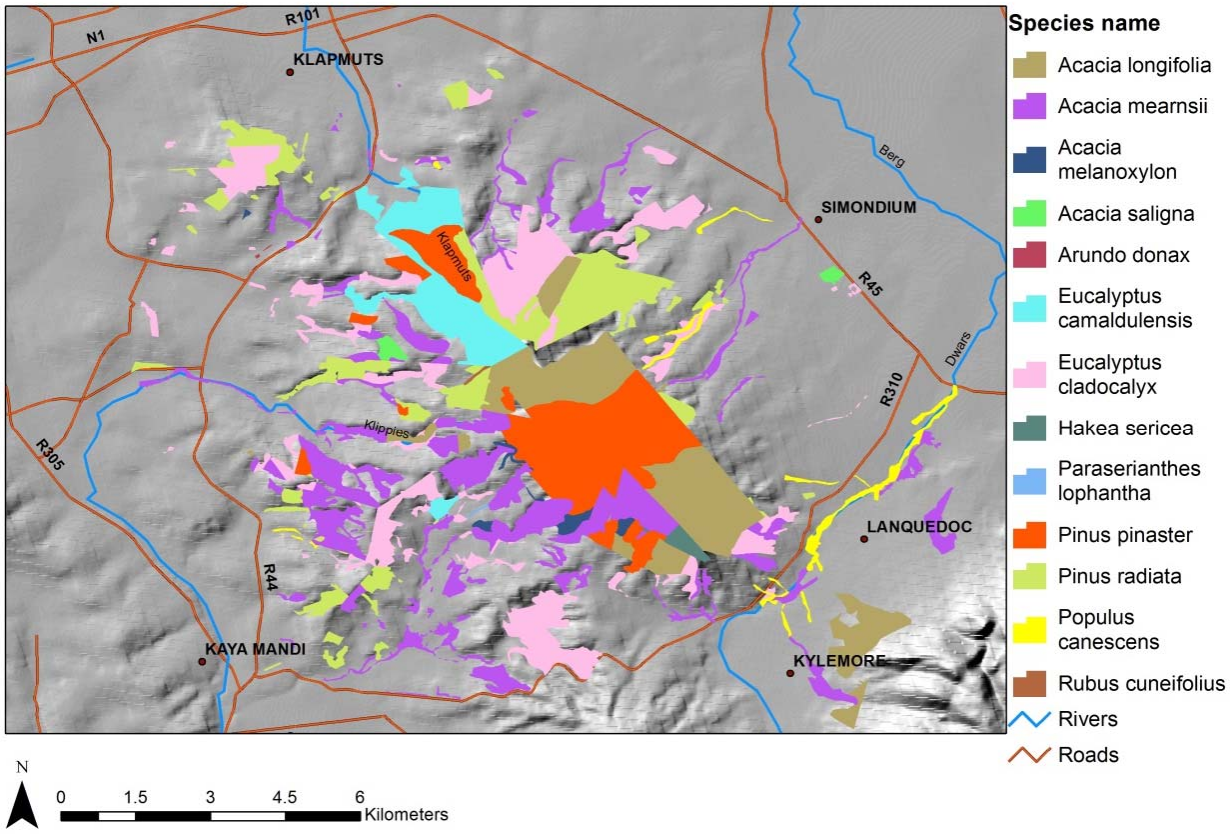


Figure 6: *The current extent of invasive alien plants in the Greater Simonsberg Conservancy*

Of the total invaded area of 4413 ha 2% consists of closed canopy stands, 15% with dense stands, while medium density (25-50% cover) stands occupy about 48% and scattered stands (5-25%) about 40% (Figure 7). Many of the areas indicated as pine dominated on the top of the mountain are actually a mixture of Eucalypts and pines.

***Table 3**: Invasions by ownership (dominant species)*

Area are in hectares (condensed area)

	Public	Private			
Species	Cape Nature	Farm	Private-mountain catchment	Urban	Total
Acacia longifolia	97.41	47.74	69.62		214.77
Acacia mearnsii	0.00	262.33	64.82	9.87	337.02
Acacia melanoxylon		3.08	2.99		6.08
Acacia saligna		15.15			15.15
Arundo donax		0.37			0.37
Eucalyptus camaldulensis	0.00	116.64	0.02		116.66
Eucalyptus cladocalyx	0.01	254.61	13.85	1.58	270.06
Hakea sericea	0.03	0.01	1.13		1.17
Paraserianthes lophantha		0.34			0.34
Pinus pinaster	49.34	20.79	49.84		119.97
Pinus radiata		170.7	21.0		191.7
Populus canescens		25.09	1.11	2.23	28.43
Rubus cuneifolius		0.00	0.84		0.84
Total	**146.80**	**916.84**	**225.27**	**13.68**	**1302.59**

Table 4: *State of invasion by dominant species in the Greater Simonsberg Conservancy*

Species	Common name	CARA Category	NEMBA Category	Area invaded (ha)	% of total invaded area	Growth form	Distribution and habitat invaded	Reproductive mode	Age (years) when first seed is produced	Herbicide required	Bio-control agent***
*Acacia longifolia**	Long-leaved wattle	1	1b	214.77	16.49	Tree	Mountain slopes	Reseeder	3	Yes	Yes, effective *Trichilogaster acacialongifoliae*
*Acacia mearnsii**	Black wattle	2	2	337	25.9	Tree	Riparian and landscape	Sprouter	3	Yes	Yes, effective *Ceratocystis albofundus, Cylindrobasidium leave, Dasineura rubiformis, Melanterius maculatus*
*Acacia melanoxylon**	Australian blackwood	2	2	6.08	0.47	Tree	Riparian and landscape	Sprouter	3	Yes	Yes, effective *Melanterius acaciae*
Acacia pycnantha				0.0152	0.0012						
*Acacia saligna**	Port Jackson willow	2	1b	15.15	1.16	Tree	landscape	Sprouter	3	Yes	Yes, effective *Melanterius compactus, Uromycladium tepperianum*
*Arundo donax**	Spanish Reed	1	1b	0.37	0.03	Reed	Riparian and moist landscape	Sprouter	-	Yes	No
Eucalyptus camaldulensis				116.66	8.96						
Eucalyptus cladocalyx		2	1b	270.06	20.73	Tree	River courses		5	Yes	No
Hakea (sericea)	Silky hakea	1	1b	41.72	3.20	Shrub	Mountain slopes	Reseeder	2	Yes (minor use)	Yes, partly effective *Aphanasium austral, Carposina autologa, Colletotrichum acutatum, Cydmaea binotata, Dicomada rufa, Erytenna consputa*
Paraserianthes lophantha	Stink bean	1	1b	0.34	0.03	Tree	Riparian and coastal areas	Reseeder	3	Yes	Yes, effective *Melanterius servulus*

Species	Common name	CARA Category	NEMBA Category	Area invaded (ha)	% of total invaded area	Growth form	Distribution and habitat invaded	Reproductive mode	Age (years) when first seed is produced	Herbicide required	Bio-control agent***
Pinus pinaster	Cluster pine	2	2 in plantations, 1b elsewhere	119.97	9.21	Tree	Mountain slopes	Reseeder	5	Yes	No
Pinus radiata	Radiata pine	2	2 in plantations, 1b elsewhere	191.7	14.7	Tree	Mountain slopes	Reseeder	7	Not listed	No
Pittosporum undulatum				1.67	0.13						
Populus canescens				36.6	2.8						
Rubus (fruticosus)				0.84	0.06						
Rubus cuneifolius	Bramble	2	2	3.84	0.30	Herb			2	Yes	No
Rubus spp	Bramble	2	2	2.31	0.18	Herb			2	Yes	No
Solanum mauritianum	Bugweed	1	1b	0.99	0.08	Shrub	Riparian and landscape	Resprouter	2	Yes	Yes, not effective *Anthonomus santacruzi, Gargaphia decoris*

Notes:

1. *Phytolacca octandra* (Ink berry) was incorrectly named as *Cestrum laevigatum* in the databases acquired from the Working for Water Information Management System (WIMS)
2. *Casuarina cunninghamiana* (Beefwood) were observed in the initial stage of spreading in farm drainage ditches during a site visit to the catchment in 2014.
3. **information from http://www.issg.org*
4. ***information from https://florabase.dpaw.wa.gov.au/*
5. *Herbicide information taken from https://sites.google.com/site/wfwplanni*
6. Biocontrol data obtained from (Klein, 2011).

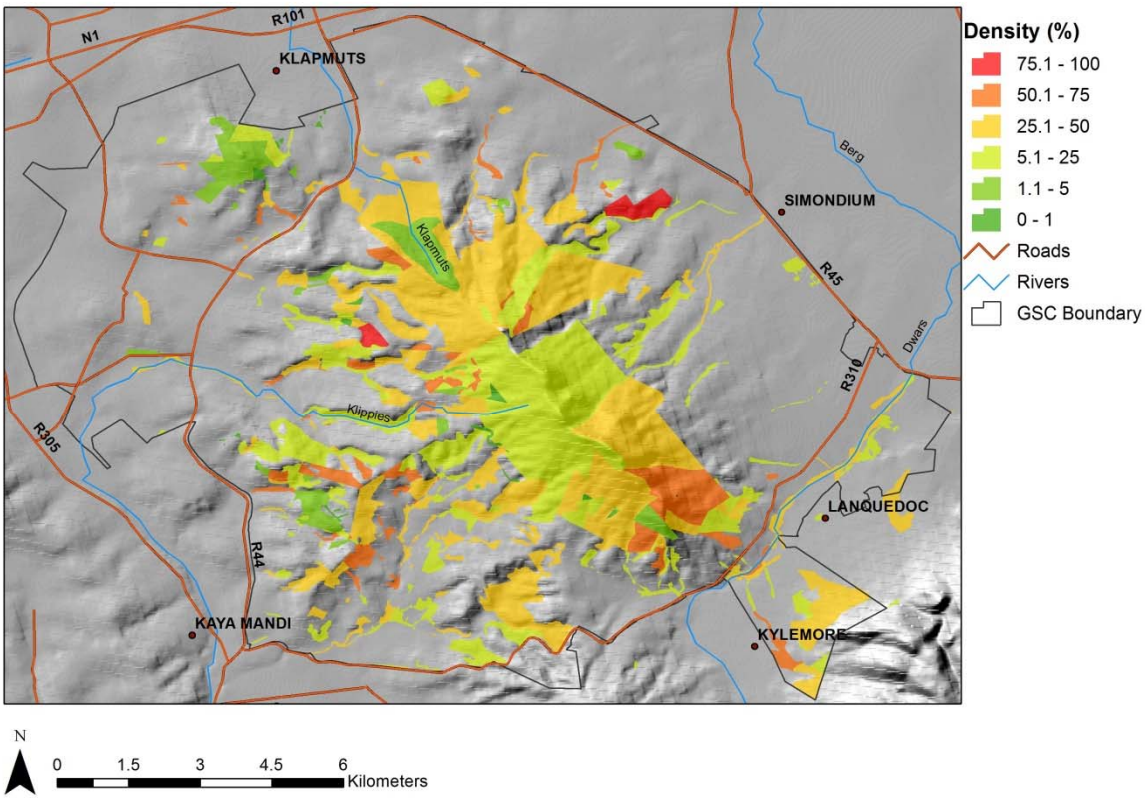


Figure 7: *Current invasive alien plant density classes per management compartment in the Greater Simonsberg Conservancy.*

Dominant invasive alien plant species in the area are Acacia mearnsii, Acacia longifolia, Pinus pinaster, Pinus radiata and Eucalyptus camaldulensis (Figure 8).
See http://www.invasives.org.za/plants/plants-a-z for more information on these species and other invaders in the catchment.

Figure 8: *The main invasive alien plant species in the catchment (A) Black Wattle (Acacia mearnsii) (B) Stinkbean (Paraserianthus lophantha); (C) Red River Gum (Eucalyptus camaldulensis); (D) Silky Hakea (Hakea sericea) (E) Cluster Pine (Pinus pinaster). (F) Blackwood (Acacia melanoxylon) (Photos G.Forsyth).*

2.6 Fire history

There have been many fires over the decades but the most important ones for this plan are the two major fires which have occurred since 2000. The one was on Saturday 15 January 2000 and the other one on Tuesday 19 Jan 2015. Both fires started on the outskirts of Johannesdal, near Pniel. The fire in 2000 spread from the town of Pniel south west up the slopes of the mountain, along the crest of the mountain and south east to the R44, across the R44 and finally north east to Klapmuts. Similarly, the fire in 2016 spread up the southern face of the mountain, crossed over to the Western (Stellenbosch) side of the Simonsberg and had grown into a fire of extremely large proportions. The fire in 2000 burned an approximate area of 1000 ha causing the vegetation age of much of the conservancy to be 16 years old at the time of the fire in 2016 (Table 5 and Figure 9). At the time of the fire much of the burnt area had only an initial treatment or hasn't been treated at all. This caused the fires to stimulate the recruitment of large numbers of pine and *Acacia* seedlings. The same fires may have stimulated the seeds of many fynbos species as well. Therefore it is important to clear the alien species as soon as possible to prevent suppression of the fynbos species, particularly in areas which were under fynbos prior to the fire.

Overall, the fires have worsened the IAP problem by stimulating seed regeneration over large areas and creating large areas of young plants, often in dense stands, that must now be treated. The risk of further fires has been reduced by the young vegetation, but even young fynbos can burn under extreme wildfire conditions (Van Wilgen *et al*., 2010). It is, therefore, important that wild fires are kept out of the area. Special care needs to be taken to prevent fires burning in areas of the cleared plantations where there is a lot of slash (i.e. cut branches), and even many logs or whole trees, lying on the surface. Due to the high availability of fuel (i.e. wood), fires in these areas can reach extremely high temperatures and can sterilise the soil (Holmes and Newton, 2004; Holmes et al., 2000; Le Maitre et al., 2014). These areas then require reseeding which is expensive. Fire can still be used as part of the control treatments (e.g. in dense long-leaf acacia stands), but care must be taken to prevent these fires from escaping.

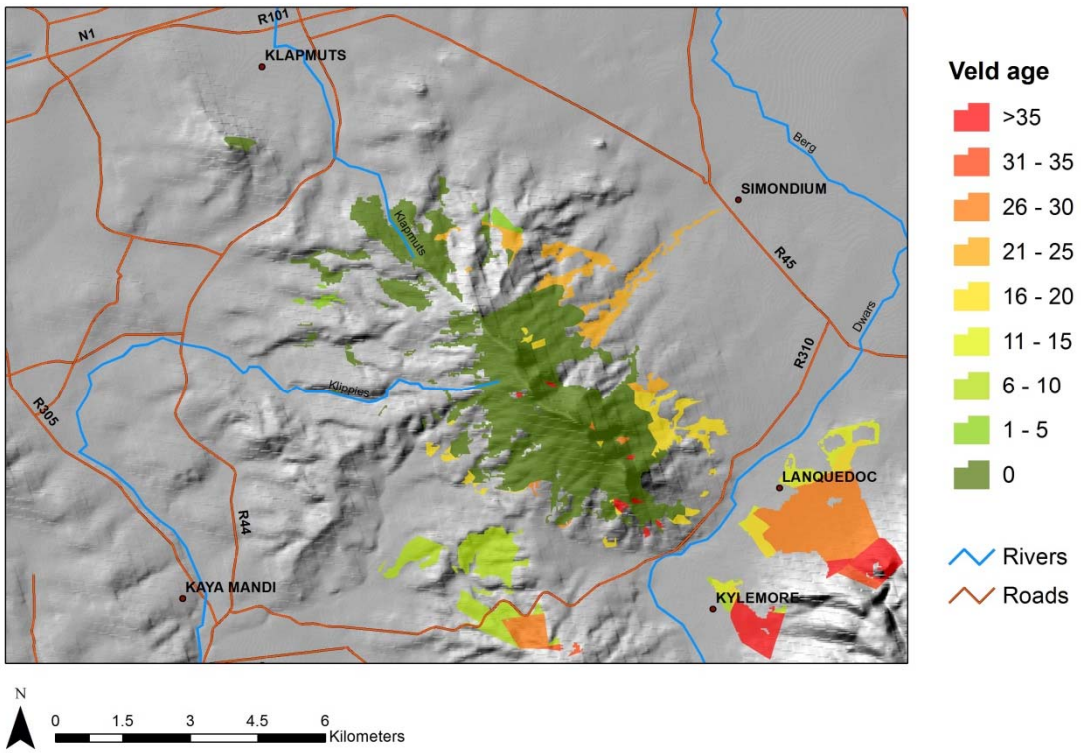


Figure 9: *Current veld age of the Greater Simonsberg as determined at the end of February 2016.*

Table 5: *Veld age in Feb 2016 for the portion of the Greater Simonsberg covered by natural veld (invaded and uninvaded).*

Post-fire veld age (years)	Ha	% of total area
0	1488.6	22.3
1-5	239.1	3.6
6-10	315.6	4.7
11-20	907.9	13.6
21-30	701.8	10.5
31-40	178.3	2.7
>40	22.4	0.3

2.7 Land ownership

The largest proportion of land (85.2%) in the greater Simonsberg conservancy is privately owned (Table 6 and Figure 10). This is made up primarily by horticulture of which wine grapes constitute 4090 ha and planted pastures approximately 1009 ha. Other crops include berries, citrus fruits, flowers, herbs / essential oils, pome and stone fruit. Although most of the natural vegetation occurs on the upper slopes of the Simonsberg mountain, many fingers of unmanaged natural veld on the lower slopes run out between the vineyards. Some of these areas have become densely invaded by a variety of plant species, particularly pines and black wattle.

In the Simonsberg conservancy public land constitutes less than 15 % of the total area. This is made up of land managed primarily by CapeNature on the upper slopes of Simonsberg mountain and some urban areas falling under the jurisdiction the Stellenbosch Municipality.

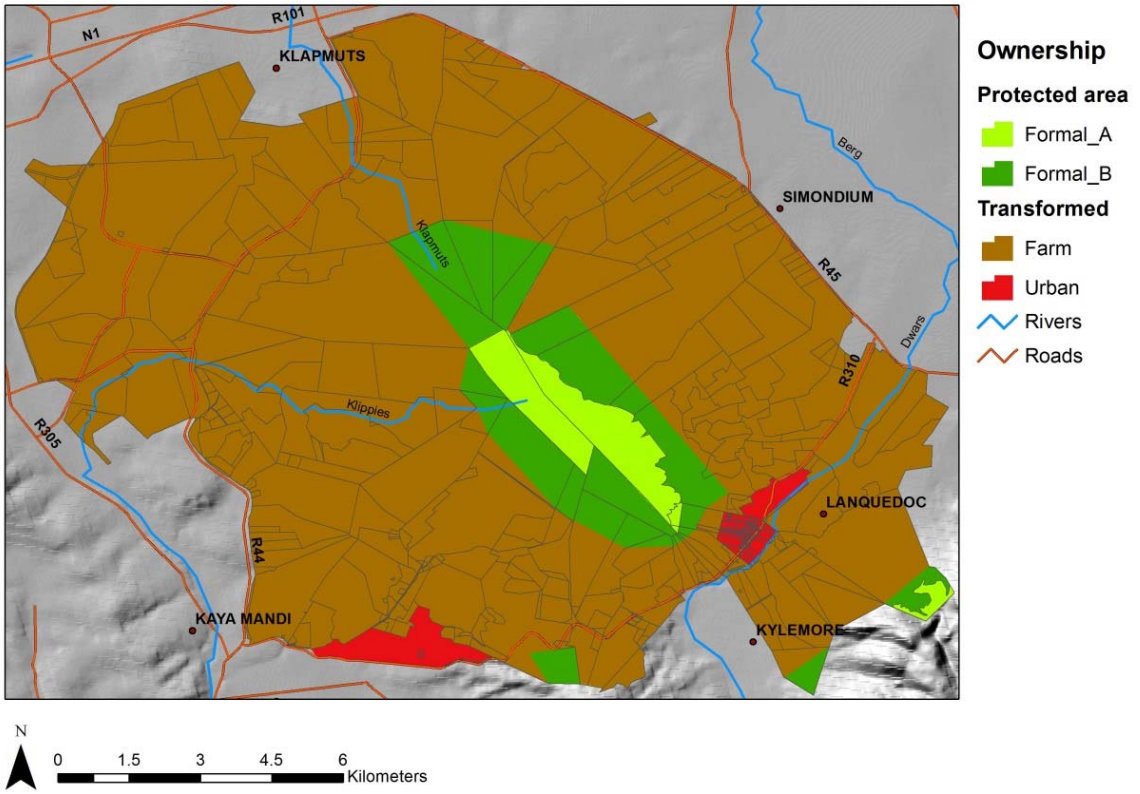


Figure 10: *Land ownership in the Greater Simonsberg Conservancy .*

Table 6: *Land ownership by category in the Greater Simonsberg conservancy*

	Area (ha)	% of total
Cape Nature	652.8	4.3
Farm	12873.1	85.2
State land	699.0	4.6
Urban	887.9	5.9
Total	15112.9	100.0

2.8 Water Users

The main water-users in the Simonsberg conservancy are the commercial farmers who irrigate their vineyards, orchards and pastures. They also grow a limited amount of annual crops which may require irrigation when conditions are dryer than usual (e.g. sweetcorn). The main source of their water is farm dams but some farmers are linked in to the Berg River irrigation scheme which is linked, in turn, to the Western Cape Water Supply System (WCWSS). This system has the ability to transfer water to the Berg River and Eerste River from the Theewaterskloof dam via the Riviersonderend-Berg-Eerste River water transfer scheme. The Stellenbosch Municipality receives water from the WCWSS via the Paradyskloof treatment works in addition to water extracted via a weir in the upper Eerste River catchment. Downstream water users on the Berg River include the towns of Paarl of Wellington and irrigation boards.

2.9 Stakeholders

All the organisations actively supporting and participating in invasive alien plant control operations within the catchment are listed in Table 7.

Table 7: *Stakeholder representatives for the Simonsberg conservancy*

Organisation	Contact	Designation	Telephone	Cell	e-mail
Western Cape – DEADP Development Planning	Jason Mingo	Berg River improvement plan	021 483-0798	084 661-8264	Jason.Mingo@westerncape .gov.za
Western Cape Department of Agriculture: Sustainable Resources Management	Rudolph Röscher	LandCare Manager : Cape Winelands DC & Simonsberg conservancy improvement plan	023-3471003	083 675 1315	rudolphr@elsenburg.com

Organisation	Contact	Designation	Telephone	Cell	e-mail
	Elmo Maree	Landcare officer: Wellington district office	021 8731135	0844079513	elmom@elsenburg.com
Agriculture Depart. of Agriculture: Sustainable Resources Management	Francis Steyn	Sustainable Resources Management	021 808-5090	082 907-2813	Franciss@elsenburg.com
LivingLands (NGO)	Nina Rivers				nina@livinglands.co.za
Irrigation Board	WD (Billy) Bourbon-Leftley	Chairman	021 8633475	082 880-1470	billyb@vodamail.co.za
CapeNature	Peter Viljoen	Catchment Management: Boland		082 7407736	pviljoen@capenature.co.za
	Ben van Staden	Natural Resources Manager	021 483-0171	079 503-6424	bvanstaden@capenature.co.za
	Deon Rossouw	Limietberg Reserve Manager	021-871-1535	082-494-9707	dross@capenature.co.za
	Anel Colison	Conservation services manager	021 871 1535	079 873 0609	avannoie@capenature.co.za
	Dian Dreyer	Central Region Protected Areas Manager	021-851-1996	082-823-7415	ddreyer@capenature.co.za
	Patrick Shone	Jonkershoek Reserve Manager (also FPA)	021 866-1560	082-467-0405	pshone@capenature.co.za
	Henry Kortje			076 424 7992	hkortje@capenature.co.za
	Corlie Hugo	Ecological co-ordinator Boland		082 380-9071	chugo@capenature.co.za

Organisation	Contact	Designation	Telephone	Cell	e-mail
	Tony Marshall	Integrated Catchment Management		082 740-7787	tmarshall@capenature.co.za
MTO Cape (Cape Pine)	Dirk Nortjie	MTO Area Manager	021 867 0184	0828875529	Dirk@mto.co.za
Cape Winelands Biosphere Reserve	Quinton Balie		021 888 5194		quinton@capewinelands.gov.za
Dirtopia Trail Centre	Meurant Botha	Company Owner		083 450 5313	meurant@dirtopia.co.za
Greater Simonsberg Conservancy (Delvera Farm)	Adele Toua	Manager		079 276 3638	conservancy@delvera.co.za
	Nora Thiel	Chairperson		0828040626	nora@delheim.com
Stellenbosch Municipality	Andre van Niekerk	Director of Engineering Water Section (IDAS Valley Dams)	021 808 8123		andren@stellenbosch.org
	Schalk van der Merwe	Environmental Planner	021 808-8679	083 324-0925	Schalk.vandermerwe@stellenbosch.gov.za
	Leon Lourens	Conservation Section	021 808 8417	079 8803086	Leon.Lourens@stellenbosch.gov.za
Water Affairs (Department of Water and Sanitation	Aisha Petersen	Director: Institutional Establishment	021 941-6000 021 941-6182	082 320-8228	pietersena@dwa.gov.za
	Derril Daniels	Western Cape Water Supply System	021 941-6000 021 941-6189	082 908-3236	DanielsD@dwa.gov.za
	Melissa Lintnaar-Strauss	Western Cape Water Supply System (Water Quality)	021 941-6000		
Winelands Fire Protection Association	Henrietta Brock	Operations Assistant		071 256 2668	
	Dale Nortje	Manager	021 888 5823		

Organisation	Contact	Designation	Telephone	Cell	e-mail
Working on Fire Programme (DEA –NRM)	Jason de Smidt	Project manager SW region: High altitude teams	021 761-1992	084 548-7140	desmidtjason@gmail.com
Working for Water Programme (NRM – Environment Affairs	Aadelia Moerat	Regional Programme Leader: W Cape Environmental Programmes	021 941-6008	076 184-0298	AMoerat@environment.gov.za
	Wessel Wentzel	Implementation Manager: WC Working for Water	021 941-6016	082 888-7766	WWentzel@environment.gov.za
	Colin Sharp	Area manager		074 100-9206	cssharp@environment.gov.za
	Nicolette (Nikki) Oliver	WIMS	021 941-6023	074 454-4556	NOliver@environment.gov.za
WWF-SA	Joan Isham				jisham@wwf.org.za
	Shelly Fuller	Programme Manager: Fruit & Wine Initiatives	021 882 9085	084 555 6068	sfuller@wwf.org.za

3 DELINEATING MANAGEMENT COMPARTMENTS

When the Working for Water programme was launched in 1995 the programme management realised that there was a need for a standardised way of mapping invasions so that records could be kept of the spatial boundaries of invaded areas and to that the costs of treatments could be estimated and monitored. The mapping standards that were developed were based on those developed by the CSIR for the Catchment Management System (CMS) for fynbos (Le Maitre *et al*., 1993) and subsequently revised and modified (Working for Water, 2003). The CMS included a series of spatial data layers aimed at providing the managers with the information they needed on the spatial distributions of key species, fires, invasions and land ownership among others. One of the key ones was a management unit known as a "compartment" which was based on the approach developed by the Department of Forestry for the mountain catchment areas they managed (similar units were used in forest plantations). Essentially these were spatial units with clearly defined and identifiable boundaries that were also useful as boundaries for fire management and other operations. They also provided a complete coverage of the area of interest, in this case a catchment. In contrast, the mapping of invasions was based on mapping units with similar invasions (similar species mix and density and location in the landscape), generally with no consideration of compartment boundaries, although rivers and streams often formed natural units. This is because rivers, streams and their floodplains (i.e. riparian areas) often have invasions which differ in species composition, structure and density from adjacent dryland invasions, typically making them separate invaded units.

Invaded areas were then overlaid with compartments to provide information on the characteristics of the invaded areas in each compartment. The key point is that there was only one fixed management unit – the compartment. This choice was deliberate and was intended to ensure that as the different invaded units within each compartment were treated the changes would be documents and form a permanent record of the treatments and the resulting changes in the state of the invasions. In this way the boundaries of the treatment unit could change over time depending on what was best suited to the contract requirements regarding workloads and time-frames. In discussions with NRM planners and implementing agents it was agreed that for the Simonsberg conservancy, compartment boundaries should follow the cadastral boundaries since most of the conservancy is managed by private landowners at farm level.

We began delineating compartments for the Simonsberg conservancy by using the existing cadastral boundaries for farms being members of the conservancy provided by Elsenburg, Western Cape Department of Agriculture. These data were overlaid on recent digitally corrected aerial photographs using GIS to assist in delineating an outer boundary for the Greater Simonsberg conservancy. Farms not belonging to the conservancy but within the outer boundary of the conservancy were included to form a continuous coverage. CapeNature had already completed a similar exercise for their "NBAL" units, in their case these are the same as their compartment boundaries. These boundaries correspond with features that are easily located in the field. Each of these coverages was then combined to create a "wall-to-wall" coverage of 189 compartments for the conservancy (Figure 11). Although this appears to be a straightforward process, much effort was needed to ensure that the resultant coverage had spatial integrity.

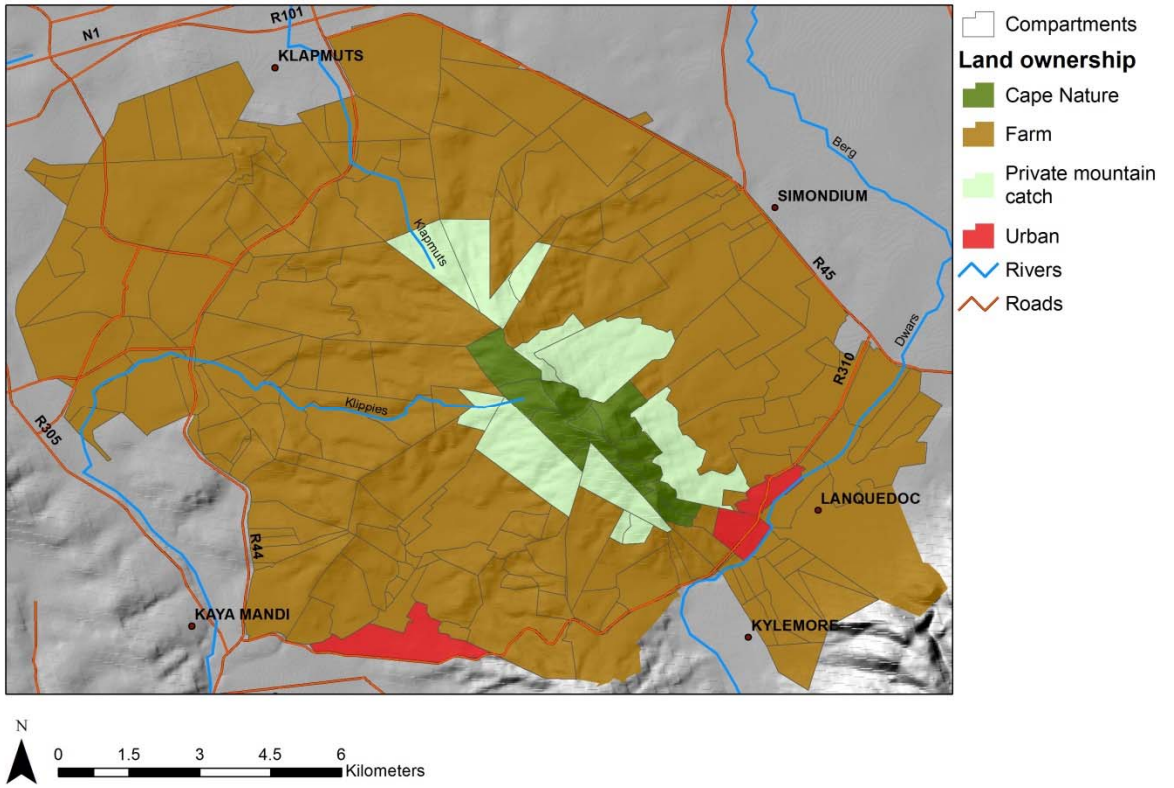


Figure 11: *Delineation of compartments per ownership category in the Greater Simonsberg Conservancy*

All the pertinent information for each compartment such as the water flows (runoff), accessibility, slope and the age of the veld is stored within a geo-database (Appendix 1). The information on historical and current invasions, previous control treatments and their costs is stored for each of the treatment units (NBALs) in the same geodatabase (Appendix 1). There is also a cross-link which tells us which NBALs fall within each compartment so this information can be summarised at the compartment level as well. The geodatabase allows for all this information to be easily retrieved and presented at a compartment level and for such information to be loaded into the Automated Management Unit Control Plan (MUCP) Generation Tool (Appendix 2) (see Section 5). An example is shown in Figure 12 where the average slope for each compartment is presented.

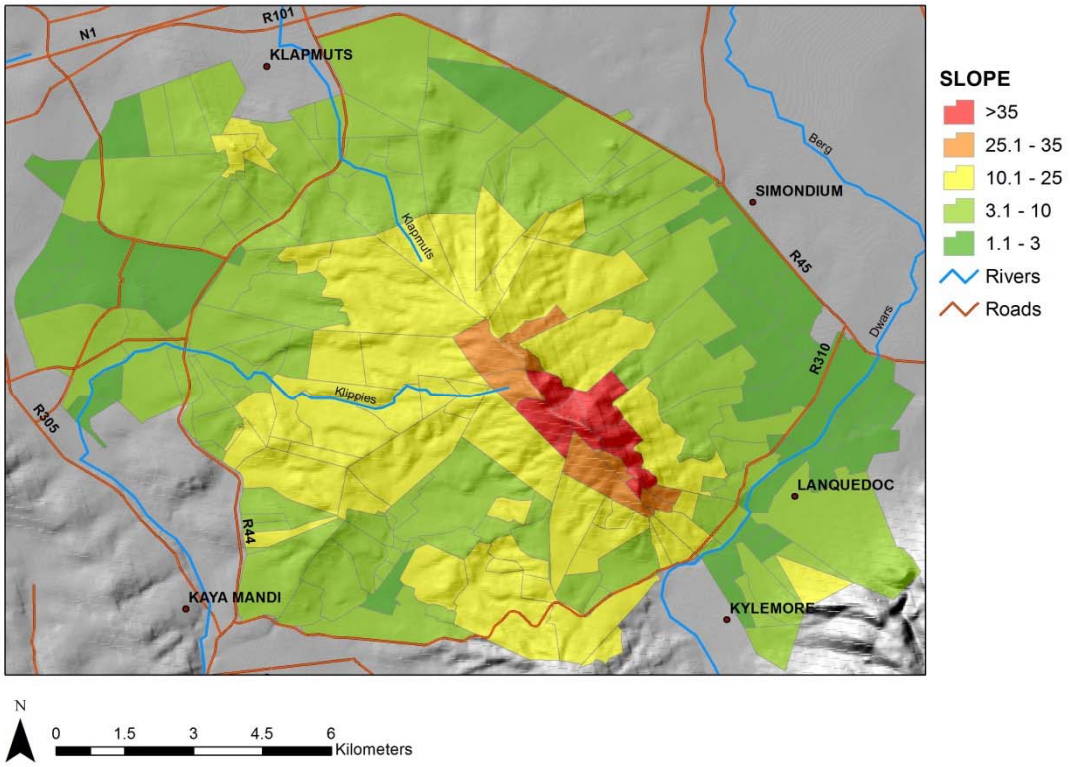


Figure 12: *The average slopes of the management compartments in the Greater Simonsberg conservancy.*

4 PRIORITISATION (Vision and goals)

Invasive alien plant control requires that managers match the available resources and budget with the work that needs to be accomplished so as to maximise benefits. This means that "trade-offs" often must be made in setting up schedules of which invasions plants will be treated and where over time. As described in Section 3 above, the entire catchment has been demarcated into management units known as "compartments", spatial units with clearly identifiable boundaries. The problem is to decide which of these compartments to treat first. This is influenced by the nature and extent of the invasions in each compartment at a given time, its treatment history, and the funds available to deal with the problem in a given budgetary cycle. Prioritisation is, therefore, critical for ensuring that both the individual treatments and the overall programme are as effective as possible.

The general approach to prioritisation is to firstly establish a clear goal that states a desired outcome of what needs to be achieved where and by when. Any such goal should be S.M.A.R.T (Specific, Measurable, Assignable, Realistic and Time-bound). Once the goal has been defined the next step is to develop the criteria (objectives) and sub-criteria (sub-objectives) that have to be realized if the goal is to be achieved.

A multi-criteria decision making process, the Analytic Hierarchy Process (AHP, Saaty 1990), was followed to develop a goal for invasive alien plant control operations in the catchment, to develop the criteria needed to achieve the goal, and to assess the relative importance of these criteria by allocating weights (ranking) to them by means of pair-wise comparisons. This was facilitated by using Expert Choice software (Anon 2009) to construct an AHP model for the catchment. The AHP process is useful for setting priorities when both qualitative and quantitative aspects of a decision need to be considered, and for achieving group consensus. The last step in the process was to identify the datasets that enabled objective comparisons to be made between compartments with regard to particular criteria.

Literature on the application of multi-criteria decision techniques suggests that the difficulties of comparing criteria increase as the number of criteria increases, with the optimal being around seven criteria (Saaty and Ozdemir 2003). The hierarchical structure followed by the AHP method reduces that difficulty somewhat as it groups criteria into clusters that facilitate comparisons. Even so, as the number of criteria increase, it takes more and more time to do the comparisons and participants become fatigued or lose interest and focus. Many of the criteria were also given low weights in the final models so they have little influence on the outcome. The aim is therefore to limit the prioritisation model to as few criteria as possible at each level in the hierarchy, while maintaining the diversity of views among stakeholders.

A number of stakeholders participated in a workshop held during September 2015 to construct a prioritisation model for the Greater Simonsberg conservancy. The major stakeholders in the area include the private landowners, Working for Water, CapeNature, Department of Water Affairs and Western Cape Department of Agriculture (Appendix 2). We deliberately followed a strategy of allowing the stakeholders at the workshop to establish a goal and set their own criteria as this facilitated participation and debate and got participants to agree to the final priorities that were identified. The process that was followed was participatory and transparent so that all the

contributors could check the outcomes of their discussions and decisions and alter these dynamically until a consensus was reached.

The workshop participants agreed on a common goal and timeframe for the control of IAPs in the Simonsberg conservancy, and the criteria needed to support this goal (Figure 13). They then assessed the relative importance of these criteria by allocating weights to them by means of pairwise comparisons (Figure 14).

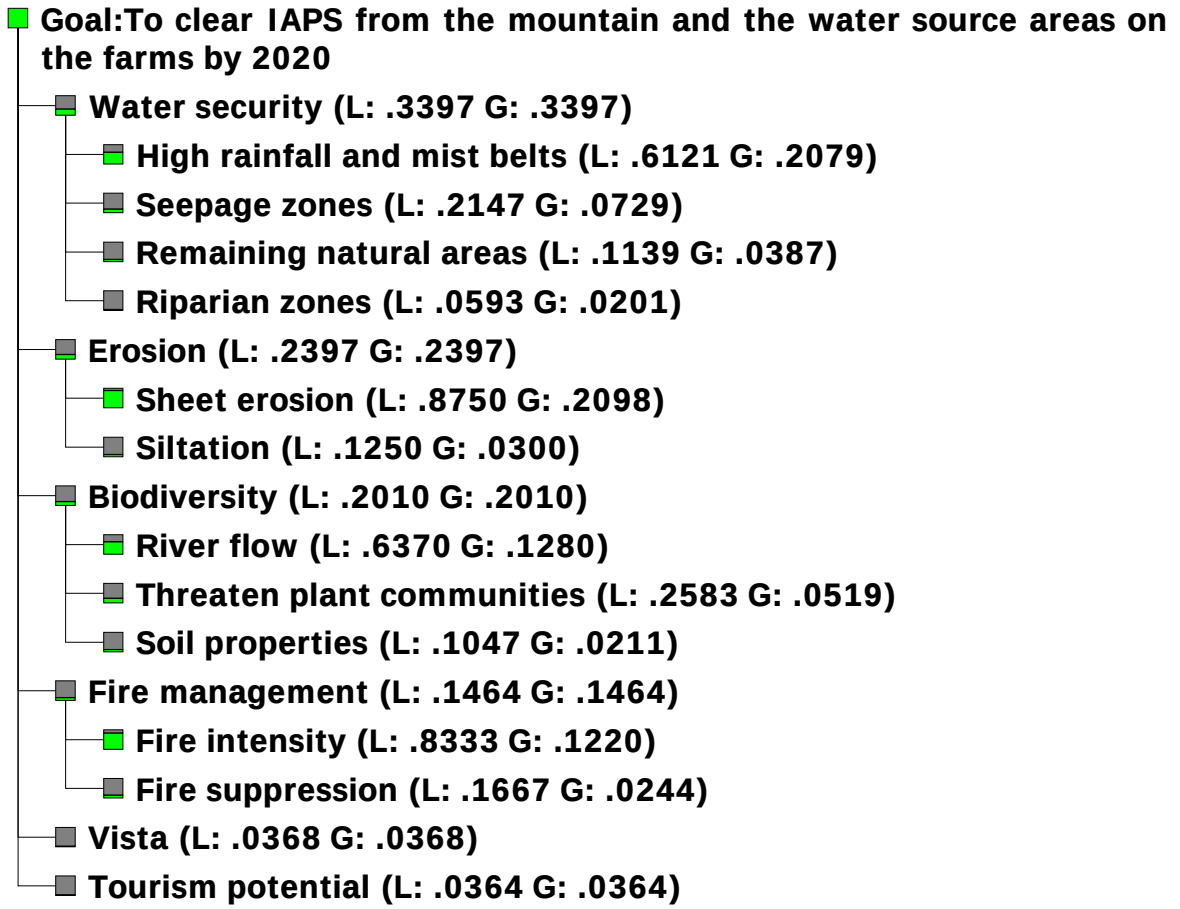


Figure 13: *Prioritisation model for the Greater Simonsberg Conservancy showing the goal and hierarchy of weighted criteria. G values refer to weights in relation to the goal while L values refer to weights for each covering criterion or sub-criterion.*

During the workshop participants indicated that they want to see the upper slopes of the mountain cleared from alien invasions by the year 2020. Most importantly, workshop participants assigned the highest priority (34%) to water security through control of IAP's in compartments having a high rainfall and run-off, protecting seepage and riparian zones as well as remaining natural areas. Containing erosion and enhancing biodiversity scored almost equal. For the latter criterion enhancing river flow and protecting threatened plant communities scored highest. Other factors to consider are fire management through better planning of fire suppression measures relative to the

location of different fuel types in the environment. Tourism is an integral part of the conservancy and experienced in many ways through hiking, mountain biking, wine tasting and mere scenery. Workshop participants therefore indicated the importance of tourists having an uninterrupted view of the mountain in its natural state, while hiking, biking etc.

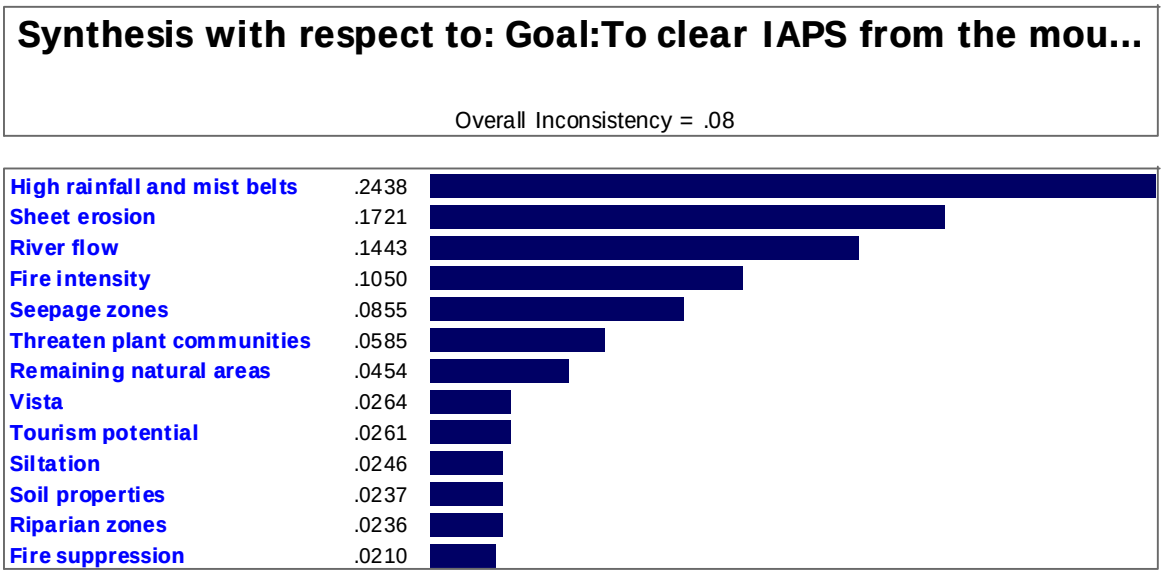


Figure 14: *Ranks assigned to individual criteria in the prioritisation model for the Greater Simonsberg Conservancy*

Initially the focus in developing the MUCP tool has been on getting the datasets formatted for the tool, implementing WfW's method of using their norms and standards to estimate the treatment cost per Nbal and assessing, together with the implementing agent, whether the estimated costs calculated by the MUCP tool are realistic based on their experience. This prioritisation model was used to calibrate the MUCP tool which in turn was used to generate a schedule of compartments and treatment for the next 20 years (see Section 5).

We were unable to find suitable datasets of some of the criteria in the prioritisation model (Figure 15) so the soil properties, tourism potential and fire suppression criteria were omitted. The remaining natural vegetation also overlapped extensively with the riparian zones, seepage areas and threatened natural communities, and was also omitted. The proto-type of the MUCP tool was not designed to use species characteristics in weighting compartments. This has meant that we have not been able to take species data into account in the tool's prioritisation. However, we do not believe that this has biased the priorities substantially as the combination of high rainfall, runoff and erosion potential has an overriding influence on the priorities assigned to compartments. In any case, the costs will remain the same and only the scheduling of compartments may have changed had more criteria been included.

5 ESTIMATING LONG TERM CLEARING COSTS (MUCP Tool outputs)

An Automated Management Unit Control Plan (MUCP) Generation Tool for planning and budgeting for invasive alien plant control is being developed on behalf of NRM by a firm of software developers, Handmade Connections. The system is known as the MUCP planning tool and it has the functionality of automating the planning of control operations for different budgets over a 20 year timeframe.

By linking the MUCP planning tool to important sources of information such as the status and impacts of invasions, conservation priorities, progress with control operations, the occurrence of events such as fires, and the availability of resources, Working for Water managers are able to set annual targets that are aligned with the overall goal and time frames set out in any MUCPs.

The approach used by the MUCP tool is to divide the entire catchment into compartments with are defined by fixed boundaries and can be located on the ground.

All the invasions in the catchment have been collated into mapped invaded units (MIUs) based on the characteristics of their invasions (e.g. species and densities). When invaded areas are identified for treatments, the portions of the MIUs in that designated area are included in that treatment unit (Nbal). Thus MIUs include invasions which have yet to be treated while Nbals include invasions which have been treated and have a treatment history. New Nbals (treatment units) are created during the process of generating clearing contracts.

An extensive wildfire occurred during January 2016 while we were compiling the data for this MUCP (see Section 2.6). This meant that we had to update the veld age data and the state of the invasions in each burnt compartment to take account of its current age how each of the species regenerates after fire. This meant changing all the species that coppice or resprout to a coppice stage in all the Nbals and MIUs that were burnt in the fire. Although it is still too soon (mid-March) to reliably determine seedling densities we have added seedling density records for all the species that we know will undergo mass recruitment from seedbanks after this fire, notably the *Acacia* species. We know that there will be very dense recruitment by both the *Acacia* and *Pinus* species so we have made the seedling densities double those of the adults or other maturity stages prior to the fire. Thus the densities of invasions shown in Figure 15, and in other figures below, are based on this adjustment. For all of these scenarios we have set the treatment intervals to 6 months for herbaceous invaders, including Rubus, 36 months for pine species and 12 months for all the other species. We know that this is less than the time the various species will require to reach reproductive maturity, but we also know that there will be a lot of seedling follow-up work and want to ensure that it is tackled timeously. The initial treatments have been set to reduce the density of all species by 20%, follow-ups by 15% and the rate of increase in density in the absence of treatment has been set at 10% per year (van Wilgen and Le Maitre, 2013). We know that these post-treatment decreases may be underestimating the efficacy of the treatments, but we also know that treatments can, and sometimes do, fail and we want to allow for that. Although the most effective approach is

to controlling invasions is to focus on low densities, in this case it is essential to control as much of the seedling regeneration as possible before it reaches reproductive maturity. We have changed the priorities to focus on follow-up by making areas with a post-fire age of less than one year and with dense stands a priority. This differs from what the pre-fire prioritisation model emphasised (Figures 13 and 14), but we believe that this is appropriate for the current circumstances. We also strongly recommend that the LUI participants ensure that they have the biocontrol agents operating effectively and actively in the unburnt areas and facilitate their recolonization of any untreated regeneration as soon as they reach a suitable reproductive stage for the various agents to attack.

Replace Figures and budget amounts once post-fire densities reworked – and comment on increase in budgets/time frames

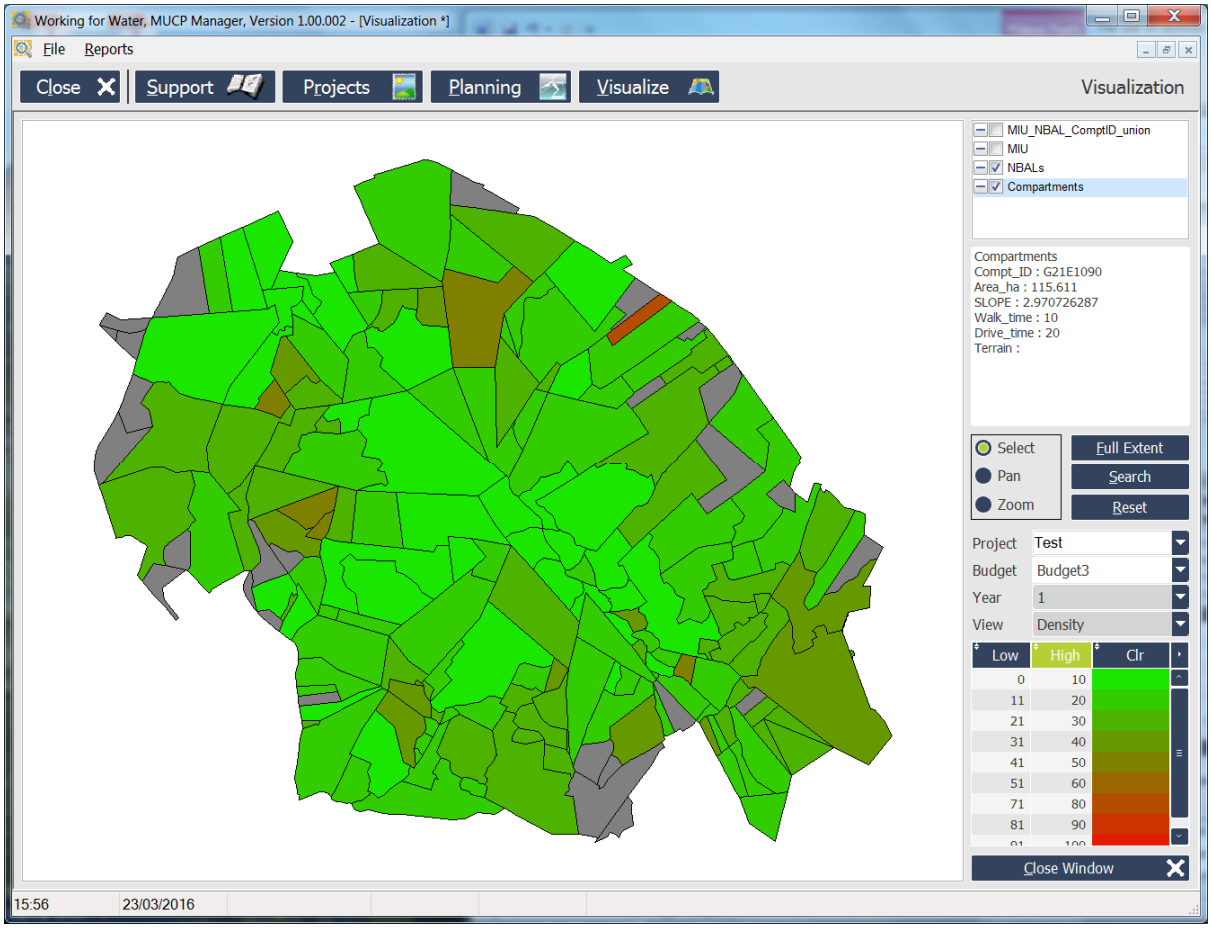


Figure 15: *Location of compartments in the Greater Simonsberg Conservancy showing IAP densities. Grey shaded compartments have no mapped invasions*

Every Nbal falls within an MIU and they in turn nested within compartments. In the case of the Greater Simonsberg Conservancy some areas have been worked on since 2000 so there are many Nbals which have long clearing histories. The MUCP tool is used to schedule future work and, therefore uses both MUIs and Nbals when scheduling initial and follow-up treatments for MUIs and

follow-up treatments for Nbals. Although the distribution of invasion densities follows the same general pattern as the compartments (Figure 15), they do show the complexity of the mixture of invasions densities in the catchment we expect to have by September 2016 (Figure 16).

Replace Figures and budget amounts once post-fire densities reworked – and comment on increase in budgets/time frames

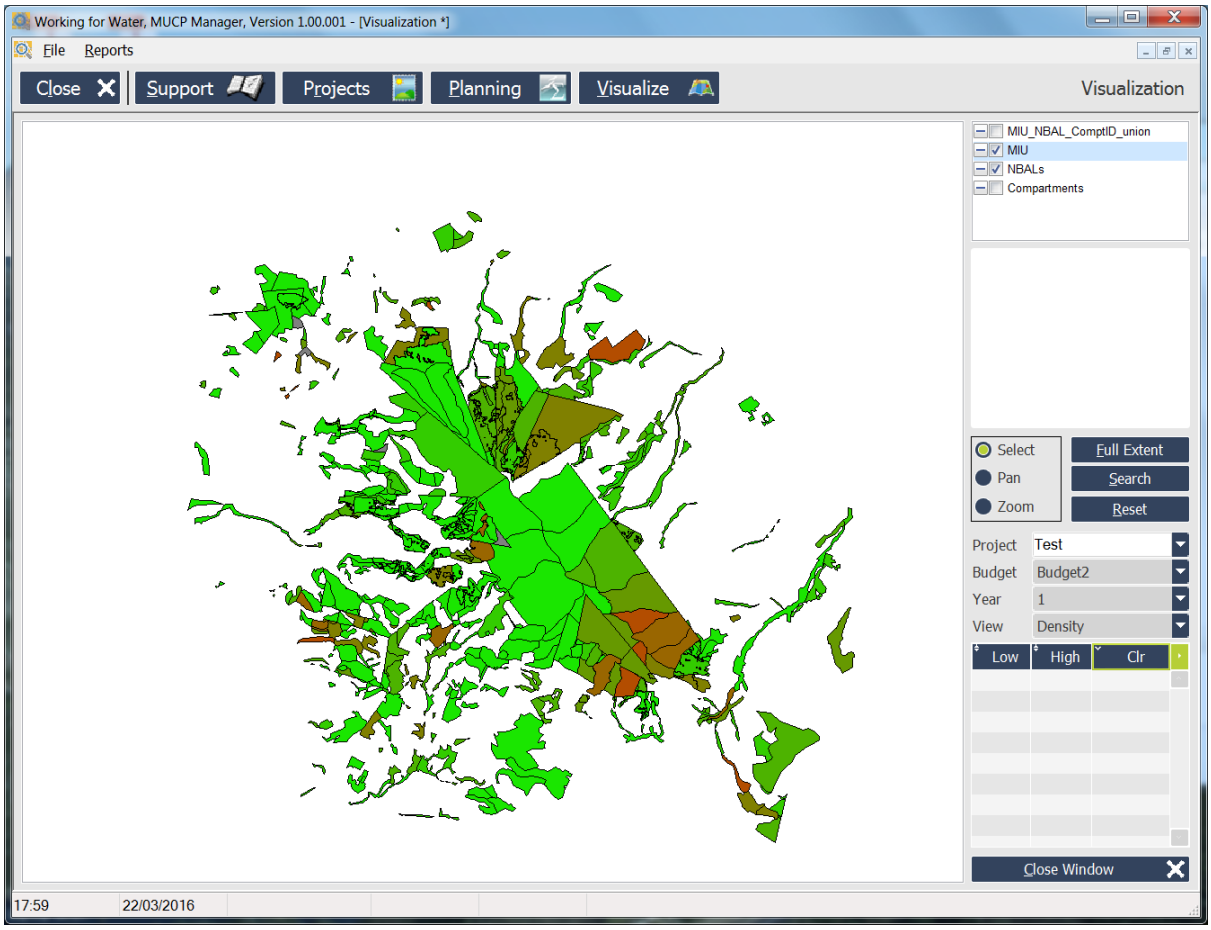


Figure 16: *Location of MIUs and Nbals in the Greater Simonsberg Conservancy together with IAP densities*

The tool applies different annual budgets over a period of the next 20 years based on the prioritisation of the compartments for clearing. In this case the annual budgets ranged from a ceiling of R 1.25 million to an unlimited amount (Figure 17).

The duration and total annual cost for each treatment unit, either an Nbal or a MIU, for each species and treatment is displayed in the top panel. The bar chart in the middle panel gives total cost per year with different colours for different annual budgets ceilings. The line graph in the bottom panel shows how average species densities change in the catchment over time for each of these budgets. Once the levels of invasion have been reduced to < 1% of canopy cover, then the compartment is

under maintenance. Although it appears as if the budgets drop to zero after a number of years there is ongoing maintenance for the remaining years, but the maintenance amounts are too small to be apparent at this scale.

Replace Figures and budget amounts once post-fire densities reworked – and comment on increase in budgets/time frames

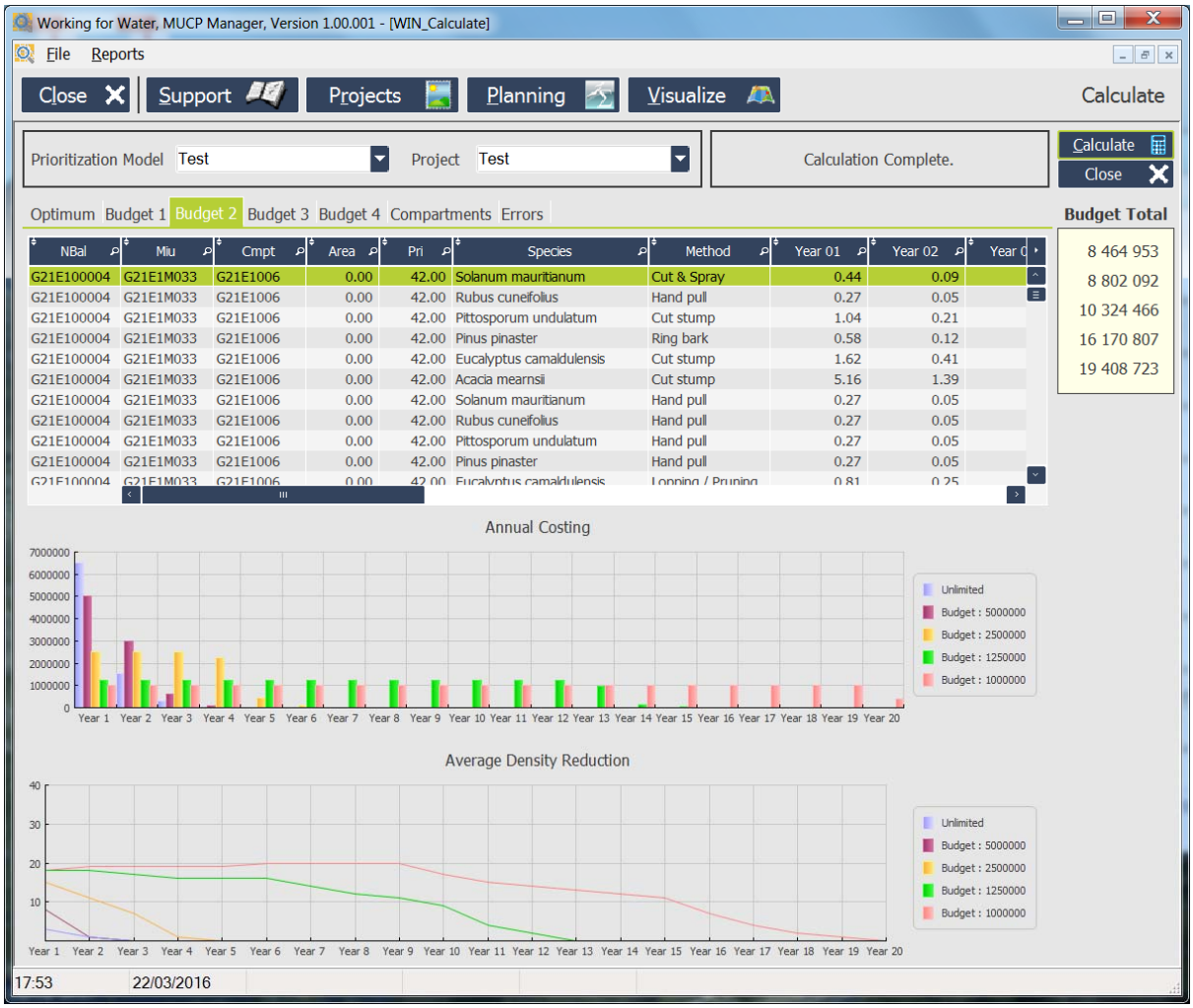


Figure 17: *Summary of the annual budget per compartment for the next 20 years based on the prioritisation of the compartments for clearing and different annual budget ceilings.*

The maintenance level is reached after 7 years with a budget of R2.5 million whereas with budget of R 1.25 million you will only be able to contain the invasions after about 14 years. A budget of R 1.0 million will achieve maintenance from year 20 onwards. The greatest total expenditure over the next 20 years is R 19.5 million for the R 1.0 million budget ceiling whereas a budget ceiling of R 5.0 will result in an overall saving of R 10.7 million. The R1.25 million per annum budget only allows for

invasions to be contained at a mean density of about 22%, this is clearly not an effective option. Compartment schedules showing the annual costs per compartment for two different annual budgets, R 1.25 million and R 2.5 million, for the next 15 years, and sorted by priority, are given in Annexures 4 and 5.

The visualization of the location of the compartments identified for treatment in the first year (year one) of control if the annual budget is set at R 1.25 million shows the high levels of expenditure projected for certain compartments (Figure 18). Most of the compartments prioritised for expenditure in year one are in in areas having a high mean annual runoff.

Replace Figures and budget amounts once post-fire densities reworked – and comment on increase in budgets/time frames

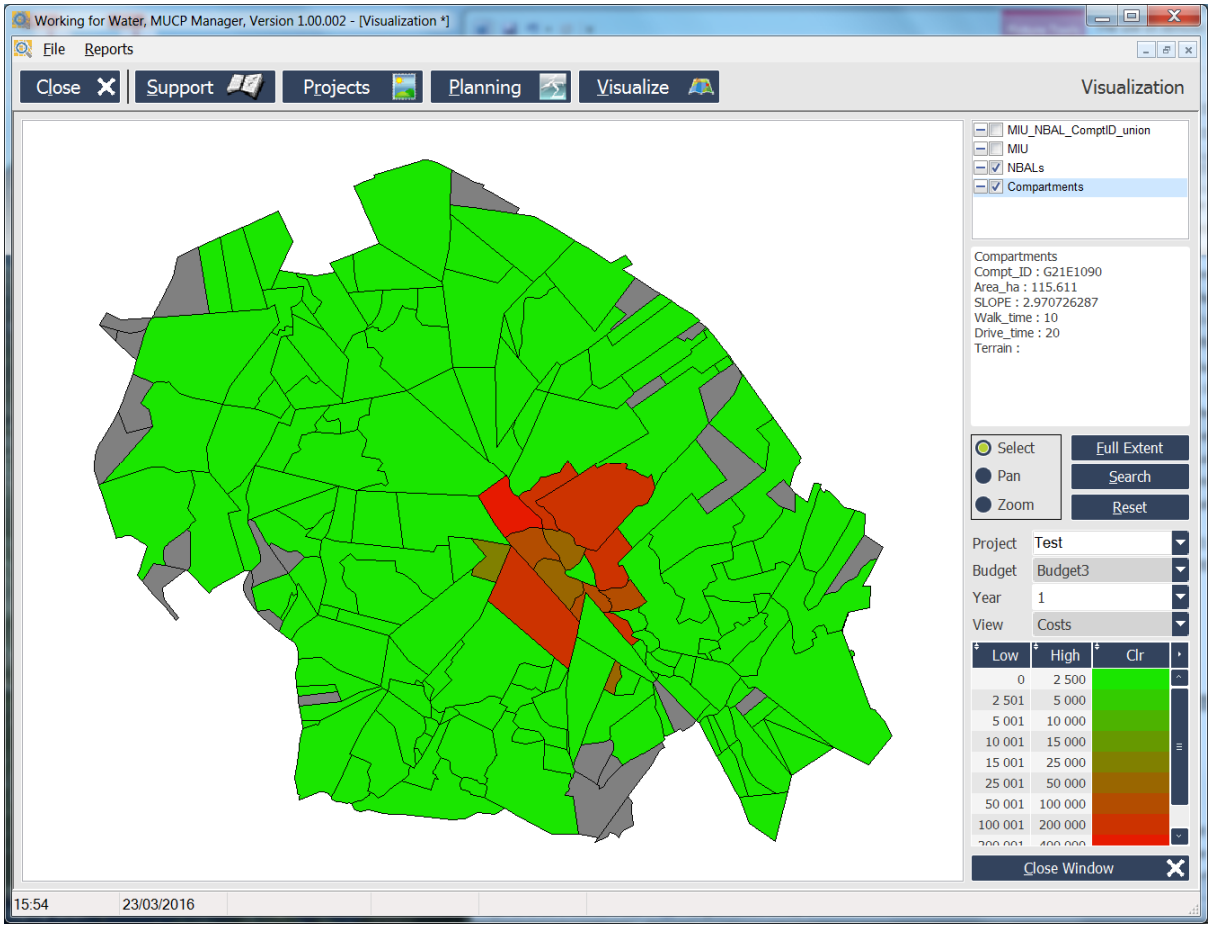


Figure 18: *Location of compartments that will receive treatments during the first year if the annual clearing budget is set to R 1.25 million (Budget 3). The shading from green to red indicates the increasing costs of the treatments. Grey shading indicates compartments with no mapped invasions*

Similarly the visualisation of the location of the compartments identified for treatment first year (year one) of control if the annual budget is set at R 2.5 million (Figure 19). More compartments can be treated compared to the smaller budget of R 1.25 million (Figure 18). Once again compartments in areas having a high mean annual runoff are in the majority.

Replace Figures and budget amounts once post-fire densities reworked – and comment on increase in budgets/time frames

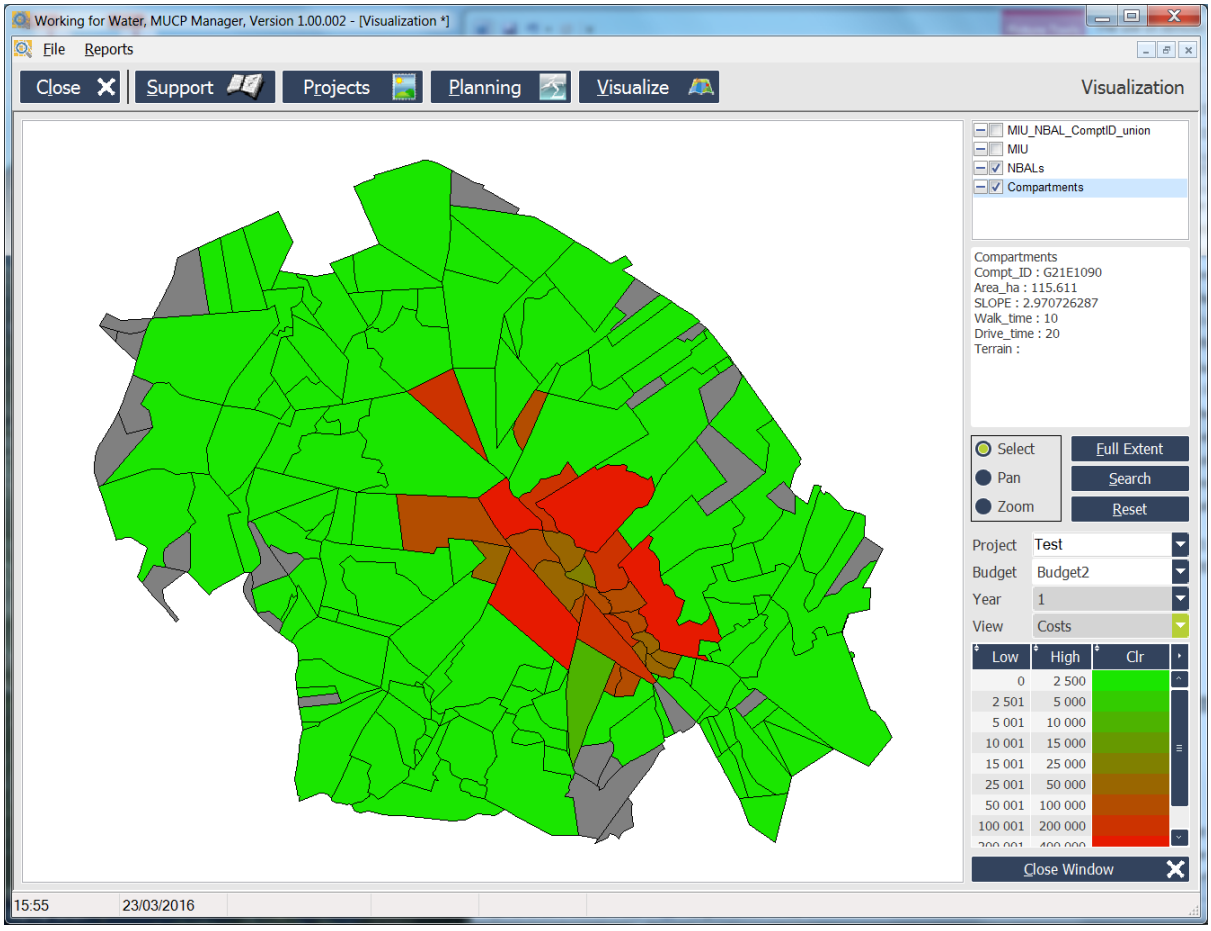
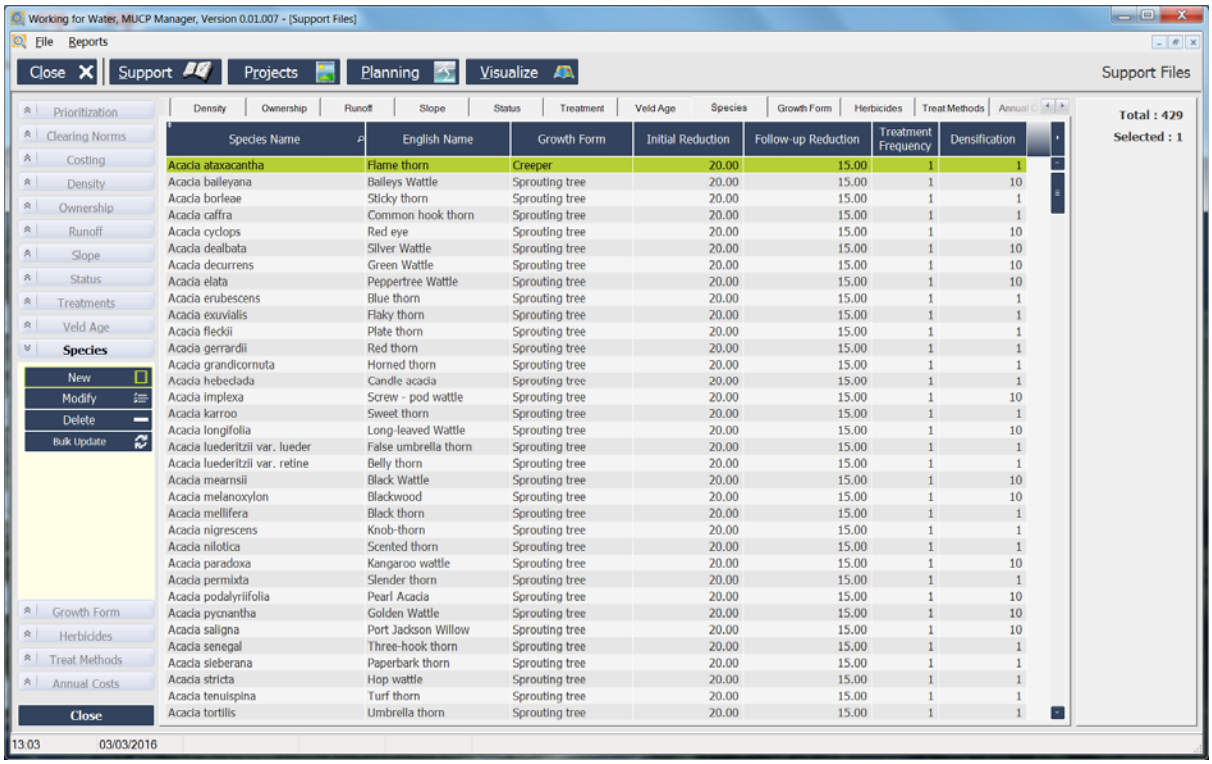


Figure 19: *Location of compartments that will receive treatments during the first year of clearing if the annual clearing budget is set to R 3.5 million (Budget 3). The shading from green to red indicates the increasing costs of the treatments per compartment.*

Another feature of the MUCP tool is that it is preloaded with WfW norms data and formulas for calculating person days, including team sizes, daily rates, and daily workloads for different species-linked treatments (e.g. herbicide on cut stumps, lopping) and densities and adjustments for slope and other factors. The MUCP tool also includes information on the typical reduction in densities after initial and follow-up treatments which can be adjusted by the user either for individual species of for selected groups of species (Figure 20). The user can also adjust the treatment frequency and how rapidly invasions by different species become denser if left untreated.



Species Name	English Name	Growth Form	Initial Reduction	Follow-up Reduction	Treatment Frequency	Densification
Acacia ataxacantha	Flame thorn	Creeper	20.00	15.00	1	1
Acacia baileyana	Baileys Wattle	Sprouting tree	20.00	15.00	1	10
Acacia borleae	Sticky thorn	Sprouting tree	20.00	15.00	1	1
Acacia caffra	Common hook thorn	Sprouting tree	20.00	15.00	1	1
Acacia cyclops	Red eye	Sprouting tree	20.00	15.00	1	10
Acacia dealbata	Silver Wattle	Sprouting tree	20.00	15.00	1	10
Acacia decurrens	Green Wattle	Sprouting tree	20.00	15.00	1	10
Acacia elata	Peppertree Wattle	Sprouting tree	20.00	15.00	1	10
Acacia erubescens	Blue thorn	Sprouting tree	20.00	15.00	1	1
Acacia exuvialis	Flaky thorn	Sprouting tree	20.00	15.00	1	1
Acacia fleckii	Plate thorn	Sprouting tree	20.00	15.00	1	1
Acacia gerrardii	Red thorn	Sprouting tree	20.00	15.00	1	1
Acacia grandicornuta	Horned thorn	Sprouting tree	20.00	15.00	1	1
Acacia hebeclada	Candle acacia	Sprouting tree	20.00	15.00	1	1
Acacia implexa	Screw - pod wattle	Sprouting tree	20.00	15.00	1	10
Acacia karroo	Sweet thorn	Sprouting tree	20.00	15.00	1	1
Acacia longifolia	Long-leaved Wattle	Sprouting tree	20.00	15.00	1	10
Acacia luederitzii var. lueder	False umbrella thorn	Sprouting tree	20.00	15.00	1	1
Acacia luederitzii var. retine	Belly thorn	Sprouting tree	20.00	15.00	1	1
Acacia mearnsii	Black Wattle	Sprouting tree	20.00	15.00	1	10
Acacia melanoxylon	Blackwood	Sprouting tree	20.00	15.00	1	10
Acacia mellifera	Black thorn	Sprouting tree	20.00	15.00	1	1
Acacia nigrescens	Knob-thorn	Sprouting tree	20.00	15.00	1	1
Acacia nilotica	Scented thorn	Sprouting tree	20.00	15.00	1	1
Acacia paradoxa	Kangaroo wattle	Sprouting tree	20.00	15.00	1	10
Acacia permixta	Slender thorn	Sprouting tree	20.00	15.00	1	1
Acacia podalyriifolia	Pearl Acacia	Sprouting tree	20.00	15.00	1	10
Acacia pycnantha	Golden Wattle	Sprouting tree	20.00	15.00	1	10
Acacia saligna	Port Jackson Willow	Sprouting tree	20.00	15.00	1	10
Acacia senegal	Three-hook thorn	Sprouting tree	20.00	15.00	1	1
Acacia sieberana	Paperbark thorn	Sprouting tree	20.00	15.00	1	1
Acacia stricta	Hop wattle	Sprouting tree	20.00	15.00	1	1
Acacia tenuispina	Turf thorn	Sprouting tree	20.00	15.00	1	1
Acacia tortilis	Umbrella thorn	Sprouting tree	20.00	15.00	1	1

Figure 20: *Species information contained in the MUCP tool as listed in WfW norms for calculating contract work loads.*

The historical data on the treatments and state of the Nbals in the MUCP is extracted from the data stored in WIMS, so it is important that data are captured correctly in the field and entered correctly into WIMS and conform to the standards (Le Maitre et al. 2016; NRM in preparation). The project managers now have smart phone based apps which they can use for mapping Nbals and recording the state of invasions which eliminates the potential for errors in recording the information on paper and entering the data into Working for Water Information Management System (WIMS).

6 IMPLEMENTING THE PLAN

When the Working for Water programme was launched in 1995, the general perception was that the programme would be able to control invasive alien plants (IAPs) effectively and reduce invasions to maintenance level. It would do this by accepting responsibility for controlling all invasions on state land and do the initial clearing and two follow-ups on private land. Experience has shown that the programme was not able to achieve effective control and that the only hope for achieving such control was to actively involve everyone who owned or managed land in the clearing effort. This has brought about a shift in the programmes policies and operations of the Chief Directorate of Natural Resource Management programmes (NRM) and it is now changing its main funding model to support both government non-government IAP management initiatives through what are called Land-User Incentives. In parallel, they have promulgated regulations (DEA 2014) that will enable them to use the provisions of the NEM: Biodiversity Act (DEA 2004) to compel all land owners and organs of state to develop and implement invasive alien species management plans. They have also developed a National Strategy for Biological Invasions which sets out what needs to be done to being invasions by alien species under control (NRM 2014).

This means that NRM now have three key things in place to bring invasive alien species under control: (a) an approach that seeks to motivate land owners to take responsibility for clearing, (b) legislation to compel those that do not, and (c) a strategy which sets out what is needed to achieve control. What they are now seeking is for the land owners in the Upper Berg River catchment to jointly take on the responsibility of controlling the invasive species under control. They could take the lead role themselves, or through their implementing agent, but they really want all land owners to take ownership. This plan shows that IAPs in this catchment can be brought under control providing there is sufficient funding and the problem is tackled systematically and the treatments are executed efficiently and effectively and it provides a schedule of those treatments that will result in the greatest benefits (e.g. water flows released and biodiversity protected).

This means that the next key step is for the stakeholders, who include the multiplicity of land owners¸ to decide who will represent them and take the lead in ensuring that this plan will be implemented. The regional office of the Working for Water programme will remain involved, as will its implementing agents because there are extensive state lands in the catchment. They will also need the active participation of other land owners in the execution of that plan but they have a key incentive – those land owners need to have a management plan for their land but by actively participating in this plan they can meet their legal obligations without having to invest in their own plans. And so can all the organs of state involved in this plan.

Given this, we suggest that a Steering or Project Implementation Committee (PIC) comprising representatives of the main stakeholders, including the current implementing agents, should be appointed and assigned the responsibility of ensuring that this plan is implemented. In the case of the Simonsberg the main bodies to represent on a Project Implementation Committee would be the Greater Simonsberg Conservancy and CapeNature. The next step would be to ensure that the current plan schedule of operations generated by the MUCP tool is evaluated by the stakeholders

and that all those involved agree that it will meet their needs and achieve the goal they set (section ##). The current implementing agents are receiving large budgets for clearing on state and private land but much of CapeNature's funding is being invested in the other parts of the Jonkershoek Reserve at present.

Securing an adequate budget to ensure that meaningful progress can be made in a reasonable timeframe of 10 years. Unless the programmes of the conservancy and CapeNature are well co-ordinated there is a possibility that they will not be working on complementary prioritised compartments leading to slower progress.

This means that more funding will be needed to secure the R5.0 million that the tool estimates will be required to reduce the IAPs in the catchment to maintenance levels within a reasonable timeframe of 10 years and save R9 million in the long-term. A key factor that will help them to secure the necessary funding from NRM will be the willingness of the parties involved to co-fund the clearing operations (e.g. private farmers using their own labour when they have spare capacity). They will also have to agree on how the NRM funds will be channelled and used and on how they will coordinate their operations. What will not work is if an unfunded mandate is given to any particular organisation. Another challenge will be maintaining stakeholder motivations over what is a long-time period and effective assessment of progress will be a key element in sustaining active participation.

No matter what the available budget, implementation of the clearing programme should always start in compartments with the highest priorities and proceed over time to those having lower priorities (Forsyth et al. 2012). In this way available budgets will be applied to achieve the maximum benefits. The PIC should begin by working through the top priority compartments listed in Appendix 4 or 5. These compartments need to be assessed and inspected to determine who are the land-owners, what has been done in the past, and to verify the current state of invasion. If this matches what the tool suggests, then the PIC need to agree jointly on who will execute the necessary treatments, the source of the funds and whose resources (e.g. labour, equipment) will be deployed. Should that compartment require more or less funding, then the planned budgets can be adjusted by the PIC and fed back into the tool. A key criterion under the goal is the high priority given to ensuring that uninvaded areas are kept clear of new invasions. This means that a portion of the overall budget needs to be set aside for surveys of these areas, with some contingency funding and resources to deal with such invasions appropriately.

This prioritisation will need to be re-examined should a wildfire or any substantial change such as a flood occur in the catchment. Such was the case in January 2016 when a wildfire burnt most of the Simonsberg. This will involve adjusting the underlying data to reflect the post-fire or flood environment, reconsidering the criteria in the prioritisation model and then running the MUCP tool to revise the list of priority catchments their associated clearing costs.

It is essential to report accurately on progress and for the Project Implementation Committee to ensure that the progress is evaluated against the goals and the schedule for each year. Planning should be revised when progress does not match the planned outcomes or meet expectations. Irrespective of the rate of progress, there are always circumstances that change or other unanticipated changes, and the plan should be formally revised every 5 years. Evaluating progress

and reflecting on, and learning from the past so that things can be done more effectively in future, is the heart of the adaptive management approach which NRM is attempting to implement in all the work that it funds.

7 BACKGROUND INFORMATION (WHAT IS INVOLVED?)

7.1 Natural Resource Management: what it does and how it works

The national Department of Environmental Affairs (DEA) has a number of programmes aimed at achieving environmental goals and creating meaningful employment[2]. The Chief Directorate of Natural Resource falls under the Environmental Programmes (EP) branch is one of six branches within the DEA. Its aim is to: "*address the threats to the productive use of land and water, and the functioning of natural systems by invasive alien species, wild fires and land degradation, as well as the opportunities for value added industries (including fibre and furniture production), whilst ensuring meaningful livelihood opportunities are supported for those employed in doing this work*". It has a number of programmes aimed at achieving this, including:

- Working for Water (WfW) was established in 1995 and focuses on controlling alien plant invasions either directly or through a range of implementing agents and a variety of incentives aimed at motivating the private sector to participate in invasive alien plant species management.
- Eco-furniture, Working for Biomass and Working for Energy all of which focus on using the material generating by the clearing of alien plant invasions to produce products.
- Working for Forests and Working for Ecosystems focus on rehabilitating degraded indigenous forests and rangelands, respectively, to functional ecosystems so ensure that they deliver ecosystem services including forage, fibre and other natural products. Working for Forests also includes the rehabilitation of neglected state plantations and woodlots to productive systems.
- Working for Wetlands which rehabilitates wetlands using engineered structures (e.g. gabions) and natural methods (e.g. planting wetland species) to ensure that they deliver ecosystem services.
- Working on Fire implements an integrated approach to veld and forest fire management to enhance the protection of life, livelihoods and assets and maintain ecologically sound fire regimes in fire-prone ecosystems. Working on Fire also does clearing of invading alien plants in rugged terrain using funding from the WfW budget.

DEA's EP branch has also launched a programme which focuses on Biosecurity whose aim is to: "protect the environment from high-risk invasive alien species through the pre-, at- and post- border management of non-indigenous species." This programme focuses on preventing and minimising invasions by high-risk alien species by educating the public about the risks, inspections of goods and baggage entering South Africa, surveys aimed at detecting new invasions, and directing teams to eradicate them wherever possible. They work closely with the Invasive Species Programme of SANBI (SANBI-ISP) to ensure that their efforts are well coordinated.

[2] See https://www.environment.gov.za/projectsprogrammes

The Working for Water programme is the lead agent for the control of invasive species but the other programmes undertake clearing where WfW does not need to be directly involved or where their special skills are needed (e.g. Working on Fire). They support control measures against invasive alien plants by providing funds and resources in a number of ways:

- Direct involvement in the management of the clearing teams where they provide all the resources, employ and train people, and oversee the operations;
- Indirect involvement through the funding of:
    - Control operations managed by implementing agents; in the case of the Upper Berg catchment these agents include:
        - The Winelands District Council who have been clearing the Simonsberg conservancy Dam area and elsewhere in the catchment, focusing on the middle and lower slopes, valley bottoms and river floodplain.
        - CapeNature for the higher lying areas.
        - Working on Fire for the steep areas which require specialised safety precautions and skills, such as rope-work.
    - Land-user incentives (LUIs) where groups of land-owners apply for funding to carry out control operations on their land (not yet active in this catchment). These initiatives can also include way of using the material (biomass) from the clearing to produce products and rehabilitation of degraded land and river systems.
    - Other inputs such as providing herbicides and advice to land-owners.
    - Working with the nursery trade to minimise introduction of invasive species and to stop selling species known to be invaders
- Support for the introduction and maintenance of biological control agents for invasive alien plants in the catchment, as well as research into agents for invasive aliens plants which do not yet have effective agents.

The WfW programme also work with the LandCare programme of the Department Agriculture, Fisheries and Forests who have been overseeing the clearing of invasions on private land.

The only way to achieve effective control of the alien plant species in this catchment and achieve the goal of reaching a state where only maintenance operations are needed is for every stakeholder to play their part. The failure to develop more effective working relationships, and thus to sustain clearing work already undertaken, is one of the key factors contributing to the overall failure to reduce the extent and impacts of invasions over the past 15 years (van Wilgen *et al*., 2012). This is one of the key reasons why WFW has invested resources in designing and testing various ways of supporting the involvement of other parties in invasive alien plant control as described above. Those responsible for implementing this plan need to ensure that all these options are used to achieve the goal of reaching maintenance levels by 2020.

7.2 Components of Effective Invasive Alien Plant Management

South Africa is one of many countries investing in the management of invasive species and there is a lot that can be learnt from their experiences and ours about what is required for effective management. The recently developed, but still not formally released, National Strategy on Dealing with Biological Invasions (NRM, 2014) builds on that experience. This strategy recognises the following things as requirements for its effective implementation:

- An integrated approach based on co-ordination and collaboration across all sectors and levels of government
- Establishment of an effective legislative and regulatory environment
- Management of invasions which entails prevention, eradication where possible and desirable, and optimising the reduction of adverse impacts by reducing the rate of spread and preventing increases in density (asset protection)
- Effective management of information on invasions and the actions being taken and making such information readily available
- Ensuring that there is adequate monitoring and evaluation so that the effectiveness of the implementation can be continuously improved
- Providing adequate resources to carry out all these measures, including capacity development
- Supporting research to provide to evidence needed to support decision making
- Raising awareness of the problem and the need to act

In particular, this plan must make provision for resources to address all the components of effective management of invading species (Hulme, 2006; McNeely *et al*., 2001; NRM, 2014): prevention, eradication and reducing impacts (i.e. asset protection).

- ***Prevention*****:** actions aimed at ensuring that no new invasive species are introduced to the catchment. Since most invaders are introduced to new areas by people, the primary way of doing this would be through educating the inhabitants about the risk involved in growing or planting alien species. Only a small proportion of all the alien species are invasive but prevention is better than cure. A lot of information on risky and safe species is available on the internet (see sections 7.8 and 7.9). The SANBI-ISP has regional representatives who can be contracted should anyone identify a suspicious species and confirm whether or not it is a new invader (see sections 7.8 and 7.9).
- ***Eradication*****:** involves taking action to ensure that the population of a newly introduced or established species is completely removed or killed and does not re-establish itself. The SANBI-ISP representative, Working for Water manager or the local Plant Protection Research Institute office should be contacted for advice on what to do (see sections 7.8 and 7.9).
- *Containment*: stopping further spread in part or all of the current range of an established invasive species and is another important component of a comprehensive control programme. In the context of this catchment this would involve ensuring that newly established individuals of existing invaders would be removed. The most practical way to do this is through regular surveys of uninvaded areas and removing any invaders that are found to ensure that these areas remain uninvaded.

- *Impact reduction/asset protection*: This involves following a systematic clearing programme in each invaded area: beginning with the initial treatment, then a sequence of follow-up treatments to ensure that all the invading species are reduced to the minimum; and finally ongoing maintenance to deal with any re-establishment. The sequencing of the areas for treatment should be based on the priority assigned to the compartment the invasion occurs in. It is important that these steps are followed but also that they are applied flexibly to ensure that opportunities to make more rapid progress, or avoid going backwards, are taken. One example of this is fires. Fires will facilitate the spread of most alien plant invaders and will result in increases in their densities. However fires can also offer opportunities by opening up dense invasions or replacing adult plants with seedlings which are much less resource intensive to control. If these opportunities are not grasped timeously, then gains made over many years can be lost.

Another essential component of this plan is to make effective use of biological control (biocontrol) which uses natural enemies of invading species to kill them or reduce their growth or seed production. Biocontrol is particularly important because there aren't enough resources to carry out control operations everywhere but biological agents can be introduced everywhere. They will reduce rates of spread and the invader density and impacts significantly in those areas where there are no control operations yet. The agents are carefully selected, bred, tested for specificity and effectiveness and, once they show promise, are then released to attack the species they were selected to target. This is a very cost-effective method of control for many invading species and limits both their ability to spread and to form dense, single-species stands. The WfW programme has regional biological control managers whose job it is to assess whether the agents are being effective, introduce new agents where necessary and maintain reserves for biocontrol agents among others. Contact details are given under Sources of information (see sections 7.8 and 7.9).

7.3 Capacity and Resources

A core component of WfW is human capacity development of staff and beneficiaries (contract workers) and more information can be found on their website:

https://www.environment.gov.za/projects programmes/wfw/resources/

Working for Water has produced a staff induction manual outlining the operations and procedures within Working for Water. There are clear requirements for employees to undergo a minimum of 48 days of training according to a prescribed training plan. Training is available for both workers and contractors to improve skills and knowledge on biodiversity and environmental practices (Table 8). For example, accredited training programmes developed by the Wildlife and Environment Society of South Africa (WESSA) provide a range of qualifications. A training matrix outlines the required courses on clearing in Terrestrial and Aquatic environments, Health and Safety, Social Development and Contractor Development. This training matrix provides information on the requirements, standards and appropriate training level (Appendix 3).

Table 8: *Websites and links related to WfW capacity development*

Training topic	Website address
Training matrix	http://workingforwater.org/features/course-information-and-materials
Staff induction manual	https://www.environment.gov.za/sites/default/files/legislations/staffinduction.pdf
WESSA training courses	http://www.wessa.org.za/uploads/documents/projects/Capacity_for_Catchment_%E2%80%93_uMngeni_Ecological_Infrastructure_on_organisations_and_courses.pdf

7.4 Communications and Advocacy

Communication should address:

- Maintaining a contact list and a website
- Regular meetings with stakeholders and the purpose of such meetings
- Updates on legislation which can be found on WfW website and www.invasives.co.za
- Further interventions in the conservancy

Advocacy focuses on motivating land owners, other bodies and the general public to become actively involved.

Communications on invasive alien plants and their management are communicated from different platform. These are in the form of pamphlets, factsheets newsletters and information can be accessed from different websites. The planning of invasive alien control program can be viewed online and contains information of the annual plan of operations. Some useful ones are listed in Table 9.

***Table 9:** Websites and links related to communications and advocacy*

Topic	Content	Website address
WfW clearing strategies	It outlines the Working for Water approach, manifesto and research agenda and contains information on clearing strategies, recent research, herbicide registrations and APO plans.	www.wfw.org.za or https://sites.google.com/site/wfwplanning/
WfW training standards	Contains information for trainers and trainees including training and norms and standards needed for workers and contractors, and the levels of qualification that can be obtained.	www.workingforwater.org
WfW overview	Overall view of the working for water programme and how it aligns with governments bodies.	https://www.environment.gov.za/projectsprogrammes/wfw https://www.environment.gov.za/projectsprogrammes/wfw/resources
WfW	This focus is on the planning, operational support and quality assurance terrestrial, invasive alien plant control in South Africa	www.wfw.org.za or https://sites.google.com/site/wfwplanning/
SAPIA and PPRI	Regular newsletters (quarterly?)	http://www.arc.agric.za/arc-ppri/Pages/Newsletters.aspx
National Information on invasive alien species		www.invasives.org.za /

7.5 Legal Background and Requirements

There are two laws and their respective regulations that deal with invasive alien species in South Africa. One is the Conservation of Agricultural Resources Act (CARA), 1983 (Act No 43 of 1983) and its regulations and the other is the National Environmental Management: Biodiversity Act (NEM:BA), 2004 (Act No. 10 of 2004) (DEA, 2004) and its regulations.

The CARA was originally intended for use in regulating agricultural weeds but was also used for plant invaders on land not used for agricultural purposes. However there were problems with the scope and implementation of CARA and the NEM:BA was drafted specifically to address environmental invasion problems and enable the Department of Environment Affairs to manage alien species invasions directly. This section deals with the relevant provisions of the NEM:BA and its current regulations (R. 598 of 1 August 2014) (DEA, 2014) (see Appendix 1 for relevant extracts from the Act and the regulations).

The NEM:BA contains two sections relating to programmes or plans for the management of invasive alien species (DEA, 2004): (1) Section 75 on the *Control and eradication of listed invasive species*, and; (2) Section 76 on the *Invasive species control plans of organs of state*. Section 75 paragraph (4) requires the relevant minister to *ensure the coordination and implementation of programmes for the prevention, control or eradication of invasive species*. Section 76 requires all organs of state, including protected area management authorities, to develop invasive species monitoring, control

and eradication plans for land under their control. The act also stipulates the Minister must provide guidelines for the development of these plans within one year of the regulations coming into effect. These plans are largely aimed at managing extensive, established invasions and, thus, on control through suppression (mitigation) and Asset Protection. There clearly is a role for plans which focus on the key components of prevention, eradication and containment of invasive species, especially given that these components are far more cost-effective than control (NRM, 2014). These plans must be incorporated into the authorities overall plans (e.g. management plans for protected areas, integrated development plans, environmental plans). Section 76 does not specifically state whether these plans are intended for particular species or for particular areas but the wording, taken in conjunction with regulation 8 (of R. 598), makes it clear that it deals with plans for specified areas and for all listed species within those areas. The Act defines control as: *…in relation to an alien or invasive species, means - (a) to combat or eradicate an alien or invasive species; or (b) where such eradication is not possible, to prevent, as far as may be practicable, the recurrence, re-establishment, re-growth, multiplication, propagation, regeneration or spreading of an alien or invasive species*. This makes it clear that the word control is to be interpreted as including all aspects of invasive species management.

Section 75 of NEM:BA deals with the control and eradication of listed species and 75(4) requires the Minister to ensure the coordination and implementation of species management programmes for the prevention, control and eradication of invasive species. In the regulations, Regulations 2-4 deal with the categories of invasive species. Within each of the species categories sub-regulation (3) stipulates that if an "*Invasive Species Management Programme*" has been developed for a listed species in terms of section 75(4) of the NEM:BA, then that species must be controlled in accordance with the programme. Neither the act nor the regulations define the content of such a programme but it is clear from the wording that the focus is on a particular species or, possibly, a suite of similar species. The now repealed 2013 draft regulations (R. 506 of 2013) did describe a Species Management Programme under regulation 4, which gives an indication of what such a programme was expected to entail:

4.(1) The competent authority must develop and coordinate species management programmes for Category 1b listed invasive species in order to assist landowners to control or eradicate their listed invasive species.

(2) A species management programme contemplated in subregulation (1) must stipulate –
(a) the listed invasive species to which it relates
(b) the measures to eradicate or control the listed invasive species specified in paragraph (a);
(c) the areas in which the measures referred to in paragraph (b) are to be applied; and
(d) the schemes to fund the measures, if applicable.

In addition to the Cara and NEM:BA acts, provincial ordinances can be declared which provide further regulations to control potential invasive alien species. Currently these are available for the Western Cape, Gauteng, Kwazulu-Natal and the Free State provinces.

Websites containing important information on the legal requirements of controlling invasive alien plants are listed in Table 10.

Table 10: *Websites and links related to legal requirements*

Topic	Content	Website address
Legal	Links to legislation and its implementation	https://www.environment.gov.za/legislation/actsregulations
		https://www.environment.gov.za/projectsprogrammes/wfw/
		www.invasives.org.za
		Incorporate a link to the guideline document for an IAS / IAP management plan as required by the Act
Raising awareness of legislation	Wildlife and Environmental Society of SA (WESSA) is facilitating NEM:BA workshops on compliance for landowners	http://www.wessa.org.za/uploads/documents/temporary-docs/WESSA Facilities NEMBA Compliance.pdf

7.6 Occupational Health and Safety

Employment needs to comply with the Occupational Health and Safety Act (1993). WfW is responsible for making sure that the Act is adhered to on projects that they fund. A number of Health and Safety courses are listed in WfW's training matrix (see Appendix 6).

7.7 Working for Water Policies

Working on private land:

A policy exists for work on private land[1]. On the whole, working on private land is being phased out in favour of land owners managing invasive alien plants themselves. This will be determined through land owner incentives or dis-incentives. There is a process to request assistance for clearing on private land.

Working on State land:

Working for Water has undertaken to reduce the density of established, terrestrial, invasive alien plants, through labour intensive, mechanical and chemical control, by 22% per annum. However, only certain areas are worked at a given time. The current process is to prioritise catchments and locations based on defined criteria. These are discussed in the annual plan of operations which are reviewed each year.

***Aquatics*:**

Until recently aquatic weeds were managed by the Department of Water and Sanitation but that responsibility was recently transferred to the Working for Water Programme. The regional office of WfW should be contacted for help in dealing with these species.

***Biological control*:**

Biological control of invasive alien plants refers to the introduction of natural enemies to reduce the vigour or reproductive potential to levels that are comparable to that of natural vegetation. Working for water works in close contact with the Weeds Research division of the Agricultural Research Council's Plant Protection Research (ARC-PPRI). The Biological Control Implementation (BCI) programme conducts research on biocontrol agents for invasive alien plants. The current list of biocontrol agents is listed in Klein (2011) and information and links can be found here: http://www.invasives.org.za/resources/biocontrol.

7.8 Sources of additional information

A list of websites containing information on: invasive alien plant species, their biological control, other control methods and training is given in Table 11.

***Table 11:** Websites and links related to additional information*

Topic	Source	Website address
Invasive species	Arc home page for invasive alien species	http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Weeds-Research.aspx
	Arc web page for links to other sites containing information on invasive alien plants.	http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Other-sources-of-information-and-useful-links.aspx
	Information on individual invading plant species that has links via both common and scientific names	http://www.invasives.org.za/plants/plants-a-z
	South African Plant Invaders Atlas (SAPIA)	The SAPIA website is out of date but there are plans to update it and make it accessible via SANBI's website
	South African National Biodiversity Institute	List SANBI website

Topic	Source	Website address
	(SANBI) Alien and Invasive Species List, 2014 – Department of Environment Affairs	*https://www.environment.gov.za/sites/.../nemba10of2004_alienandinvasi.*
Biological control	Fact sheets supplied by the ARC	http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/The-Working-for-Water-Programme-and-Biological-Control-Implementation-%28BCI%29.aspx https://www.environment.gov.za/projectsprogrammes/wfw/biocontrol#integration http://www.arc.agric.za/arc-ppri/Pages/Weeds%20Research/Fact-Sheets-on-Invase-Alien-Plants-and-their-Biological-Control-Agents.aspx http://www.invasives.org.za/resources/biocontrol.
Control methods	Control tables outlining procedure for removing alien plants, including herbicide application Outline of clearing techniques Overview of clearing techniques	www.dwaf.gov.za/wfw/Control/docs/controltables.doc https://www.environment.gov.za/projectsprogrammes/wfw/alienplantcontrol_managementplan http://www.invasives.org.za/resources/control-methods/item/392-how-to-remove-invasive-plants.html https://www.dwa.gov.za/wfw/Control/
Academic training institutes	CIB (Post graduate) NMMU (Under post graduate diplomas and degrees) Other training	http://academic.sun.ac.za/cib/ See training matrix in appendix 6 http://www.unep.org/training/programmes/Instructor%20Version/Part_3/readings/WfW_case.pdf

7.9 Clearing support options for private land owners

The Working for Water (WfW) programme no longer solely manages the clearing of invasive alien plants on private land. Instead a new policy was adopted whereby working for water would enter in contracts with private land owners and offer incentives to facilitate the clearing of invasive alien plants. This approach aims to get private land owners to both manage and be accountable for invasive alien plants on their own land.

The contract would outline roles, responsibilities and obligations of the land owner, clearing team and working for water. For this approach the clearing team is contracted to the land owner who is responsible for the clearing operation.

The working for water programme provides incentives which include training of clearing teams, support of labour costs (up to 100% for initial clearing, 75% for 1st follow-up, 50% for the 2nd follow up), branded clothing, planning and mapping support, biological control, herbicides and monitoring and evaluations. The private land owner will be responsible for the provision of the following to clearing teams: equipment, protective clothing, food, transport, or facilities for suitable working conditions (e.g. ablutions).

It is important to note that where Emerging species are present on private land then the Working for Water programme may provide the full labour, herbicide and other costs for species listed as "emerging species" in a particular area as part of its prioritization of early detection of and rapid response to emerging invasive alien plant species.

The Working for Water programme reserves the right to issue disincentives which may extend to charges for seed pollution, or a general charge for the control of invasive alien plants, as determined by WfW's parent Departments through its Executive Committee.

Resources:

Full private land policy	https://www.environment.gov.za/sites/default/files/legislations/approachtoworkon_privateland.pdf
WfW incentive application form:	https://www.environment.gov.za/sites/default/files/docs/forms/clearing_assisstance_application.pdf

The following applications processes are available to private land owners

Herbicide assistance:

The Working for Water programme provides assistance for herbicides where necessary to control invasive alien plants. This will be provided for the initial and up to three follow-up clearing applications. This assistance does not require that an incentive contract (as mentioned above) be entered into. Herbicide assistance can be applied for to contain invasive alien species prior to incentive contracts.

Herbicide application form:	https://www.environment.gov.za/sites/default/files/docs/forms/herbicide_assistance.pdf

Biocontrol assistance:

The Working for Water programme may provide biological control agents to the land-owner, who will be responsible to report back to WfW on the impact of these agents against key performance indicators.

Biocontrol application form:	https://www.environment.gov.za/sites/default/files/docs/forms/dermacationof_biologicalcontrol_reservesite_forteristerailplants.pdf
Biological control observation forms	https://www.environment.gov.za/projectsprogrammes/wfw/resources

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***Appendix 1**: Spatial datasets*

Data file name	Description	Methods used as a basis of comparison	type	Source
Compartments	Management units with clearly defined and permanent boundaries for establishing priorities, scheduling treatments and recording progress	*Shapefile fields:* Compt ID, AREA HA, OWNERSHIP, SLOPE, VEG STATUS, VELD AGE, Ave MAR, Walk time, Drive time Erosion actual, Siltation, Soil prop, Rain, Fire intensity, Riparian, Seepage zones. *Method*: Each variable i.e. were assigned to a compartment based on the unique compartment ID.	Vector	
IAP	Mapped invaded units for GSC	This layer contains all fields for IAP species type, age, density and source of data. Combination of mapped IAP areas in GSC. Data was merged in the following order GSC data, Landcare, WIMS and Aurecon data.	Vector	GSC, Landcare, Wims, Aurecon.
MIU	Mapped invaded units	A layer with variables MIU_ID, Area, Riparian code	Shapefile	
MIU linked species list	All IAP species	Variables include: MIU-ID, Species name, Density, Maturity;	Excel	
Treatment units NBALS	All IAP species which have a treatment history	Variables include: NBAL_ID, Area, Treatment stage and Treatment date, Contract nr.	Shapefile	Wims
NBAL linked species list	All IAP species	Variables include: MIU-ID, Species name, Density, Maturity	Excel	
Ownership	Indicate extent of all land ownership in GSC	*Shapefile showing ownership by area.* Ownership derived from farm cadastres, Cape Nature protected areas coverage, urban cadastre.		Dept of agriculture, Elsenburg.

Data file name	Description	Methods used as a basis of comparison	type	Source
Veld age	Indicate veld age in natural areas with reference to fire attributes.	*Shapefile fields:* Merge of AFIS fire scar and SANBI fire history.	Vector	AFIS and SANBI
Ownership	Indicate extent of all land ownership in GSC.	Excel table summarizing ownership by area.	Excel table.	
Invasions by ownership	To show type and extent of invasions by ownership in GSC	Method: Attribute table based on IAP data. IAP data was combined with ownership shapefile to show invasions by ownership. Condensed areas of invasions were derived from density field statistics.	Excel table.	
LC by description	Describe extent of different land uses in GSC.	New LC 2014 was used as input. All natural veld types were classified according to vegetation map (SANBI). All agricultural areas were classified according to Dept Agriculture (field boundaries). All other land uses remained as was indicated in the LC 2014.	Excel table.	
Landcover	To indicate the extent of different landcover in the catchment	Method: New LC 2014 was used as input. All natural veld were classified according to vegetation map (SANBI). All agricultural areas were classified according to Dept Agriculture (field boundaries). All other land uses remained as was indicated in the LC 2014.	Raster	
Erosion	Actual Erosion	Layer created as input for compartment prioritization. Derived from actual erosion raster.	Raster	Le Roux
Siltation	Potential erosion	Layer created as input for compartment prioritization. Derived from potential erosion raster.	Raster	Le Roux
Riparian	River buffer	Layer created as input for compartment prioritization. 1:50000 rivers were buffered. Perennial by 20m and non-perennial by 10m.	Shapefile	DLDLR
Rainfall	Mean annual rainfall	Layer created as input for compartment prioritization. Indicate mean annual rainfall in GSC.	Raster	Aurecon, Ninhamshand.

Data file name	Description	Methods used as a basis of comparison	type	Source
Seepage zones		Layer created as input for compartment prioritization. Derived from landcover where all water seasonal and wetlands occur.		
Fuel load	Fire intensity	Layer created as input for compartment prioritization. Derived from Landcover. Fuel types were classified as follow: 1- All mines, all water, all bare, all non-vegetation. 2- Cultivated, grassland, low shrubland, urban low vegetation. 3- Fynbos, open trees/bush/wetlands. 4- Thicket, woodland, urban dense trees/bush 5- All plantations.	Raster	Landcover of 2014
Ecosystem status		Layer created as input for compartment prioritization. Derived from ecosystem to indicate conservation status: 1- LT 2- VU 3- EN 4- CE	Raster	SANBI
Land capability	Proxy for soil properties	Layer created as input for compartment prioritization. Derived from land capability layer (based on landtypes).	Raster	DOA
Slopes (degrees)		Layer created as input for compartment prioritization. Derived from 20mDEM	Raster	
MAR	Mean annual runoff	Layer created as input for compartment prioritization. Resampled to 20m.	Raster	
DEM	Base data: Elevation	20m DEM	Raster	
GSC boundary	Base data:	Method: Functional boundary derived by creating an outline to include all GSC member farms.	Vector	DOA
Natural vegetation types.	Base data: vegetation type	Method: All untransformed areas classified by vegetation type. Derived from ecosystem layer and landcover.	Vector	SANBI
Natural vegetation types	Base data: vegetation type Indicate all natural veld.	Method: All untransformed areas classified by vegetation type. Derived from ecosystem layer and landcover.	Raster	Landcover and SANBI

Data file name	Description	Methods used as a basis of comparison	type	Source
Roads	Base data: Infrastructure, all major and minor roads	Method:	Vector	
MAR	Base data: Mean annual runoff		Raster	
Crops	Base data: Field boundaries of farms	Indicate all field boundaries and crop info	Vector	DOA

Appendix 2: *Management compartment input data for MUCPs*

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1001	38.45	Farm	8.49	Transformed	16	125.53	10	20	0.64	126.11	4	831.44	2	2.48	0.96
G21E1003	72.80	Farm	9.36	Transformed	16	100.63	10	20	0.49	148.81	7	824.98	2	4.12	4.40
G21E1004	9.39	Farm	4.13	Transformed	16	141.00	10	20	0.24	95.05	6	759.98	2	0.44	0.12
G21E1007	100.34	Farm	2.47	Transformed	16	87.24	10	10	0.25	20.74	6	637.39	2	1.72	11.68
G21E1008	69.33	Farm	3.38	Transformed	16	86.60	10	10	0.44	27.50	4	675.53	2	2.24	5.32
G21E1009	102.85	Farm	8.05	Transformed	16	107.38	10	10	2.75	53.91	4	772.17	2	1.84	0.68
G21E1010	389.86	Farm	4.61	Transformed	16	87.43	10	10	0.53	36.83	4	682.52	2	4.04	22.16
G21E1011	25.48	Farm	1.14	Transformed	16	63.84	10	10	0.32	9.98	6	569.04	2	0.00	1.44
G21E1013	50.17	Farm	8.44	Transformed	16	149.68	10	10	18.90	65.25	4	813.93	2	0.00	2.24
G21E1014	60.91	Farm	6.75	Transformed	16	144.40	10	10	4.81	83.57	4	763.53	2	0.00	2.48
G21E1016	105.24	Farm	8.92	Transformed	16	162.01	10	10	4.95	79.29	4	798.72	2	0.80	1.80
G21E1018	85.26	Farm	5.01	Transformed	16	141.65	10	10	6.45	48.95	6	769.03	2	3.00	4.24
G21E1028	49.37	Farm	11.81	Transformed	16	119.77	10	10	0.99	190.52	7	871.89	5	2.16	2.28
G21E1029	77.10	Farm	3.57	Transformed	16	114.09	10	10	0.64	58.90	6	777.41	2	7.72	2.08
G21E1030	65.69	Farm	4.36	Transformed	16	99.59	10	10	0.73	62.47	6	732.30	2	1.16	2.20
G21E1031	107.06	Farm	4.82	Transformed	16	139.71	10	10	0.61	53.97	6	763.71	2	3.24	5.20
G21E1032	43.69	Farm	4.88	Transformed	16	108.63	10	10	3.32	70.41	6	776.23	2	0.00	0.80
G21E1033	54.70	Farm	8.25	Transformed	16	143.65	10	10	0.86	79.35	4	818.26	2	0.00	0.00
G21E1034	16.29	Farm	7.07	Transformed	16	118.39	10	10	0.64	124.80	6	800.21	2	1.24	0.40
G21E1035	19.61	Farm	7.74	Transformed	16	108.06	10	10	1.65	96.99	6	814.56	2	0.00	0.00
G21E1037	198.65	Farm	3.59	Transformed	16	85.72	10	10	1.26	47.57	6	706.49	2	7.64	9.76
G21E1038	4.02	Farm	7.61	Transformed	16	112.99	10	10	0.85	84.83	7	821.62	1	0.52	0.68
G21E1040	39.05	Farm	14.72	Transformed	16	102.10	10	10	38.43	172.03	7	902.12	2	1.00	0.00

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1041	17.53	Farm	8.82	Transformed	16	107.58	10	10	0.89	108.70	7	853.35	2	0.00	0.00
G21E1042	175.54	Farm	14.10	Transformed	16	109.32	10	10	4.57	196.73	7	873.09	2	8.92	3.68
G21E1043	14.16	Farm	8.93	Transformed	16	100.28	10	10	0.50	93.71	7	840.84	2	0.00	0.00
G21E1044	19.14	Farm	9.47	Transformed	16	468.40	10	20	1.87	198.22	4	851.78	2	0.00	0.72
G21E1045	49.26	Farm	7.54	Transformed	16	318.72	10	20	0.93	126.29	4	793.57	2	0.68	0.88
G21E1051	91.24	Farm	9.66	Transformed	16	576.68	10	20	1.16	199.02	8	829.84	5	6.92	9.76
G21E1055	19.46	Farm	9.85	Transformed	16	583.64	30	20	0.98	172.78	8	866.82	5	1.32	0.80
G21E1056	68.59	Farm	21.50	Transformed	16	738.68	30	20	0.97	403.59	8	1105.38	5	2.76	0.00
G21E1058	120.98	Farm	8.06	Transformed	16	96.19	10	20	1.71	113.96	7	808.75	2	4.92	9.56
G21E1060	29.75	Farm	14.53	Transformed	16	272.28	10	20	2.40	228.90	4	778.97	2	0.60	0.00
G21E1061	99.65	Farm	8.63	Transformed	16	136.27	10	10	6.98	57.76	4	764.70	2	0.88	1.16
G21E1062	113.51	Farm	6.84	Transformed	16	155.62	10	10	0.77	58.10	4	773.92	2	2.64	1.76
G21E1063	25.36	Farm	3.24	Transformed	16	157.47	10	10	0.81	22.03	4	692.07	2	1.52	2.44
G21E1064	30.99	Farm	4.87	Transformed	16	161.77	10	10	0.37	54.21	4	693.64	2	1.96	2.12
G21E1066	46.26	Farm	7.01	Transformed	16	176.61	10	10	3.28	81.64	4	718.48	2	2.24	1.04
G21E1067	38.37	Farm	11.22	Transformed	16	108.95	10	10	1.07	139.12	7	852.21	2	0.60	0.00
G21E1068	7.07	Farm	1.35	Transformed	16	273.32	10	20	0.17	26.12	3	622.85	2	0.20	0.00
G21E1069	48.26	Farm	6.07	Transformed	16	192.47	10	20	3.69	94.32	4	698.99	2	2.76	2.52
G21E1072	10.82	Farm	3.87	Transformed	16	193.03	10	20	3.76	78.81	4	744.41	2	0.04	0.12
G21E1073	256.30	Farm	5.01	Transformed	16	277.67	10	20	1.32	117.38	7	711.74	2	22.60	17.56
G21E1074	92.45	Farm	4.95	Transformed	16	127.75	10	10	4.86	37.34	4	728.59	2	1.84	0.52
G21E1075	32.51	Farm	3.95	Transformed	16	144.20	10	10	1.04	49.17	6	730.26	2	0.00	2.60
G21E1077	184.17	Farm	3.29	Transformed	16	183.63	10	10	1.71	52.17	4	640.50	2	3.84	8.44
G21E1078	1.25	Farm	7.02	Transformed	16	150.12	10	20	0.40	141.59	4	794.75	5	0.00	0.32
G21E1081	32.49	Farm	13.48	Transformed	16	116.15	10	10	2.01	240.72	7	899.24	5	0.72	0.00
G21E1082	165.47	Farm	10.12	Transformed	16	211.60	10	10	8.48	177.50	4	866.66	2	11.32	9.36
G21E1083	212.89	Farm	8.93	Transformed	16	213.77	10	20	3.30	138.50	4	753.04	2	7.88	10.12

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1084	33.07	Farm	11.95	Transformed	16	468.40	10	20	1.27	192.55	4	847.72	2	0.08	0.08
G21E1086	53.21	Farm	7.44	Transformed	16	107.64	10	10	6.91	84.28	7	814.27	2	2.68	1.08
G21E1087	58.69	Farm	17.17	Transformed	16	293.02	10	20	2.11	313.58	7	853.75	2	4.12	1.64
G21E1089	166.33	Farm	6.40	Transformed	16	344.61	10	20	3.33	149.02	7	805.87	2	8.44	8.84
G21E1090	115.61	Farm	2.97	Transformed	16	277.06	10	20	2.91	51.66	3	698.36	2	3.72	0.48
G21E1091	165.03	Farm	1.99	Transformed	16	265.76	10	20	1.52	33.32	3	679.52	2	6.52	7.92
G21E1092	122.99	Farm	9.22	Transformed	16	341.40	10	20	1.44	204.59	7	831.36	2	3.56	4.32
G21E1093	42.62	Farm	2.66	Transformed	16	305.35	10	20	0.19	56.21	3	728.55	2	0.28	1.48
G21E1094	106.55	Farm	1.55	Transformed	16	297.89	10	20	0.18	27.36	3	688.24	2	1.36	0.36
G21E1095	50.44	Farm	5.29	Transformed	16	379.45	10	20	0.40	140.43	7	766.12	2	2.36	6.52
G21E1096	80.64	Farm	3.08	Transformed	16	309.40	10	20	0.24	58.20	7	736.83	2	0.16	3.00
G21E1101	43.15	Farm	8.10	Transformed	16	273.52	10	20	0.71	182.45	7	747.00	2	1.20	2.32
G21E1102	73.36	Farm	2.78	Transformed	16	75.21	10	10	0.53	29.18	6	607.96	2	0.00	1.92
G21E1103	41.29	Farm	4.31	Transformed	16	190.73	10	10	11.44	83.07	4	652.59	2	1.80	1.16
G21E1104	337.54	Farm	3.36	Transformed	16	131.84	10	10	6.85	38.00	4	660.74	2	4.52	24.12
G21E1105	185.80	Farm	2.36	Transformed	16	103.06	10	10	1.67	30.41	6	697.52	2	2.80	6.56
G21E1106	163.11	Farm	7.05	Transformed	16	224.27	10	20	1.29	141.60	7	682.97	2	5.32	3.24
G21E1108	7.04	Farm	5.39	Transformed	16	149.66	10	20	0.43	71.22	4	836.63	4	0.48	0.04
G21E1112	38.86	Farm	6.03	Transformed	16	190.73	10	10	3.90	73.75	4	681.18	2	0.08	0.48
G21E1114	9.92	Farm	14.72	Transformed	16	116.15	10	10	1.76	84.42	7	955.77	3	0.20	0.00
G21E1115	54.28	Farm	2.22	Transformed	16	273.32	10	20	3.16	43.15	3	649.43	2	1.44	3.20
G21E1116	123.38	Farm	1.81	Transformed	16	273.79	10	20	0.11	27.27	3	654.90	2	0.12	11.08
G21E1118	20.16	Farm	4.62	Transformed	16	269.88	10	20	0.78	92.06	7	703.89	2	0.36	0.28
G21E1120	114.81	Farm	4.31	Transformed	16	156.37	10	10	3.42	55.09	4	688.40	2	1.88	3.72
G21E1121	46.79	Farm	6.81	Transformed	16	308.71	10	20	0.59	120.17	4	719.88	2	1.44	2.04
G21E1124	36.79	Farm	2.46	Transformed	16	86.59	10	10	1.67	20.97	6	664.83	2	3.56	0.44
G21E1125	14.76	Farm	7.58	Transformed	16	141.69	10	20	1.05	98.97	6	790.45	4	0.56	0.24

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1126	61.52	Farm	3.77	Transformed	16	140.50	10	10	6.93	63.16	4	645.53	2	1.16	1.12
G21E1127	196.61	Farm	2.58	Transformed	16	146.70	10	10	2.57	47.60	4	634.16	2	5.32	12.52
G21E1128	14.26	Farm	9.47	Transformed	16	167.39	10	10	0.69	116.37	4	818.86	5	1.28	1.04
G21E1129	4.74	Farm	1.22	Transformed	16	63.84	10	10	0.18	12.62	4	565.46	2	0.00	0.24
G21E1130	266.74	Farm	3.01	Transformed	16	82.46	10	10	2.36	32.12	6	649.31	2	3.28	5.20
G21E1131	34.84	Farm	2.76	Transformed	16	88.78	10	10	0.43	30.99	6	668.72	2	2.12	1.32
G21E1132	170.68	Urban	4.52	Transformed	16	123.27	10	20	0.42	58.27	6	778.28	2	5.48	2.24
G21E1135	72.89	Farm	9.49	Transformed	16	105.81	10	10	1.00	122.61	7	840.68	2	4.76	3.16
G21E1136	196.27	Farm	8.22	Transformed	16	104.05	10	10	4.20	108.91	7	830.65	2	5.04	1.32
G21E1138	117.85	Farm	12.81	Transformed	16	149.66	10	20	4.92	185.01	4	847.76	5	5.60	1.60
G21E1139	41.81	Farm	9.85	Transformed	16	150.52	10	20	0.97	116.94	4	856.89	2	1.56	0.44
G21E1140	29.59	Farm	8.73	Transformed	16	365.01	10	20	1.19	125.63	4	837.50	2	0.00	0.60
G21E1143	15.74	Farm	6.47	Transformed	16	342.86	10	20	0.92	80.62	4	709.16	2	1.36	0.96
G21E1144	48.73	Farm	4.17	Transformed	16	161.77	10	10	0.38	49.39	4	696.70	2	2.76	5.40
G21E1146	56.06	Farm	1.54	Transformed	16	58.68	10	10	0.13	16.81	6	594.41	2	0.00	0.48
G21E1147	55.46	Urban	4.94	Transformed	16	437.64	10	20	0.09	119.63	7	740.90	2	3.92	3.16
G21E1149	56.33	Farm	2.10	Transformed	16	255.69	10	20	0.35	43.50	4	628.11	2	4.08	1.32
G21E1150	11.11	Farm	1.43	Transformed	16	199.36	10	20	0.23	21.77	4	622.35	2	0.00	0.00
G21E1151	74.40	Farm	3.39	Transformed	16	252.74	10	20	0.44	49.62	7	658.29	2	2.28	1.52
G21E1174	256.92	Farm	2.92	Transformed	16	76.60	10	10	1.91	28.80	6	648.21	2	0.08	7.40
G21E1175	180.34	Farm	7.94	Transformed	16	187.07	10	10	1.95	83.01	4	816.87	2	4.64	3.32
G21E1178	102.76	Farm	6.14	Transformed	16	155.77	10	10	4.27	77.25	4	699.94	2	2.92	2.56
G21E1181	71.07	Farm	2.42	Transformed	16	391.98	10	20	0.22	97.23	3	707.38	2	5.16	7.20
G21E1186	32.78	Farm	18.67	CE	16	146.08	10	10	6.68	110.34	8	910.54	3	0.56	0.00
G21E1002	5.74	Farm	5.17	EN	16	149.66	10	20	0.32	52.91	4	799.38	4	0.00	0.08
G21E1005	3.24	Farm	3.41	EN	16	109.98	10	20	0.09	105.47	6	754.81	3	0.80	2.24
G21E1012	21.79	Farm	1.47	CE	16	62.99	10	10	0.12	11.15	6	566.11	3	0.00	8.48

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1015	14.05	Farm	13.60	CE	16	146.08	10	10	2.28	101.80	8	870.34	3	0.00	0.00
G21E1025	29.64	Farm	3.87	EN	16	185.15	10	20	0.25	54.61	4	790.20	2	1.80	2.04
G21E1026	4.85	Farm	4.33	EN	16	183.66	10	20	0.12	71.55	4	772.81	2	1.92	1.12
G21E1036	51.67	Farm	11.74	EN	16	107.99	10	10	4.75	167.54	7	887.33	3	2.00	0.96
G21E1039	10.44	Farm	5.60	CE	16	107.40	10	10	0.54	128.15	6	755.89	3	0.00	0.00
G21E1047	13.33	Farm	2.52	CE	16	425.66	10	20	0.19	129.61	6	645.36	3	0.36	0.28
G21E1048	21.53	Farm	2.85	CE	16	425.66	10	20	0.25	91.36	6	662.78	3	1.04	5.56
G21E1049	28.33	Farm	2.42	CE	16	429.53	10	20	0.23	43.12	6	665.96	3	2.04	0.44
G21E1050	28.77	Farm	4.42	CE	16	472.91	10	20	0.45	78.94	6	727.42	3	2.24	2.28
G21E1052	11.95	Farm	2.52	CE	16	425.66	10	20	0.24	102.78	6	651.47	3	1.56	2.60
G21E1053	17.54	Farm	2.26	CE	16	429.46	10	20	0.29	58.66	6	698.95	2	1.24	0.00
G21E1054	21.36	Farm	2.27	CE	16	490.96	10	20	0.24	38.52	8	736.52	3	1.40	0.72
G21E1057	29.97	Farm	7.17	CE	16	735.72	30	20	0.64	118.79	8	921.54	4	1.80	0.00
G21E1059	8.67	Farm	5.35	EN	16	149.66	10	20	0.26	113.31	6	776.75	2	0.36	0.68
G21E1085	5.42	Farm	10.20	CE	16	105.25	10	10	11.55	104.76	7	877.43	4	1.08	0.12
G21E1097	107.08	Farm	1.40	CE	16	293.59	10	20	0.16	26.34	3	670.87	3	6.16	21.64
G21E1098	76.23	Farm	1.74	CE	16	304.73	10	20	0.33	55.13	3	690.23	3	0.00	9.16
G21E1099	186.35	Farm	2.53	CE	16	310.50	10	20	4.86	72.62	3	723.36	4	9.64	14.08
G21E1100	9.45	Farm	2.13	CE	16	313.32	10	20	0.28	45.90	3	709.48	3	0.72	0.60
G21E1107	47.93	Farm	2.83	EN	16	138.61	10	20	0.18	39.65	6	763.34	3	3.28	5.20
G21E1109	272.04	Farm	15.29	EN	16	207.27	10	20	2.66	259.92	4	830.79	4	15.36	13.04
G21E1119	46.60	Farm	15.26	EN	16	272.28	10	20	1.54	255.70	4	812.08	4	2.76	0.68
G21E1122	7.05	Farm	7.54	CE	16	425.66	10	20	1.08	417.33	6	696.80	4	1.40	0.80
G21E1134	22.59	Farm	1.45	CE	16	245.74	10	20	0.19	26.65	3	666.74	2	1.92	0.88
G21E1137	53.32	Farm	8.02	CE	16	95.50	10	20	0.87	89.89	7	798.57	4	2.88	3.56
G21E1141	48.20	Farm	2.71	CE	16	279.04	10	20	0.47	86.26	3	703.89	3	1.12	5.68
G21E1145	15.52	Farm	13.81	EN	16	272.28	10	20	1.34	247.41	4	819.01	4	1.44	0.12

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1179	61.09	Farm	9.79	EN	16	938.05	10	20	0.97	174.39	8	891.27	4	2.92	1.12
G21E1180	16.23	Farm	2.34	CE	16	433.89	10	20	0.35	108.98	6	684.06	3	2.44	4.40
G21E1182	11.30	Farm	6.39	CE	16	99.11	10	10	0.42	37.29	7	776.42	4	1.60	0.24
G21E1183	11.36	Farm	14.73	EN	16	293.02	10	20	1.31	212.00	7	849.66	4	0.28	0.00
G21E1017	409.25	Farm	15.19	Transformed	0	238.43	30	20	3.38	169.54	8	928.06	5	19.12	3.80
G21E1019	42.19	Farm	13.15	Transformed	0	203.63	10	10	7.75	123.35	8	830.38	2	2.16	0.24
G21E1020	106.39	Farm	10.26	Transformed	0	224.75	10	10	7.96	132.92	4	880.04	2	2.76	2.92
G21E1021	48.67	Farm	9.07	Transformed	0	218.09	10	10	1.19	101.20	4	843.81	2	0.92	0.60
G21E1022	44.71	Farm	10.66	Transformed	0	259.71	30	20	0.71	140.87	4	929.86	5	4.12	0.00
G21E1023	219.00	Priv mountain catch	20.99	EN	0	420.61	30	20	1.56	291.63	8	1107.06	3	16.56	3.84
G21E1024	98.31	Priv mountain catch	30.88	LT	0	368.67	60	30	2.50	457.38	8	1235.81	3	6.60	1.08
G21E1027	216.39	Farm	13.62	Transformed	0	197.51	10	20	1.08	232.48	4	884.45	5	16.72	10.20
G21E1065	189.24	Farm	8.72	Transformed	0	200.24	10	10	4.72	90.10	4	797.20	5	9.68	6.96
G21E1071	107.60	Farm	16.80	Transformed	0	279.59	10	20	0.89	227.85	8	873.45	5	4.04	4.24
G21E1076	43.61	Priv mountain catch	15.81	EN	0	264.53	30	20	1.14	194.21	8	1039.36	5	3.08	0.32
G21E1079	198.98	Farm	14.01	Transformed	0	251.26	30	20	1.71	198.02	4	949.24	5	11.96	4.20
G21E1080	199.13	Farm	12.28	Transformed	0	219.10	10	10	7.43	158.78	4	882.29	2	14.32	5.36
G21E1088	198.95	Priv mountain catch	20.13	EN	0	425.87	30	20	1.99	421.51	7	1086.97	4	13.80	0.72
G21E1110	11.61	Farm	8.04	Transformed	0	437.64	30	20	1.18	244.12	7	827.37	5	0.76	0.32
G21E1123	105.60	Farm	9.67	Transformed	0	204.84	10	10	12.35	83.32	4	806.52	2	4.48	3.24
G21E1133	81.79	Farm	11.93	Transformed	0	335.09	10	20	1.51	235.65	7	821.70	2	5.40	2.44
G21E1142	173.18	Farm	6.71	Transformed	0	308.38	30	20	6.53	136.17	7	796.50	2	4.96	1.76
G21E1152	15.11	Cape Nature	25.72	LT	0	336.86	60	20	2.17	567.18	8	1103.03	5	0.72	0.00
G21E1153	15.85	Cape Nature	30.71	LT	0	336.33	30	20	2.41	632.39	8	1083.06	4	1.24	0.00
G21E1154	14.32	Cape Nature	42.68	LT	0	336.33	60	30	3.09	630.10	8	1235.09	4	0.08	0.00
G21E1155	19.19	Cape Nature	43.67	LT	0	343.38	60	30	4.78	791.68	8	1298.65	4	0.44	0.00
G21E1156	34.70	Cape Nature	43.49	LT	0	466.40	60	30	48.58	724.69	8	1483.67	3	0.88	0.00

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1157	73.80	Cape Nature	35.12	LT	0	463.83	60	30	57.01	529.80	8	1522.58	5	2.56	0.00
G21E1158	20.93	Cape Nature	42.07	LT	0	414.59	60	30	34.17	612.34	8	1487.39	3	0.80	0.00
G21E1159	27.60	Cape Nature	41.11	LT	0	440.75	60	30	43.07	591.55	8	1462.35	3	1.00	0.00
G21E1160	55.01	Cape Nature	38.06	LT	0	410.32	60	30	3.86	499.18	8	1496.15	3	3.52	0.00
G21E1161	51.19	Cape Nature	33.02	LT	0	410.20	60	30	3.10	396.04	8	1428.88	3	1.44	0.00
G21E1162	40.81	Cape Nature	39.99	LT	0	410.32	60	30	4.22	515.48	8	1490.07	4	1.88	0.00
G21E1163	53.28	Priv mountain catch	30.76	LT	0	363.95	60	30	5.24	376.87	8	1297.66	4	1.36	0.12
G21E1164	85.11	Cape Nature	29.99	EN	0	317.99	60	30	1.90	341.44	8	1298.77	3	3.64	0.00
G21E1165	39.77	Priv mountain catch	20.43	EN	0	300.02	30	20	1.29	252.27	8	957.53	5	1.48	0.20
G21E1166	1.34	Farm	29.58	Transformed	0	336.33	30	20	2.86	549.39	8	1076.53	4	0.04	0.00
G21E1167	325.21	Farm	15.36	Transformed	0	315.75	30	20	2.47	251.90	7	944.91	5	14.12	1.40
G21E1168	13.26	Priv mountain catch	19.00	EN	0	336.33	30	20	1.61	419.57	7	1002.51	5	1.48	1.04
G21E1169	18.01	Cape Nature	32.33	LT	0	336.33	60	30	3.46	595.74	8	1236.09	3	0.00	0.00
G21E1170	21.38	Priv mountain catch	21.08	EN	0	336.33	30	20	1.93	440.38	8	1034.20	4	1.64	0.80
G21E1171	8.73	Cape Nature	35.06	LT	0	336.33	60	30	1.90	531.96	8	1190.33	3	0.00	0.00
G21E1172	18.72	Farm	14.51	Transformed	0	417.85	30	20	1.77	445.81	7	908.47	5	1.96	0.00
G21E1173	70.76	Urban	7.80	Transformed	0	436.29	10	20	0.58	221.84	7	766.62	4	5.08	4.68
G21E1176	253.55	Priv mountain catch	17.94	EN	0	338.94	30	30	2.45	270.06	7	1098.75	4	20.80	0.40
G21E1177	244.52	Farm	9.40	Transformed	0	191.84	10	10	6.79	134.35	4	734.59	2	11.64	10.00
G21E1184	137.09	Priv mountain catch	20.86	Transformed	0	278.48	30	20	1.01	225.73	8	989.46	5	9.00	0.36
G21E1185	44.59	Farm	20.70	CE	0	146.08	10	10	6.54	134.11	8	902.32	3	0.00	0.00
G21E1006	267.04	Farm	8.56	EN	0	252.95	10	20	0.75	132.17	4	850.26	2	14.04	19.04
G21E1046	138.31	Farm	11.58	EN	0	367.24	10	20	1.35	170.05	7	877.86	2	10.52	6.44
G21E1070	112.08	Priv mountain catch	20.17	EN	0	265.01	10	20	10.09	205.84	8	954.19	3	2.08	0.16
G21E1111	46.05	Farm	13.29	EN	0	397.44	10	20	2.22	326.52	7	835.24	4	1.76	0.00
G21E1113	98.07	Farm	8.04	EN	0	343.53	10	20	1.10	184.38	4	713.34	2	7.28	14.04
G21E1117	14.90	Farm	15.38	CE	0	342.67	10	20	1.89	407.77	7	769.33	2	1.12	0.36

Compt ID	AREA_HA	Ownership	Slope	Veg Status	Veld Age	Ave MAR	Walk time	Drive time	Erosion actual	Siltation	Soil prop	Rain	Fire intens	Riparian ha	Seepage zones
G21E1148	35.45	Farm	14.23	CE	0	365.15	10	20	1.53	422.27	7	779.67	2	1.68	0.76
G21E1187	27.88	Farm	10.14	EN	16	286.60	10	20	0.97	251.40	4	872.94	4	0.00	0.04
G21E1188	146.86	Farm	11.90	EN	16	318.30	10	20	0.86	148.90	4	785.52	4	2.44	0.68
G21E1189	442.42	Farm	9.80	EN	16	503.00	20	30	12.70	162.10	8	1010.89	5	13.60	3.32

***Appendix 3**: Participants in the expert workshop*

Participants in the workshop held at Delvera Farm on 4th September 2015 to determine criteria and rank these to use in prioritising the clearing of invasive alien plants from the Simonsberg conservancy.

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Appendix 4: *Summary of annual budget of R 1.25 million*

Summary of the annual budget per compartment for the next 15 years based on the prioritisation of the compartments for clearing and a total annual budget ceiling of R1.25 million. Once the levels of invasion have been reached (<1% cover), then the compartment is under maintenance (e.g. year 10 onwards for the 1st compartment below). **Replace budget amounts once post-fire densities reworked**

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15

Appendix 5: *Summary of annual budget of R 2.5 million*

Summary of the annual budget per compartment for the next 15 years based on the prioritisation of the compartments for clearing and a total annual budget ceiling of R2.5 million. Once the levels of invasion have been reached (<1% cover), then the compartment is under maintenance (e.g. year 10 onwards for the 1st compartment below). **Replace budget amounts once post-fire densities reworked**

Compartment	Area (ha)	Priority	Year 01	Year 02	Year 03	Year 04	Year 05	Year 06	Year 07	Year 08	Year 09	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15

Appendix 6: *Working for Water's Training Matrix*

#	Course Name	Priority	Accreditation	Unit Standard	NQF Level	Credits	Duration (days)
FUNCTIONAL - TERRESTRIAL CLEARING							
1	Induction	Before operations	Aligned	117049	2	1	3
2	Plant identification	Before operations	Aligned	252453	2	3	1
3	Chainsaw Operations	Before operations	Yes	117049 117058 117061 117062 117064 117069	2 2 2 2 2 2	1 4 3 2 5 2	10
4	Chainsaw refresher	every 6 months	Aligned				1
5	Brushcutter operations	Before operations	Yes	123243	2	5	10
6	Brushcutter refresher	after 6 months	Aligned				1
7	Herbicide Applicator	Before operations	Yes	123134 123135 252453	1 1 2	3 1 3	3
8	Herbicide refresher	Every 6 months	Aligned				1
9	Pest control operators course	First month	Yes	123134	1	3	5
10	Environmental literacy	First month	Yes	116064 119554	2 2	4 5	6
11	Chainsaw management	After 6 months	No				5
FUNCTIONAL - AQUATIC CLEARING							
12	Aquatic weed team induction	Before operations	Aligned	117049	2	1	1
13	Aquatic weed plant identification	Before operations	Yes	252453	2	3	1
14	Herbicide applicator (aquatic)	Before operations	Yes	123134 123135 252453	1 1 2	3 1 3	3
15	Boat handling	Within 1 month	No				5
16	Boat operators	Within 3 months	No				5
17	Advanced Boat Operators	Within 6 months	No				5

#	Course Name	Priority	Accreditation	Unit Standard	NQF Level	Credits	Duration (days)
18	Aquatic refresher training	Every 6 months	No				2
19	Bio-control induction	Before operations	No				1
20	Bio-control plant & agent idenitification	Before operations	No				5
21	WIMS/GPS Mapping introduction	Before operations	No				2
HEALTH AND SAFETY							
22	First Aid I	Within 1 month	Yes	119567	1	5	2
23	First Aid II	Within 6 months	Yes	120496	2	5	5
24	First Aid III	Within 12 months	Yes				5
25	Health & Safety level I	Within 6 months	Aligned	259622	2	3	2
26	Health & Safety level II	Within 12 months	Yes	259639 9964	2 2	4 3	3
27	Fire awareness	Before operations	Yes	117079	1	2	1
28	Fire fighting	Within 6 months	Yes	117082 123140	1 1	2 1	3
29	Workplace Risk Assessment	Within 3 months	Yes				5
30	Understanding COIDA Procedures	Within 6 months	Yes				3
31	Preliminary Incident Investigation	Within 6 months	Yes				3
32	Advanced Driving	Within 3 months	Yes	257025 123257	2 2	4 10	5
33	Dangerous Animals Awareness	Within 1 month	No				1
34	Field Safety and Survival	Within 1 month	No				1
35	Snake Awareness	Within 1 month	No				1
36	Safety & First Aid in WfW Refresher	Annually	No				1
37	First Aid level I for Aquatic Teams	Within 1 month	Yes	119567	1	5	3
38	First Aid level 2 for Aquatic Teams	Within 6 months	Yes	120496	2	5	3
39	Water Safety Level 1	Before operations	No				3
40	Water Safety Level 2	Within 3 months	No				1

#	Course Name	Priority	Accreditation	Unit Standard	NQF Level	Credits	Duration (days)
SOCIAL DEVELOPMENT							
41	HIV/AIDS	Annually	Yes	8494	2	4	1
42	Peer Educator Course	Before appointment	Yes	9224	5	4	5
43	Counselling	Within 3 months	Yes	13203	5	3	10
44	Healthy living	Within 6 months	Yes	14659	1	4	1
45	Personal finances	Within 12 months	Yes	15092	1	5	1
46	Diversity (Race and Gender)	Within 12 months	Yes	14664	1	3	2
47	Adult learning (literacy/numeracy ABET)	As arranged	Yes				
CONTRACTOR DEVELOPMENT							
48	WfW Contractor course unit 1 - 11	Within 6 months	No				10
49	WfW Contractor course practical	Within 6 months	No				2
50	WfW Contractor course unit 12 - 16	Within 12 months	No				5
51	WfW Contractor course unit 17 - 19	Within 18 months	No				3
52	Advanced entrepreneur course	Within 24 months	No				2
53	Worksite management	Within 6 months	No				1