The clearing of invasive alien plants in South Africa: a preliminary assessment of costs and progress

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This paper provides estimates of the costs of clearing important species of invasive alien plants, as well as of progress made with clearing, based on data from a recently developed GIS-based project information system. Before the deployment of the system, managers were unable to record, in any detail, information relating to the costs associated with areas cleared at different densities for a range of species. As a result of this, only superficial estimates of the impact of the Working for Water programme have been possible hitherto. While the system is not yet in full operation, data for about 60% of project expenditure from the 2002/03 financial year were available, and we used this information on which to base our analysis. These data show that the costs of clearing rise sharply with the density of invasion, reaching more that R2000/ha in some cases. These amounts do not include expenditure on herbicides, which can reach over R1000/ha for dense infestations of sprouting species. A large proportion (57%) of the costs was incurred in clearing large trees, which are perceived to have a significant influence on water resources. Large sums were also justifiably spent on species that probably are not substantial water users, including lantana, triffid weed and cacti. These plants affect biodiversity, catchment stability, and the agricultural potential of land. Some of the species on which large amounts have been spent, however, are arguably not a priority. Good progress has been made with clearing certain species. At current rates of clearing, however, many other species will not be brought under control within the next half century. This underscores both the importance of biological control as a sustainable, effective and inexpensive solution to the most intractable of the invasive alien plant problems, and the need for landowners to share the responsibility for clearing. Our estimates are preliminary, given the incomplete data on the project management system, and should be treated as such.

Introduction

This account provides a preliminary assessment of the costs associated with the control operations of South Africa's Working for Water programme, gleaned from data entered into a newly implemented project management system. We have used this information to estimate the degree to which control operations have made an impact on invasive alien plant infestations in South Africa. While the data are preliminary, they do allow for an informed discussion of the challenges facing the programme, and they highlight areas where research could make valuable contributions to the development of appropriate policies for the control of different species.

The Working for Water programme was started in October 1995, with the dual purpose of protecting water resources (through controlling invasive alien plants), and of job creation (through employment of poor people in control projects).[1] The programme was launched with a budget of R25 million for the period October 1995 to March 1996. Its success saw the programme grow rapidly over the next seven years, to a point where the annual budget exceeded R400 million in the 2003/04 financial year. This initiative was begun during a period of administrative transition, which followed the election of South Africa's first democratic government in 1994. The programme's success has been attributed to several factors, including the unique climate of change that accompanied the new government, political support, and a convincing argument about multiple benefits.[1] The need to find and train large numbers of workers and managers (who in the main had little or no previous experience) was the main focus of management for the first few years of Working for Water. There were no protocols in place for recording the programme's activities and, as a result, only crude estimates of areas cleared (which until recently did not account for the density of the stands of alien plants that were cleared), and aggregated totals of the costs of clearing, could be reported in the annual reports.[2] These were based in turn on rudimentary estimates made at the project level (Working for Water supported over 300 projects in the 2002/03 financial year).[2]

A more detailed analysis of the costs and impacts of the programme is necessary, for obvious reasons. These include the need to assess the consequences of Working for Water in different regions of the country, and their effects on different invasive alien plant species. This will lead, in turn, to an assessment of the programme's effect on the status of invasive alien plant infestations in South Africa. Thorough cost data are necessary also to support budgeting and planning. It is necessary to review the programme's activities in the light of this information combined with an understanding of priority species and areas. To address these needs, the Working for Water programme commissioned a GIS-based project information system. While this system is not yet fully operational, it offers the opportunity to assess costs associated with clearing and follow-up operations at a scale, accuracy and resolution that were not possible before. In this paper, we provide a preliminary assessment of the costs and extent of clearing based on limited data — on terrestrial weeds only — available from the project information system.

Historical costs and extent of clearing

The extent of areas cleared, and the costs of clearing, reported in the Working for Water programme's annual reports[2] are based on two primary sources of information. The first is the Department of Water Affairs and Forestry's financial management system, which accurately records all costs associated with the programme's activities.

The second is the reports from project managers on the degree to which key performance targets were met. These targets include the numbers of people employed in project activities, the areas cleared of invasive alien plants, and the areas subjected to follow-up. Follow-up refers to areas that were initially cleared, and then reworked in order to remove regrowth, either of sprouting invasive alien plants or those germinating from soil-stored seed banks.

These early estimates had various drawbacks, the most important of which is that no estimates were reported of the densities

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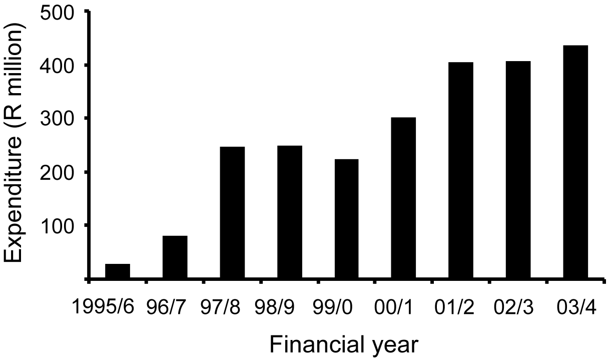

Fig. 1. Total expenditure by the Working for Water programme on invasive alien plant clearing for the period October 1995 to March 2004. Data for 1995/96 to 2002/03 are actual expenditure (from annual reports).[2] The amount for 2003/04 is projected expenditure.

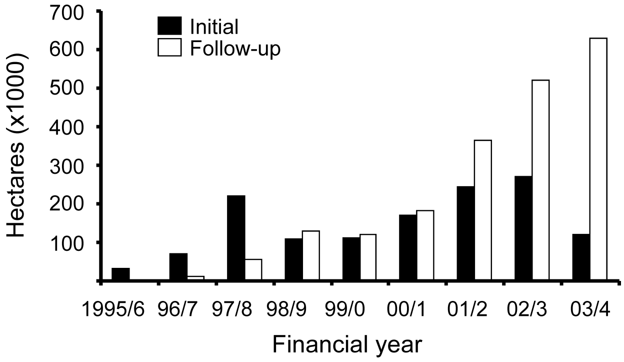

Fig. 2. The areas cleared, and subjected to follow-up treatments, by the Working for Water programme for the period October 1995 to March 2004. Data are for all densities of invasive plants combined (from annual reports)[2].

of invasive alien plants that had been cleared. A preliminary assessment of the extent of invasive alien plants in South Africa[3] introduced the concept of 'condensed' area. Condensed area expresses the extent of invasion as the equivalent of 100% cover of alien plants (for example, 100 ha that was covered by 10% with invasive plants was expressed as a condensed area of 10 ha with 100% cover). The estimates given in annual reports show that 1 225 370 ha had been cleared, and 1 390 742 ha had been subjected to follow-up operations between October 1995 and March 2003. However, these covered all densities, including many areas of light infestation, and consequently the overall impact on the country's estimated 10 million 'condensed' hectares of condensed infestions[3] cannot be assessed.

The annual expenditure on Working for Water operations increased from R25 million in the 1995/96 financial year to over R400 million in 2003/04 (Fig. 1), with R1.95 billion having been spent up to and including the 2002/03 financial year.[2] The costs associated with follow-up treatments have grown annually, and they substantially exceeded those of initial clearing by the 2001/02 financial year (Fig. 2). This is because two or more follow-up exercises may be required after initial clearing (and this varies with the species concerned). It is also well known that

Table 1. The costs associated with the clearing of invasive alien plants in 9 provinces in South Africa during the 2002/03 financial year. Total costs are from the government financial management system, and project costs show the amounts captured on the GIS-based project database.

Province	Total costs (R million)	Overhead costs (R million)	Project expenditure accounted for on project database (R million)	Total expenditure accounted for on project database (exluding overheads) (%)	Major genera of invasive alien species treated
Western Cape	62.850	20.824	23.329	56	Australian wattles (*Acacia* species) Gums (*Eucalyptus* species) Pines (*Pinus* species) Hakeas (*Hakea* species)
Eastern Cape	63.072	23.835	18.941	48	Australian wattles (*Acacia* species) Gums (*Eucalyptus* species) Lantana (*Lantana camara*) Bugweed (*Solanum mauritianum*) Queen of the night (*Cestrum jamacaru)* Triffid weed (*Chromolaena odorata*)
Northern Cape and Free State	21.688	12.119	7.248	76	Mesquite (*Prosopis* species)
KwaZulu-Natal	46.288	14.986	7.688	25	Australian wattles (*Acacia* species) Gums (*Eucalyptus* species) Triffid weed (*Chromolaena odorata*)
Mpumalanga	47.730	21.654	26.077	100	Australian wattles (*Acacia* species) Gums (*Eucalyptus* species) Lantana (*Lantana camara*) Bugweed (*Solanum mauritianum*)
South African National Parks	25.401	8.711	3.922	24	Australian wattles (*Acacia* species) Lantana (*Lantana camara*) Castor-oil plant (*Ricinus communis*) Mexican poppies (*Argemone mexicana*)
Limpopo	43.296	21.181	17.594	80	Lantana (*Lantana camara*) Australian wattles (*Acacia* species) Triffid weed (*Chromolaena odorata*) Mauritius thorn (*Ceasalpinia decapitala*)
North West	19.321	8.061	6.606	59	Syringa *(Melia azedarach*) Queen of the night (*Cestrum jamacaru*) Australian wattles (*Acacia* species) Gums (*Eucalyptus* species) Lantana (*Lantana camara*)
Gauteng	25.204	11.120	13.558	96	Australian wattles (*Acacia* species) Gums (*Eucalyptus* species) Queen of the night (*Cestrum jamacaru*)
Total	354.850	142.491	124.963	61	

Table 2. The areas cleared and followed up by the Working for Water programme for the most important species or genera of invasive alien plants during the 2002/03 financial year. The areas and costs account for 61% of the activity in the year (see Table 1). The cost of herbicides is not included in the costs of initial clearing or follow-up.

Invasive alien plant species or genus	Area subjected to initial clearing (hectares of equivalent 100% cover)	Costs of initial clearing (R million)	Area subjected to follow-up (ha of equivalent 100% cover)	Costs of follow-up (R million)	Cost of herbicides (R/ha, for infestations with 100% cover)
Australian wattles (*Acacia* species)	15 187	19.40	13 003	24.27	285
Queen of the night cactus (*Cereus jamacaru*)	3 207	1.22	17 228	3.76	183
Lantana (*Lantana camara*)	5 407	8.97	7 295	7.02	572
Gum trees (*Eucalyptus* species)	2 264	5.02	3 497	6.50	992
Pine trees (*Pinus* species)	2 464	5.33	1 842	3.99	0 (does not sprout)
Triffid weed (*Chromolaena odorata*)	1 669	2.69	1 912	2.45	282
Bugweed (*Solanum mauritianum*)	1 769	2.95	3 074	4.37	0 (does not sprout)
Mesquite (*Prosopis* species)	1 501	1.39	4 108	3.26	804
Poplar trees (*Populus* species)	533	1.17	521	1.08	345
Hakeas (*Hakea* species)	690	0.85	546	1.02	0 (does not sprout)
Syringas (*Melia azedarach*)	286	0.84	781	1.45	351
Brambles (*Rubus* species)	425	0.73	983	2.71	280
All other species	3 644	8.00	4 976	6.13	–
Total	39 047	58.56	59 767	68.01	–

the costs of clearing increase with the density of invasive alien plant infestations, and that they vary with species. The estimates reported to date do not provide any insights into these aspects of invasive alien plant control.

A GIS-based project information system

The development of a GIS-based project information system was begun in 1999. In this database, the following are recorded for each site: the species involved, the area treated (which was captured spatially at a scale of at least 1:50 000), the density class of the infestation (seven density classes were used, based on aerial canopy cover; the classes were: 0.1–1%, 1–5%, 5–25%, 25–50%, 50–75% and 75–100%), workload (expressed in person-days per hectare) and contract value (money spent on direct clearing operations, including direct supervision, labour, equipment, protective clothing, transport, and administration costs incurred by the contractor). The cost of chemicals was included in overheads (see below).

The system was piloted in some provinces in 1999, and this was extended to include all nine of South Africa's provinces by the 2002/03 financial year. The earliest data were recorded in KwaZulu-Natal, Mpumalanga, North West and Gauteng during 1999. The Western Cape was added in 2000 and Limpopo and Northern Cape in 2001. Data for all national parks were collected separately from 2002, as was information from the Eastern Cape, Free State and Northern Cape. The data sets are incomplete, in that it has not yet been possible to capture comprehensive information from all projects within a province (with the exception of Mpumalanga). The most complete data set available is for the 2002/03 financial year, where the percentage of expenditure accounted for ranged from 48% to 100% (Table 1). All clearing projects in the Working for Water programme are run as contracts, and the project information system included only the costs of contracts awarded for the clearing of invasive alien plants. Overhead costs (for staff employed in the programme, and all activities other than direct clearing contracts) were not included in the project information database, and these were estimated by subtraction from expenses recorded in the financial management system, and adjusted for the proportion of the budget accounted for in the project management system (Table1). In this paper, we have used these data as a sample on which to base estimates of areas cleared by species, and of costs.

Costs associated with clearing and follow-up

For purposes of comparison, data on the areas cleared for important species or groups of invasive alien plants were expressed as condensed areas (see above). The sample available from the project database shows that 12 species (or genera) accounted for 89% of the costs of clearing (Table 2). Australian wattles (*Acacia* species) represented most of this. Initial clearing of wattles accounted for almost 40% of the area in this category, for 22% of the area in the follow-up category, and for 35% of the costs of management of invasive plants for the year concerned. The costs of initial clearing and follow-up in Table 2 do not include expenditure on herbicides, which are listed separately in the table. These costs are given as the mean for initial clearing and follow-up in the 75–100% density class, and they apply mainly to species that resprout after felling. These expenses can be substantial, notably for mesquite and gum trees, where costs approach R1000/ha.

The expenditure on clearing and follow-up operations was estimated for different density classes on the basis of the areas subjected to initial clearing (Fig. 3) and follow-up treatments (Fig. 4) during the 2002/03 financial year. The results show the following:

i. The cost of clearing rises sharply with the density of invasive alien plants, both for initial clearing and for follow-up. For example, costs associated with clearing Australian wattles

(*Acacia* species) rose from R15/ha for infestations with 0–1% cover, to R1927/ha for infestations with 75–100% cover (Fig. 3). The expenditure on herbicides for this species was R285/ha for 75–100% cover (Table 2), which means that total costs were over R2000/ha for the densest class of infestations.

ii. The costs of clearing can vary significantly depending on the species concerned. For example, the expense of clearing the densest class of syringa trees (*Melia azedarach*) was more than nine times that of queen of the night cactus (*Cereus jamacaru*) (Fig. 3).

iii. Some of the cost estimates are based on very small areas being cleared at this stage, and better assessments will only be possible once more data have been collected. For example, the estimate of R2922/ha to clear dense syringa trees was based on clearing only 7 ha.

iv. Some anomalies in the data are the result of different approaches to clearing the same species in different areas. For example, the higher costs associated with follow-up clearing of Australian wattles in the 25–50% cover class, compared to lower costs for denser classes (Fig. 4) is because in some cases seedlings were hand-pulled (more expensive, but requiring no chemicals), or sprayed (cheaper, but the cost of chemicals should be added).

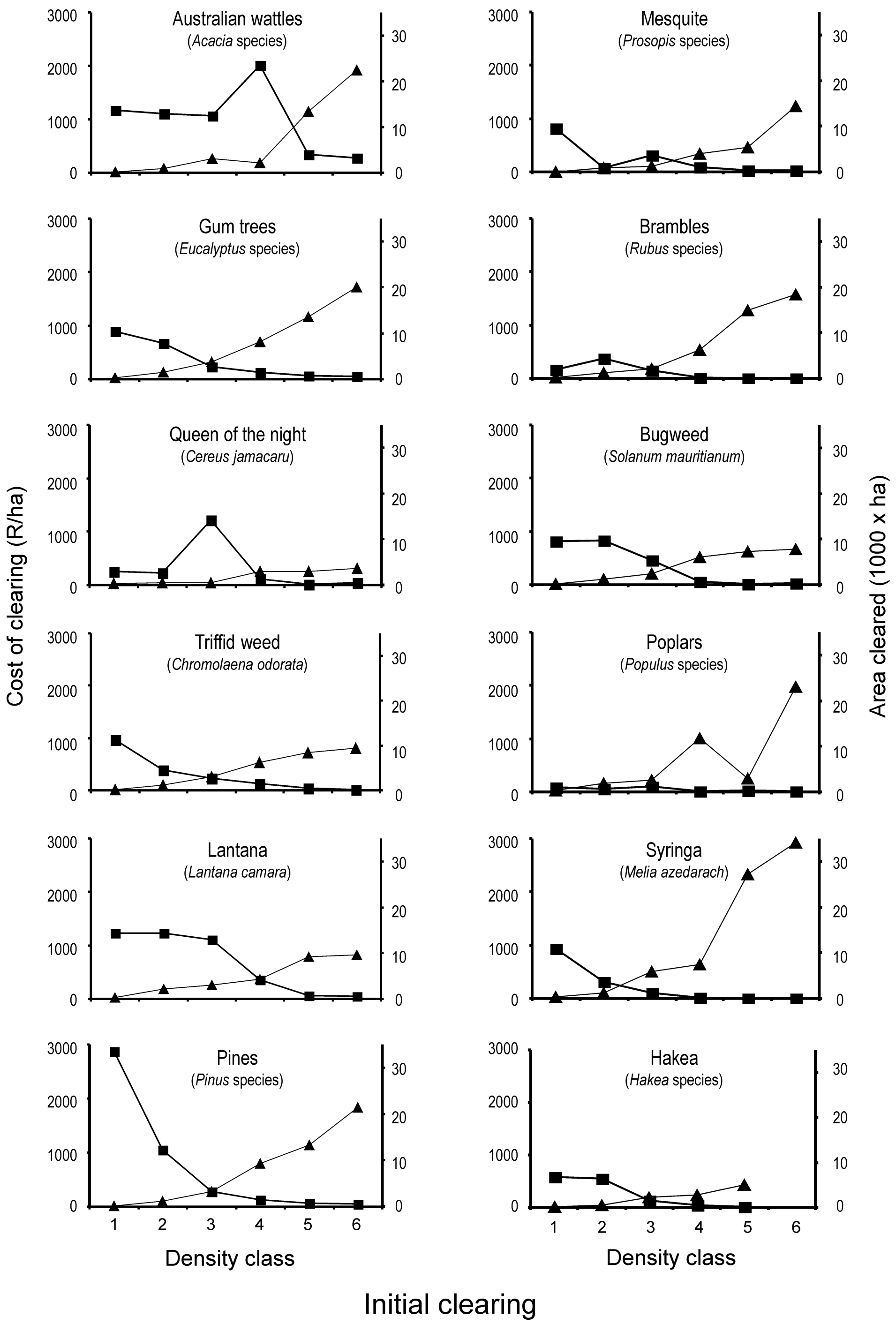

Fig. 3. The estimated costs of initial clearing associated with different density classes for 12 species or genera of invasive alien plants. The density classes are: 1 = 0–0.1%, 2 = 1–5%, 3 = 5–25%, 4 = 25–50%, 5 = 50–75% and 6 = 75–100%. Estimates are based on data from the project information system, which accounted for 61% of expenditure in the 2002/03 financial year. The graphs show the estimated costs (▲), and the areas cleared (■) for different density classes.

Discussion

Are we targeting the right species and areas?

This preliminary analysis has raised a number of questions regarding the relative effort expended on various invasive alien plant species. As expected, most of the costs of clearing, and the largest areas cleared, were related to the large tree species that are perceived to have significant impacts on water resources. The large tree genera (wattles, gums, pines, mesquite, poplars and syringas) made up 57% of the area subjected to initial clearing, 40% of the area subjected to follow-up, and accounted for 58% of the costs (Table 2). Large amounts were also spent on species that probably are not large water users, including lantana, triffid weed, and cacti. These species have other consequences, notably for biodiversity, catchment stability, and the agricultural potential of land, and so these expenses can be justified. However, some of the species on which large sums have been spent are arguable priorities. For example, almost 10% of the funds were spent on bugweed and queen of the night cactus (Table 2). The significance of bugweed as an invasive species has been questioned (it is seen largely as a weed of disturbed areas and forestry plantations), while queen of the night cactus is under a substantial degree of biological control.[4]

There are some important species that do not appear to be targeted by Working for Water, for example Spanish reed (*Arundo donax*) and weeping willow (*Salix babylonica*), both of which are listed as very widespread and common in a recent analysis of invasive plants in South Africa.[5] There seems also to have been a focus on riparian areas, with less done to control important invaders of mountainous catchments. For example, hakeas are abundant in the mountains of the Western and Eastern Cape,[5] but relatively little was spent on them, probably owing to the difficulties of working in the remote and rugged areas where they occur. The data from the project management system will allow managers to assess the relative effort expended on the various species, and as the system becomes fully operational, we expect that informed decisions on the allocation of funds to priority species will be possible.

Impacts on alien plant infestations

One of the key questions that should be addressed is whether or not the activities of the Working for Water programme really affect the status of invasive alien plant infestations in South Africa. The programme has been proposed to last 20 years,[2] and progress towards achieving the goal of clearing major infestations within that period has not yet been assessed. The limited and preliminary nature of available data does not allow any confident conclusions to be drawn in this regard, but it does allow the question to be explored. The only available (albeit crude) estimate of the extent of invasion in South Africa showed that about 10 million ha of the country was affected.[3] To assess the area cleared in the 2002/03 financial year, we adjusted upwards the combined condensed area subjected to clearing and follow-up (Table 2) to allow for incomplete coverage (61% of the budget) in the project information system. Assuming that each species receives an initial clearing and one follow-up treatment (that is, the same area is tackled twice), the area subject to initial clearing plus follow-up in 2002/03 was divided by 2. We used these approximations to assess the time that would be required

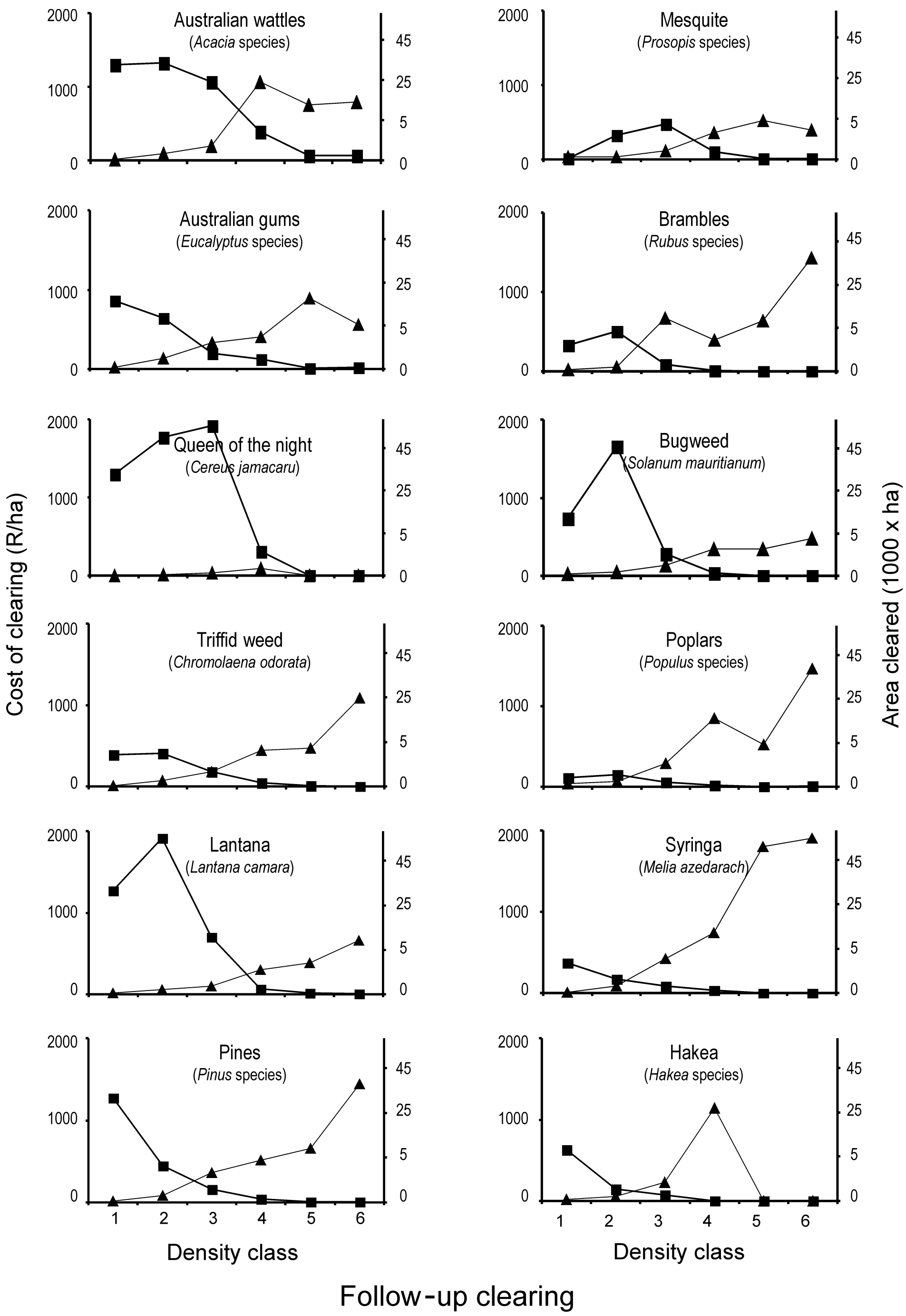

Fig. 4. The estimated costs of follow-up operations associated with different density classes for 12 species or genera of invasive alien plants. The density classes are: 1 = 0–0.1%, 2 = 1–5%, 3 = 5–25%, 4 = 25–50%, 5 = 50–75% and 6 = 75–100%. Estimates are based on data from the project information system, which accounted for 61% of expenditure in the 2002/03 financial year. The graphs show the estimated costs (▲), and the areas cleared (■) for different density classes.

to reduce existing infestations to zero by dividing the estimated area infested nationally by the area treated in one year (Table 3).

The above approximation relies on several assumptions, and each of these must be understood when the results are interpreted. The assumptions, and their interpretations, include:

i. That infestations are static, and will not spread further while clearing operations are under way. This assumption is obviously false, and it means that our calculations will underestimate the time needed to clear existing infestations. The spread of an invading organism generally follows a sigmoid curve over time.[6–8] The initial expansion is slow as the founder colony becomes established, and increases rapidly as the colony expands and founds new colonies, decreasing again as the potential habitat (invadable area) becomes fully occupied. Some species of invasive alien plants are already widespread in South Africa (for example, black wattles, *Acacia mearnsii*),[5] and their spread may be slowing. Spread rates of this species will be further retarded by the introduction of effective biological control agents.[4] Other species (such as triffid weed, *Chromolaena odorata*) are currently expanding exponentially, and are without effective biological controls, so their effects are likely to be underestimated.

ii. That clearing a site will eradicate the invasive alien species.

Table 3. Estimates of the time required to treat national-scale infestations of important groups of invasive alien plants in South Africa, on the assumption that each species requires an initial clearing and one follow-up, and that expenditure will continue at 2002/03 spending levels.

Invasive alien plant species or genus	Estimated area in South Africa (hectares of equivalent 100% cover)*	Estimated area treated in 2002/3 (hectares of equivalent 100% cover)+	Projected time needed to treat national infestation (years)#
Australian wattles (*Acacia* species)	719 979	23 105	31
Queen of the night cactus (*Cereus jamacaru*)	21 950	16 794	1.3
Lantana (*Lantana camara*)	69 268	10 411	7
Gum trees (*Eucalyptus* species)	62 949	4 722	13
Pine trees (*Pinus* species)	77 093	3 529	22
Triffid weed (*Chromolaena odorata*)	43 227	2 935	15
Bugweed (*Solanum mauritianum*)	89 491	3 961	23
Mesquite (*Prosopis* species)	173 149	4597	38
Poplar trees (*Populus* species)	15 235	863	18
Hakeas (*Hakea* species)	64 089	1 013	63
Syringas (*Melia azedarach*)	72 625	874	83
Brambles (*Rubus* species)	26 461	1 154	23

*Data from Versfeld *et al.*[3]
+Total area recorded as receiving initial clearing plus follow-up divided by 2, and adjusted upwards for incomplete coverage in the project management system.
#Area in South Africa divided by area treated in 2002/03.

The effectiveness of clearing will in fact vary (most notably with the density of the original infestation, the species, and the time that the site has been invaded),[9] and no clearing operation will totally eradicate an invasive species. It is therefore necessary to be able to quantify the effects of clearing, and follow-up operations, on the density of the remaining plants in the area, in order to assign a new density class to a cleared area. These factors will also result in an underestimate of the time required to bring existing infestations under control.

iii. That only one follow-up treatment is required. The number of subsequent clearings required to bring an infestation of invasive alien plants back to sustainable, manageable levels may be as many as five or six. Sprouting species normally require more treatments than species that lack the ability to sprout, and the number of treatments increases with the density of the original infestation. Again, these factors will lead to an underestimate of the time needed to bring infestations under control.

iv. That current funding levels will be maintained. Obviously, this may not happen, especially in view of the long time frames required. Any decrease in funding will proportionally extend the time needed to bring invasives under control.

v. That we know how big the problem is. This is not the case, and the available estimates are based on a preliminary assessment and must be treated with caution.[3] However, it is not clear whether the available information constitutes an over- or underestimate.

Overall, therefore, the approximations in Table 3 are likely to underestimate the time that will be needed to gain control of major existing infestations. For some species (notably queen of the night cactus, *Cerius jamacaru*, but also lantana, *Lantana camara*, and gums, *Eucalyptus* species), good progress has been made, but this is subject to verification in the field. For others, notably hakeas (especially the widespread *Hakea sericea*), mesquite (*Prosopis* species) and syringas (*Melia azedarach*) the indications are that, even with the existing generous levels of funding, it is unlikely that the problem will be contained within the next half century, and clearly other solutions need to be found. This underscores the importance of biological control as a sustainable, effective and inexpensive solution to the most intractable of the invasive alien plant problems.[4] Taking hakeas as an example, most infestations occur in inaccessible areas, where manual clearing operations are unlikely ever to be a practical option. Currently, the Working for Water programme is investing in research aimed at establishing a range of seed-feeding insects, stem-boring insects, and plant pathogens (including mycoherbicides that will target the weed species concerned, and that can be applied using aircraft against flushes of seedlings that emerge after fires in remote areas). In addition, the fact that the state currently carries the burden of clearing most areas is not sustainable. Landowners must take responsibility for invasions on their land, and legal and financial incentives should be sought to facilitate this. It is hoped that these solutions will reduce the threat posed by the significant weed, and offer the possibility of gaining control of existing infestations.

Important research questions

The new project information system will assemble important data on the activities of the Working for Water programme in future, and these will provide a basis for the prioritization of activities as well as for monitoring the effects of the enterprises on the status of invasive alien plant infestations. However, our understanding of a number of important aspects of the dynamics of invasions remains relatively poor. These could be improved with focused research so that, together with available data from the project information system, more meaningful interpretations could be made. This research should include the development of improved understanding of the rates at which different invasive alien plant species can spread (and the processes that drive dispersion), and the potential areas that invasive species would be likely to occupy if no action was taken to control them. It will also be necessary to develop a better understanding of the effectiveness of clearing operations. Finally, the role that biological control plays in changing the population dynamics of invasive alien plants, and contributing to the long-term maintenance of cleared areas, needs to be better understood.

The choice of appropriate courses of action regarding the clearing of invasive alien plant infestations can be assisted by the development of decision-support models based on the above understanding. For example, managers need to decide whether available labour and funds should be directed towards clearing light or dense infestations where these occur together, as these choices could have different outcomes because of the differences in costs and in the rate of spread of different species.[10] Such models have been developed[11,12] but have not yet been used in practice. The development of the project information system reported on here will provide an opportunity to develop these models further as well as to apply them for the first time in practice.

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Alien plant invasions in South Africa: driving forces and the human dimension

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Invasive alien plants pose a substantial threat to the rich biodiversity of South Africa, and to the sustained delivery of a wide range of ecosystem services. Biological invasions are driven by human activities and mediated by culturally shaped values and ethics. This paper explores the human dimensions of alien plant invasions in South Africa. We consider four primary forces, those which directly influence the likelihood and rate of invasion — arrival of propagules; changes in disturbance regimes; changes in the availability of limiting factors; and fragmentation of the landscape — and the roles of 22 secondary driving forces in shaping the outcomes of the four primary driving forces. Human societies and their dynamics and activities are an integral part of each of the secondary driving forces. A map of the interactions between and among the primary and secondary driving forces shows how they are interlinked and influence each other — either positively or negatively, or switching between the two. There are two key points for intervention: prevention of the introduction of propagules of potentially invasive species and developing collaborative initiatives with enterprises that rely largely on alien species (for example, horticulture, agriculture and forestry, including community forestry) to minimize the introduction and use of potentially invasive species. An example of the first type of intervention would be to implement more effective inspection systems at international border and customs posts. This type of intervention can only be effective if those who are directly affected — whether businessmen, tourists or migrants — understand the requirement for these measures, and collaborate. The need to build public awareness of the critical importance of the human dimension of invasions emerges as a key theme from this analysis and is the basis for better-informed decisions, more effective control programmes and a reduction of further invasions.

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Introduction

Invasive alien plants, hereafter called invaders, are widely considered as important a threat to biodiversity as direct human transformation of the natural environments and production of greenhouse gases.[1,2] Invaders also threaten ecosystem services, including water purification, soil generation, waste decomposition and nutrient cycling, which are critical to human survival. A recent overview for seven different countries estimates the global costs of control programmes plus the total costs of damage caused by invaders to be of the order of US$314 billion per year.[3] Invaders cost South Africans tens of billions of rand annually in lost agricultural productivity and resources spent on weed control.[4] An assessment of the economic impact of black wattle (*Acacia mearnsii*) gave a net present cost of $1.4 billion (R9.8 billion)[5]. The costs associated with invasion by black wattles are at least partly offset by the substantial social and economic