



Challenges in invasive alien plant control in South Africa

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The Department of Environmental Affairs' strategic plan¹ for 2012–2017 outlines programmes and projects that collectively aim to (1) 'contribute to sustainable development, livelihoods, green and inclusive economic growth through facilitating skills development, employment creation and infrastructure development' and (2) 'restore and maintain vegetation structure and function in order to contribute to ecosystem services'. The largest programme is the Working for Water programme, which strives to control invasive alien species (until recently only plants), and in so doing to protect essential ecosystem services. Several related programmes on forests, fire, wetlands and energy address overlapping issues that can either assist with, or enhance the benefits of, invasive alien plant control. These programmes collectively have a 3-year budget of R7.8 billion, arguably the most generous funding for an environmental problem that South Africa has ever seen. Although Working for Water operated for 16 years under the administration of the Department of Water Affairs, its recent transfer to the Department of Environmental Affairs, its consolidation with other initiatives and its substantially increased funding offer opportunities to the scientific community to inform improvements in ecosystem management. Through careful monitoring, assessment and analysis, important lessons can be learned and fed back into the programmes to continually improve management.

Working for Water owes much to the community of fynbos ecologists who were instrumental in putting forward an argument to government for its initiation in 1996.² The 33rd Annual Fynbos Forum (attended by over 250 delegates at Cape St. Francis on 17–19 July 2012) included a plenary workshop on the effectiveness of Working for Water, and discussions on ways for the scientific community to assist in the identification and implementation of improvements. This brief report outlines the issues discussed, including the problems faced by Working for Water, and possible ways for the scientific community to assist in addressing them.

The late Kader Asmal, in his capacity as Minister of Water Affairs, outlined the challenge facing Working for Water at its inception in 1996. He stated that the programme was the world's most comprehensive initiative to clear invading alien plants, and that it needed to clear approximately 750 000 hectares each year to bring invasive alien plants under control within 20 years. Funding for Working for Water increased from R25 million in 1995 and 1996 to R250 million in 1997 and 1998, at which stage it was estimated that R600 million per year would be needed over the next 20 years (assuming that invasive alien plants spread at a rate of 5% per year) to reduce the problem to a level where the invasive species could be contained at a relatively low cost.³ This proposed level of spending was justified principally on the basis of the predicted economic consequences of lost water if invasive alien plants were to occupy all of the land suitable for invasion.⁴ Subsequent studies have estimated the value of potential ecosystem services (water, grazing and biodiversity) in South Africa at R152 billion annually.⁵ Although an estimated R6.5 billion of this amount is lost every year as a result of invading alien plants, the loss would have been an estimated additional R41.7 billion had no control measures been carried out. These values indicate a saving of R35.2 billion every year (approximately 4.8% of South Africa's annual GDP); about one third of this saving was as a consequence of biological control.⁵

Recent reviews of Working for Water's performance over the past decade have revealed both strengths and weaknesses.^{6,7} In the fynbos biome alone, R855 million has been spent on clearing invasive trees and shrubs. Despite this substantial investment, Working for Water was able to reach only a relatively small proportion of the invasions, which continue to spread, albeit less rapidly. It also appears that the initial estimates of rates of spread of about 5% per year were too low. Thus, while there has been progress in some areas in the fynbos biome (for example on the Cape Peninsula), these successes have been localised, and many areas remain under considerable threat from invasions. For example, it was estimated that, at current levels of effort, it would take 50 years to clear invasive wattles from the Krom catchment and 695 years for the Kouga catchment, assuming that no spread takes place in the interim.⁷ The accelerating spread of invasive pine trees in inaccessible mountain areas, where clearing is particularly difficult,⁸ threatens to displace fynbos over vast areas, with serious consequences for water resources, catchment stability and the risk of wildfires.



Investments by Working for Water into biological control, combined with these mechanical clearing, are nonetheless paying substantial dividends. *Hakea* species appear to have declined because of historic (pre-1995) mechanical clearing, ongoing clearing by Working for Water, and a substantial degree of biological control.⁹ Some Australian *Acacia* species, among the worst invasive species in the fynbos, have been reduced in extent and vigour.¹⁰ In particular, a gall-forming fly recently released on *Acacia mearnsii* has virtually stopped pod production in some areas,¹¹ offering encouraging prospects for gaining control through a combination of mechanical clearing and seed reduction through biological control. There are also prospects for the release of a biological control against pines,¹² which would be the only sustainable long-term option for keeping these aggressive invaders in check.

Working for Water has the dual mandate of protecting ecosystem services and providing employment. Workshop participants were reminded that the original argument for investing in invasive alien plant control centred on the threat that they posed to water supply and other ecosystem services. These services are needed to underpin sustainable economic development, and this need alone would have justified the investment because economic growth was an obvious priority. The opportunity for creating employment for the rural poor was an added, and very attractive, benefit. Such additional goals can create tension if trade-offs have to be made (for example, shifting focus to priority areas may mean the loss of jobs in some areas), but they have been essential for gaining political support.

Most invaded land is privately owned, and landowner involvement needs to be addressed by Working for Water, because without such involvement invasive alien plants would continuously re-invade cleared areas. Social research showcased at the meeting¹³ showed that landowners and other stakeholders generally support the notion of inclusive environmental governance involving both public and private sectors, but also that there is a strong need for monetary incentives, motivational tools and regulation enforcement if the desired outcomes are to be achieved. Buy-in from landowners is closely linked to personal and local circumstances, indicating the need for differentiated policies for working on state and private land.

Guy Preston, who has overall responsibility for the programmes, outlined how Working for Water has to address many issues if sustainable solutions to controlling invasive alien species are to be found. He stressed the need for more effective legislation that would require land-users to take responsibility for managing invasive species, hold growers accountable for seed pollution, and require compulsory clearing of invasive species prior to the transfer of land. Other challenges mentioned included the need to increase vigilance and compliance at our borders, to expand the capacity to respond rapidly to the threat of new invasive species as they arise, to broaden the scope of projects to include species other than plants, and to find innovative ways to utilise

the biomass provided by invasive species without creating dependency. The magnitude of the problem threatens to overwhelm those tasked with addressing it, and there is a real danger that overall effectiveness will decline if attempts are made to address everything. The question of whether to increase effectiveness by focusing on priority areas, or to continue to operate broadly while at the same time increasing effectiveness (for example by better enforcement of legislation and by tapping into additional sources of funding), will be an ongoing debate for some time.

The intention for the workshop was to identify actions to increase the effectiveness of Working for Water. A number of suggestions were made, including:

- To focus on priority areas, so that available funds can be more effectively utilised. Currently, there are arguably too many projects in too many areas trying to control too many species. This lack of focus leads to the dilution of funding, with the inevitable consequence that not enough projects make adequate progress.
- To pay more attention to planning, monitoring and evaluation. Currently, management plans do not have clear, time-based goals. Setting such goals would lay the foundation for accurate estimates of the effort that would be required to reach them, and thus for the allocation of adequate funding. Monitoring by independent auditors should assess progress towards these goals, and it should be acceptable to adapt goals or time frames if necessary. Research has revealed that such monitoring can be carried out at a relatively low cost.
- To phase in a greater proportion of funding for biological control, where impressive levels of success have been achieved. Currently, spending on biological control is only about 3% of the total funds available, despite the substantially better returns on investment.¹⁴
- To pay more attention to bio-security, through strengthening the capacity to assess the risks of introducing new species as well as by intercepting illegal or accidental introductions (including pathogens and diseases), and to effect early detection and rapid response.
- To adopt a more nuanced approach in entering into contracts with private landowners detailing shared responsibilities, because buy-in from private landowners is closely linked to their circumstances (one size does not fit all). Flexible financial assistance would be needed to address the realities of unplanned fires that drive the episodic spread of invasive species, new and emerging invasive species and unexpected variations in treatment response. Working for Water recognises the need for private landowners to take responsibility for alien plant control on their land, and has set out guidelines for support, advice and other incentives, as well as for the enforcement of regulations regarding alien plant control.
- To improve the qualifications of field managers. Currently, very few Working for Water managers have qualifications in ecosystem management. The establishment of a 2-year diploma course in alien plant management, the provision

**TABLE 1:** Key performance indicators and their possible improvements.

Performance indicator	Current formulation	Shortcomings	Possible improvements
Progress with control operations aimed at widespread invasive plant species	Area (hectares) of invasive alien plants treated	Areas could be situated anywhere; level of treatment achieved is open to interpretation	Identify priority areas and species Specify required levels of treatment Assess changes in invasive alien plant cover over time at an appropriate scale
Effectiveness of biological control	Number of sites where biological control agents established	Sites could be situated anywhere, and the target weed species for biological control are not specified (some are able to disperse unaided)	Specify target weed species and appropriate densities of biological control agents, where necessary
Effectiveness of containing or eradicating invasive plant species with limited distributions	Number of emerging invasive alien species controlled	'Control' and 'emerging' are not adequately defined The number of species targeted appear to have been derived arbitrarily	Specify target species and desired levels of control Allow for the inclusion of new target species should they emerge
Effectiveness of fire management	Area (hectares) of fire suppression, fire protection and prescribed burning	Confuses fire protection and suppression (keeping fire out) with prescribed burning (applying fire)	Specify a lower ratio for area burnt in wildfires to area burnt by prescribed fires in particular areas

Current formulations are from the Department of Environmental Affairs' strategic plan¹.

of bursaries and employment of graduates would go a long way to addressing this need. The failure of previous field programmes because of this shortcoming was identified long ago.¹⁵

The workshop concluded with a discussion on key performance indicators. The process of formulating these indicators was seen as very important, not only because they drive behaviour ('what you measure is what you get') but also because, if clearly formulated, they would help to focus the programme on important outcomes rather than on inputs (Table 1). While inputs are easy to measure, they provide no insights into progress towards goals. Measuring outputs would be more meaningful than measuring inputs; quantifying outcomes would be even better, and demonstrating impacts on government's priorities better still. However, undertaking any of these assessments is challenging. For example, measuring the progress towards a clearing goal (output = hectares effectively cleared) can be relatively easily attributed to the inputs (money spent, labour effort). Demonstrating the effects of hectares cleared on streamflow runoff (an outcome) would be more difficult, and ultimately illustrating the links to economic growth (an impact) would be almost impossible. In addition, each result along this continuum requires more time to manifest itself, and is increasingly affected by multiple factors, making it difficult to demonstrate links to particular inputs. Key performance indicators therefore need to be carefully formulated so that they can assist in identifying real progress. This area is one in which the scientific community can make a meaningful input.

Like all environmental management programmes, Working for Water has to operate in complex socio-ecological environments, in which it is continually necessary to monitor outcomes, learn from experience, and adapt new approaches. We see the way forward as a continued partnership between scientists and practitioners, in which we work together to address the significant challenges that lie ahead.

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