

*Editor's Note: This article brings some good news on progress against exotic pest plants in New Zealand and elsewhere in the Southern Hemisphere. It also offers a summary of basic approaches to the problem. Florida readers will probably recognize the "habits" discussed here as already well-established strategies for invasive plant management in the Sunshine State.*

# Seven Habits of Highly Effective Weed Programmes

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**M**osquitoes, crazy ants or black widow spiders slip into a country inside shipping containers or old tyres. By contrast, few plants new to the country are brought in accidentally. They are already here, brought in quite legally for horticultural, agricultural or forestry purposes. Gardens, farms and plantations are the main source of new weeds in several countries: New Zealand (74%: Buddenhagen et al., 1998), Australia (65%: Blood, 2003), South Africa (66%: Lesley Henderson, pers. comm.), UK (48%: Preston et al., 2002). In North America Reichard, 1994 (in Reichard and White, 2001) reported that 99% of naturalised woody species had been deliberately introduced. These garden plants, lurking in cultivation, are the future alien plant invaders.

New Zealand has over 24,700 introduced plant species (Williams et al., 2002). Over 2100 species are already naturalised; a proportion will become invaders. Proactive management is essential for handling species that escape garden boundaries and threaten ecosystems. Establishing strategies and tools allows us (country, industry or agency) to deal quickly with new weeds, and effectively with widespread weeds. This paper discusses the steps and the science needed to effectively manage these future invaders. The steps are based loosely on Covey's (1989) seven habits of highly effective people. Most of the procedures discussed were developed for weeds of concern to conservation in New Zealand, but they can be applied to weed management elsewhere.

## SEVEN HABITS

The seven essential ingredients of effective weed management are: get ready, set objectives, prioritise, understand weeds, get everyone involved, actively control weeds, and "sharpen the saw."



Helicopter spraying gorse (*Ulex europaeus*)

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### 1) BE PROACTIVE - GET READY

We know for certain new weeds will appear, but not which species, nor when, nor where. We need to act quickly, whether they arrive fresh from overseas or, more likely, as recent garden escapes.

"Being ready" nationally involves having in place strategies for dealing with newly discovered weeds, and "seamless" procedures for dealing with these species once they have spread beyond the scope of early response. Such strategies must include tools like:

- Effective surveillance for early detection of new naturalisations
- Weed risk assessment for all newly naturalised species
- Work teams to contain and control new and spreading threats
- Monitoring procedures to assess progress in eradication, containment or management

Similar strategies and tools are required for states or regions, where authorities may wish to protect the general public,

landowners or conservation areas from new "internal escapes," new incursions, and, sometimes, established invasives.

In several countries scientifically based tools for weed risk assessment, surveillance, monitoring and control are now in place, and science will continue to improve their value.

Because of the unpredictability of weeds, the strategies and tools must be based on principles, rather than being weed or place specific. They may need to be backed up by appropriate legislation: unpopular or drastic actions may sometimes be necessary to achieve important goals.

### 2) BEGIN WITH THE END IN MIND: SET OBJECTIVES

Objectives establish what we aim to do to the weed and what we want to achieve in the affected environment; they keep us focused. This allows us to get beyond just controlling weeds for the sake of it. For example we may continue to con-



Helicopter spraying *Clematis vitalba*

trol a weed because we've always done it, even though in some circumstances that weed may be useful, e.g. blackberry may protect seedlings of native trees from browsing animals, frosts or drought.

The sort of measurable and time-bound objectives we might have are:

- Eradicate *Hydrilla* from the South Island by 31 December 2004.
- Reduce *Salix* spp. to zero density (no obvious sign of plant, although seeds may still be in the soil) in Whangamarino by 31 December 2004.
- 95% reduction in identified weeds on Kapiti Island by 31 December 2004.

In the past, the nominal long-term goal of many weed control projects has been "eradication." This has often been next to impossible and thus the objective did not serve a useful purpose. Having an *appropriate* objective helps keep us on target.

### 3) PUT FIRST THINGS FIRST: PRIORITISE

Decide which weeds are worth controlling and at which sites weed control is most beneficial. In New Zealand we have encapsulated these approaches, coining the words *weed-led* for programmes to eradicate new infestations early and *site-led* for control of widespread weeds at important sites. Before we can set those priorities, we need to know about the weeds

themselves, or the sites, or both. For a weed we need to know how it grows and spreads, how widespread it is now and, most importantly, whether we can control it. For a site, we need to know its conservation value.

The priority setting systems are based on scientific knowledge of weed ecology (Timmins and Owen 1999). Models to determine the future spread of weeds under different levels of management are currently being developed in New Zealand (PestSpread; Kean et al., 2003) and Australia. They will be used to predict the future benefits and costs of different control scenarios, including no control. Research that helps improve priority setting, especially in determining which weeds have the greatest potential to spread and which sites are most at risk, will be valuable.

Early kill of new infestations of a weed is the most cost-effective approach (Harris and Timmins 2004). However, once a weed is established and widespread, often the most cost-effective approach is to focus control just at high-value sites.

Sometimes we have to admit defeat, and give up. Some weeds in New Zealand, like gorse and blackberry, have been treated as noxious for over 100 years, but despite this they have steadily spread. Wide scale control seems inappropriate: efforts are better channelled into targeted control where it counts.

### 4) UNDERSTAND WEEDS

Knowing how weeds behave helps in their control and in efforts to limit their spread and impact on ecosystems. Historically, most weed research efforts have concentrated on the biology and control of agricultural weeds. More research is needed on the invasive environmental weeds that we now have to deal with. Australia's Cooperative Research Centre for Weed Management sets a good example, as research on the basic principles of weed biology and control is conducted in both environmental and cropping ecosystems.

Studies of the impacts of invasive species on native ecosystems are few and far between. Such studies often need to be long term for various reasons: because native vegetation may eventually overcome some weeds; to assess the long-term impacts; or to allow the ecological processes to play out. Sometimes, invasive species can actually serve as nurse crops for the recovery of native systems, as happens in the case of gorse (Hackwell, 1980) and other species (Williams, 1983) in New Zealand. But recent work has shown that even while acting as a nurse crop, weeds may alter the trajectory of natural succession (Williams et al., 2004).

The role of propagule pressure in promoting weed establishment and spread is only now being investigated. Enserink (1999) pointed out that marketing an exotic species over a period of time increases its chances of establishment, and Perrings et al. (2002) that repeated introductions (or escapes from gardens) have the same effect. Propagule pressure is related to closeness to settlements and roads, aspects discussed by Timmins and Williams (1991) and Sullivan et al. (in press).

A fruitful area of future research would be on factors that encourage invasiveness. This may lead to better ways of preventing weed invasion of ecosystems. It might include controlling seed vectors or establishing quarantine strips between weeds and conservation areas. Better methods of finding individual weeds and mapping their precise positions would be useful. Dogs, already used for finding pest mammals like stoats, could possibly be trained to search for isolated weed plants. Further improvements in weed control methods – better herbicide or application

technology, or novel methods of killing isolated plants – could make weed control more effective.

### 5) GETTING EVERYONE INVOLVED

Finding new weed invasions is hard; controlling weeds is slow and laborious. Everybody—public, non-government organisations, local and central government—must work together. Members of the public have important roles to play at all stages of weed invasions, and early planning must ensure cooperation among agencies and with individuals. This is true at national, state or regional level for new weeds or weeds of very limited distribution.

A good example of communities working together in New Zealand is the National Pest Plant Accord (<http://www.maf.govt.nz/biosecurity/pestsdiseases/plants/accord.htm>, cited 9/17/04). This was put together as a co-operative effort by central and local government and the nursery and gardening industries. Listed plants are classified as “unwanted organisms” which means they cannot be sold, displayed or distributed.

## These garden plants, lurking in cultivation, are the future alien plant invaders.

Getting the public “on side” with weed control efforts is vital—people are both the problem and the solution. Commonly, the “weeds” being controlled are attractive plants in home gardens. People may share these nuisance plants with friends and neighbours or distribute weeds by dumping their garden waste in nearby natural areas. Greater awareness of weeds and the problems they cause can help curb such inappropriate behaviour. Individuals and communities can play many parts in weed management, from spotting the first escaped invader through to actively helping to manage weeds in their local area.

The South African “Working for Water” scheme, which targets invasive weeds because they use more scarce water than native species, has been a success in combating both weeds and unemployment (<http://www-dwaf.pwv.gov.za/wfw/>, cited 9/21/2004).

The Weedbusters movement, coordinating weed efforts within each of

Australia, South Africa, New Zealand and parts of America recognises that people are both the problem and the solution and facilitates activities on both fronts (Bill et al. 2004).

### 6) ACTIVELY CONTROL WEEDS

Plans, objectives and committees have never stopped the spread of a single weed. People kill plants.

Teams of people on the ground must be available to eradicate new invasives, early, and contain established alien species. The action must be in line with established plans, and the correct approach must be chosen for each weed or, more often, for a precious site.

Mechanical control (pulling, digging or cutting) is adequate for some weed species, but soil disturbance should be minimal. Some conservation groups prefer not to use herbicides, but chemical control can be effective and efficient, especially where weed control is necessary over large areas.

### 7) SHARPEN THE SAW

Covey's 7th habit involves “balanced self-renewal.” In a weed context, that means learning from the past to improve future weed control. To do this, we must accurately assess progress against proper objectives (set in step 2). This requires scientifically robust monitoring, evaluation of progress, and if necessary, re-jigging future management.

After measuring progress against objectives, control methods may need to be changed. Often, suppressing the weeds is only the means to an end. The real aim is protection or restoration of a patch of bush, or protection of a larger area from the potential ravages of a new alien invasive species. Monitoring our progress in protecting biodiversity, i.e. measuring the response of the native species to our weed control, must be conducted at selected sites so we can tell if we are making a conservation difference.

We have talked about measuring progress in weed control and in improve-



Vegetation monitoring

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ment of national heritage. Equally important is assessment of the progress of public awareness about weeds. Recruiting the public to help in detecting new invasions, stopping inappropriate garden rubbish dumping and assisting in weed control operations are important parts of getting everybody involved. A survey of awareness of weed issues among the general public of New Zealand, carried out in 2003 (Bill et al. 2004), served to establish appropriate goals for Weedbusters New Zealand, and also serves as a benchmark against which to measure gains in weed awareness.

In conclusion, the seven essential ingredients of highly effective weed programmes mirror those of highly effective people—have plans in place, set objectives, prioritise to achieve those objectives, understand the weeds, get people involved and working together, take action, and engage in constant improvement. Science is a vital part of effective weed management at all steps. Taking New Zealand as an example, we have reported some progress, but we have also identified some of the further research required to improve our ability to perfect the seven habits.

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