

Messages and metaphors: is it time to end the ‘war on weeds’?

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Summary This paper considers aspects of human psychology involved in our responses to weeds and problems associated with the ‘war on weeds’. It argues for a better understanding of weeds as part of nature, and for a cessation of hostilities.

Keywords Psychology, fear, guilt, pollution, emotive language, nativism, war on weeds, herbicides, resistance, collateral damage, propaganda.

WEED PSYCHOLOGY

What part do emotions play in our dealings with weeds, including our decisions about waging war on weeds, and which plants to regard as the enemy? How did fear and loathing become so widespread as the typical response to weeds?

My thinking about the psychology of weeds began when I came across a perceptive review by Professor William Stearn in the 1956 *Journal of the Royal Horticultural Society*. What struck me was Stearn’s suggestion that the appropriate sphere of science for considering weeds was psychology rather than botany: ‘Taken as a whole, weeds are not so much a botanical as a human psychological category within the plant kingdom, for a weed is simply a plant which in a particular place at a particular time arouses human dislike...’ (Stearn 1956).

Weeds carry emotional impacts which are sometimes very powerful. Weeds are often considered unsightly, as disfiguring the landscape, as a sign of disorder and neglect. Weeds attract adjectives such as ‘ugly’, ‘pernicious’, ‘hateful’, and ‘noxious’; expressions of the emotions aroused by the threat to good order that they represent. Weeds growing on waste land, roadsides, ruins, rubbish heaps, and other uncultivated areas, where they might merely be thought untidy, attract these epithets as readily as weeds of farms and gardens.

Feelings of guilt may also be involved in our response to weeds. We may feel that to permit weeds to take over a garden, or to allow thistles to grow unchecked, is to fail to maintain proper standards, to be untidy, to be socially irresponsible, to set a bad example, to permit pollution. Such feelings can operate when we are told that a particular plant is a weed. We may feel a strong compulsion to remove the plant even if it has not been troublesome in this location,

without pausing to ask ‘Why do you say it’s a weed?’

The depth of the feelings which may be involved is demonstrated by Hamlet’s first soliloquy contemplating suicide because of his disgust with the world after his mother’s unseemly marriage to his father’s brother just two months after his father’s death. How did Shakespeare bring home to his audience the reality of Hamlet’s suffering? By the lines:

‘...O fie! ‘tis an unweeded garden,

That grows to seed: things rank and gross in nature
Possess it merely.’

(*Hamlet* Act I Scene II)

Shakespeare uses the emotions aroused by a garden possessed by weeds *rank and gross in nature* to help us share in Hamlet’s emotions. The *unweeded garden* around him is so unbearable that Hamlet wants to kill himself. Why do weeds give rise to such feelings? A consideration of human psychology helps us to understand what humans think, say and do about weeds.

In an article in *Gardens Illustrated*, ‘Wonderful Weeds’, Frank Ronan argues that ‘A weed, in fact, is a plant that will flourish with no help from us; that does not require our intervention. That is the insult and why we despise it. A weed is a plant that injures our pride’ (Ronan 2010). The suggestion that such feelings are involved in our response to weeds is very interesting (even if made tongue in cheek), but I think that something more than insults and injured pride is at work; that we are deep down frightened of weeds and the threat they pose to our need for order and control, not to mention the harm they can do.

Fear is a key emotion in our response to weeds, and has been for a long time. The *Book of Isaiah* (c.742 BC) refers to ‘the fear of briars and thorns’. Many people are subject to a deep-seated fear that weeds will take over their patch, some even fear for the environment or even the planet as a whole (Quammen 1990). The science fiction writer John Wyndham memorably exploited such fears in his fable of feral carnivorous plants, *The Day of The Triffids* (1951). The vital question is whether such fears are grounded in reality, or whether they should be seen as exaggerated and irrational, as something to conquer. Hamlet has often been seen as an example of a man suffering mental illness, and as demonstrating the power of feelings to govern behaviour.

One explanation of the psychological basis for our fear of weeds lies in the association between weeds and contaminants. Weeds have sometimes been likened to dirt. For example, in 1909 Professor Alfred Ewart (1872–1937), Government Botanist and Professor of Botany in The University of Melbourne, applied what he said was Palmerston's definition of dirt (*matter out of its proper place*) to weeds: 'A weed is a plant out of its proper place, and a troublesome weed is one which makes itself objectionable by continually asserting itself in places where it is not desired' (Ewart and Tovey 1909).

The idea that dirt is matter out of place was developed by the English social anthropologist Mary Douglas (1921–2007) as part of her analysis of concepts of defilement and pollution: 'If we can abstract pathogenicity and hygiene from our notion of dirt, we are left with the old definition of dirt as matter out of place. This is a very suggestive approach. It implies two conditions: a set of ordered relations and a contravention of that order. Dirt then, is never a unique, isolated event. Where there is dirt there is a system. Dirt is the by-product of a systematic ordering and classification of matter, in so far as ordering involves rejecting inappropriate elements' (Douglas 1966). In the same way, weeds imply the existence of plants which are not weeds, and the exclusion of a plant described as a weed from the ordered world of acceptable plants.

Humans reject the *dirty* as a contaminant, in contrast to the virtuous *cleanliness*. What is invoked here is a universal feature of human societies, the concept of pollution. Pollution ideas have been shown to be powerful influences on human behaviour. Neil Evernden, following Mary Douglas, pointed out that all societies identify contaminants, 'something that is out of place and hostile to the environment, as a danger to the well-being of individuals or society' (Evernden 1992). Sometimes it seems that social groups have a need to specify some aspects of the world around them as polluting, and that the need may be satisfied regardless of whether the threat identified is real. The observation by Douglas, '...danger-beliefs are as much threats which one man uses to coerce another as dangers which he himself fears...' (Douglas 1966), can sometimes be applied in the case of weeds; particularly when someone seeks to prevent another from cultivating or selling a plant by calling it a weed.

Mary Douglas also demonstrated that the human response to dirt is associated with our deep-seated need for order. Absence of order is something we tolerate with great difficulty. To identify something as a pollutant is to see it as threatening the appropriate order

of things. When plants are treated as weeds, they are seen as presenting a similar threat.

Our need for order is also reflected in the unease, fear even, we feel about the absence of control. Out of control plants often attract the label *weed*. As noted, Professor Ewart objected to weeds continually asserting themselves in places where they are not desired. Many weeds present this difficulty. Even a chosen plant may fall from favour if it becomes too hard to control; 'It is taking over,' says the gardener, and so yesterday's cultivated amenity plant has become today's (and perhaps tomorrow's) weed.

Weeds have sometimes been defined as *plants that are not wanted*. This gave rise to a suggestion that it is a matter of human *caprice* whether a plant is a weed. Elmer Grant Campbell of Perdue University, in a short essay in *Science* in 1923, wrote that, 'we have an odd rule, under which any plant in the universe may instantly become a weed without the slightest change in character, habitat or position. Under this rule, a plant is a weed, not according to specific qualities nor by a definite concept in the mind of any man, but by human caprice' (Campbell 1923). I do not agree with Campbell. It may be frustrating that there is no agreed set of necessary and sufficient conditions for use of the term *weed*; but it does not follow that its use is a matter of caprice.

Even if, as may well be the case, weeds are simply *unwanted* plants, human wants and desires are not capricious. Wants are not wanton chance occurrences or arbitrary feelings. They are not able to be taken up or discarded at a whim. Each person's wants are related to their upbringing, their individual conceptual structure and to the culture of the groups and the society of which the individual forms part. As the philosopher Mary Midgley pointed out, 'Wants are not random impulses. They are articulated, recognisable aspects of life; they are the deepest structural constituents of our characters' (Midgley 2002). This is a long way from *caprice*, which has been defined as: 'a sudden change of mind without apparent or adequate motive; whim'. But perhaps Campbell's real point was that calling a plant a weed is often the expression of how we *feel* about this plant in these particular circumstances. Which puts me in mind of the typical question asked by psychologists, 'How do you feel about that?' A more pertinent question for this discussion would be, 'Why are you frightened of that plant?'

To understand why weeds frighten us we must think more closely about their impact. There is nothing capricious about treating many plants as weeds. Nor is it simply that they are hard to control. The farmer has his reasons for treating plants as weeds. To begin, plants which volunteer in a crop compete with the crop

for nourishment and water. Shakespeare provides an example in *Richard II*, when he has the Gardener in the Duke of York's garden say,

'...I will go root away

The noisome weeds, that without profit suck

The soil's fertility from wholesome flowers.'

Many pasture weeds have bad effects which are more serious. Weeds may be poisonous to humans or stock, or otherwise harmful because they have hard, sharp structures such as spines or thorns, which wound stock. Some weeds will taint dairy products or meat. Others harbour diseases of crop plants, or insect pests. Weeds with burrs to accumulate on fleeces have troubled sheep farmers in Australia. Further examples are given in standard works of reference (Parsons and Cuthbertson 2001).

The emotions of fear and dislike that such plants arouse are understandable. Do we reject such plants for the specific troubles they bring? Perhaps we are governed by ancient responses and attitudes which have become engrained in our culture; or by fashions as to which plants are acceptable? Is a sound rationalization available for every occasion when a plant is called a weed? The critical issue is as to the appropriate response to the particular plant or group of plants in all the circumstances. The emotions aroused and the actions they give rise to may be out of all proportion to the actual threat.

EMOTIVE LANGUAGE

Whenever a plant is called a weed, some of the psychological overlay associated with the class is invoked. We may not always be conscious of the emotional and other forces at play, but we should recognise that they are likely to be present. For years I was troubled by the fact that so many of the terms used in the vocabulary of weed science (words such as *alien*, *feral*, *invader*, *infestation*) were emotive and judgmental. The term *invasion* carries associations of attack on our homeland by enemy forces, and suggests that we should automatically take action against the invader. Why do we speak of *aliens*, with overtones of enemy aliens or space invaders, instead of *exotics*, which carry a hint of excitement and romance? Why, when human aliens can become lawful citizens by naturalisation, do we fail to accept that *naturalised* plants have become part of the flora and continue to call them *aliens*? Why do we speak of *feral* plants, likening them to wild and savage animals (from the Latin, *fera* = a wild beast, *ferus* = savage) instead of *volunteers*? Why do we speak of plants as *invading* rather than simply *spreading*, or *increasing their range*? Why do we speak of weeds *infesting* (again from the Latin *infestus* = hostile) rather than simply being present?

We should keep in mind that many of the terms used are metaphors. Even the words *naturalise* and *naturalisation*, applied to plants so often as to seem unremarkable, referred to human affairs only in Dr Johnson's *Dictionary* (1799). When Darwin, de Candolle, and others applied these words to plant species they were speaking metaphorically. The metaphor is problematic because plants, unlike people, do not have a country to which they owe allegiance; plants do not have *nationality* (Seddon 2002, Trigger 2011).

I now understand that the use of emotive language is related to the fact that emotions are involved, even if unconsciously. The words used both reflect and compound emotions such as fear and anxiety, which distort our thinking about weeds. As James Brown of the University of New Mexico pointed out, 'There is a kind of irrational xenophobia about invading animals and plants that resembles the inherent fear and intolerance of foreign races, cultures, and religions... This xenophobia needs to be replaced by a rational, scientifically justifiable view of the ecological roles of exotic species' (Brown 1998). There is an irony about the present inhabitants of Australia allowing xenophobic attitudes towards new arrivals to flourish; but an even greater irony in prejudice directed towards exotic plants by people who cannot themselves claim to be indigenous. In any event, as is widely accepted, only a small proportion of introduced plants are harmful (Perrins 2011). A civilised society should avoid xenophobia whether against people or plants.

Mark Davis has written of 'a sort of simple minded 'nativism' paradigm, in which native species are embraced and non-native species are vilified' (Davis 2009). Many people in Australia have such nativist attitudes towards plants. Conceptually, such attitudes have links to the nativist political movements that flourished in the USA, Canada, and Australia in the 19th and early 20th centuries (Jensen 2009). The Australian Natives Association was the local manifestation, and the White Australia Policy a longstanding outcome. Nativist movements were not made up from indigenous peoples, rather they were established by native born persons, usually of British origin, who sought to keep out later arrivals on the basis that immigrants would distort or spoil cultural values. It is interesting that, as Zachary Falck has pointed out, political nativists often referred to people they disapproved of as 'human weeds' (Falck 2010). The German writers Gert Groning and Joachim Wolschke-Bulmahn have drawn attention to what they call 'the mania for native plants in Germany' (1992) and to its associations with the ideology of Nazi Germany (2010).

Plant nativism in Australia is in at least one respect the converse of political nativism. Plants with exotic

origins are not accepted as 'native' even if their introduction was more than 100 years ago, and they have become naturalised in their new country through many generations. Unlike people, plants cannot, it seems, acquire native status by birth. Nativists continue to accord privileged status to indigenous plants over naturalised exotics. What plant nativism and political nativism have in common is an approach based on prejudice.

Sometimes xenophobia is expressed by statements such as 'introduced plants do not belong here', or 'are not at home here.' (Mirmohamadi 2003). But belonging should not be determined by the geographic origin of species. Exotic plants are part of our civilisation and belong here as much as we do. The fact that plants are exotics is never a sufficient reason to describe them as weeds or to seek to compel others to do so (Davis *et al.* 2011). The nativist paradigm is, however, not easily overcome, in part because of the emotions (the feelings of heart and mind) on which it is based.

I should say at once that some plants introduced to cultivation in Australia have been very troublesome. We are all familiar with the prickly pear (*Opuntia* spp.) saga, with the curse of the blackberry (*Rubus fruticosus* L. agg) and with gorse (*Ulex europaeus* L.), to take but three examples. But the trouble is that the category *invasive* tars with the same brush many plants that hardly seem troublesome at all. Some garden escapes have been much more serious than others.

Weed scientists have on occasion acknowledged that it would be preferable to use a value neutral terminology instead of emotionally charged metaphors, but tend to dismiss the problem as 'semantic' (Richardson *et al.* 2000) or not hindering 'scientific progress in understanding and managing invasions' (Simberloff 2011). But the issue is not simply one of semantics or political correctness. The concepts used in weed science may control outcomes and reveal as much about the way the science is conducted as about the weeds themselves.

Instead of careful and exact observation of plants with attention to different circumstances and situations in which the harm they cause makes it appropriate to describe them as weeds, we sometimes have the application of what Roland Barthes, writing about judging human actions, described as 'an adjectival psychology' which describes and condemns at one stroke, a psychology which 'is ignorant of everything about the actions themselves, save the guilty category into which they are forcibly made to fit' (Barthes 1980). Another name for this behaviour is *stereotyping*, where an individual is summed up and disposed of by a group description (often racial or gender based) without regard to their actual qualities. Many are too

ready to assign plants to the guilty categories *invasive alien species* or *weed*, without giving proper consideration to the plant in the particular circumstances: its aesthetic or amenity value, its ecological function, its capacity to withstand drought, its medicinal or culinary uses, and its cultural associations; let alone whether it does any harm.

If we are to achieve a proper understanding of weeds we should avoid the use of emotive and prejudicial language. To understand and describe the place of weeds in the natural order we should aim to use expressions that are value neutral, dispassionate, and non-judgmental. The same plant may seem very different if we call it a *wildflower* instead of a *weed*. We need to guard against the risk that our actions may be governed by our emotions; that we may treat plants as weeds in circumstances where to do so is not appropriate or justifiable. We should seek to overcome emotions of fear and guilt in our responses to weeds, and to base what we do about weeds on well established facts arrived at dispassionately.

THE WAR ON WEEDS: ARE WEEDS OUR ENEMY?

References to the *war on weeds* are now common (Evans 2002). Government agencies have declared war on weeds, and powerful forces have joined together in waging war. Killing weeds is a multi-million dollar business for herbicide manufacturers and those recruited to the war effort. To some, it is clear that the management of Australia's weed problems is a form of warfare. Some claim to be *winning the war on weeds*, or to tell others how to do so (Wolff 1999). Learned papers are given about *strategies* to be adopted (Lonsdale 2002). *Weed warriors* are recruited to wage war (Kwong 2002). The idea of a war on weeds reminds us of the much used and abused expression so prevalent today, the *war on terror*.

Just as talk about the war on terror contributes to deep seated feelings of fear and insecurity in the population generally, so that people become concerned that they may at any time become the targets of a terrorist attack as they go about their daily lives, so repeated references to the *war on weeds* give rise to fears that we are under serious threat from weeds. The government agencies leading the war on weeds seek to muster support for their activities by the call to take up arms. The war on weeds is based on claims that alien plant invaders are threatening the world around us, the very environment in which we live. But the threat has, I believe, been exaggerated. Serious ecological harm has often been caused by the use of herbicides as a weapon to attack weeds.

A real problem about the war on terror is to specify the enemy. There is a similar problem with the war on weeds, the enemy is elusive and hard to identify. Given that, as has often been said, *any* plant may be a weed (Auld and Medd 1997), it is not surprising that the weed status of many plants is disputed. Once weeds were confined to weeds of horticulture and agriculture; even then it was uncertain whether many plants were weeds. The early monograph, William Pitt's 'On the subject of weeding' included a list of plants 'whose characters are doubtful, or uses not ascertained, and to which little attention is commonly paid but what they command from the beauty and variety of their flowers...' that included valerian (*Centranthus ruber* (L.) DC ssp. *ruber*) and daffodil (*Narcissus pseudonarcissus* L) (Pitt 1806). Both of these popular garden plants are included in *Weeds of the South East* (Richardson *et al.* 2011). Many will be familiar with the survey conducted by James Perrins, Mark Williamson and Alastair Fitter from the University of York in about 1990, which revealed a considerable divergence of opinion about the weed status of 49 species occurring in the UK. Sixty five scientists from different disciplines completed questionnaires in which they were asked to indicate whether they considered each plant to be a weed (Perrins *et al.* 1992).

Some plants have been regarded as weeds in some times and places but not in others. Some plants which used to be weeds hardly count as such any more. New plants are being added to weed lists all the time. As a category, *weed* is inherently uncertain. Is it a feature of the plant or the human response to it that makes a plant a weed?

Despite many attempts over the past 60 years, weed scientists have not been able to agree on a set of necessary and sufficient conditions to establish which plants are weeds. If the often repeated statement that any plant may be a weed is true, as a matter of logic it must follow that whether a plant is a weed depends on something other than the plant.

The boundary between weeds and crops (non-weeds) is a moveable one. Many cultivated plants have been regarded as weeds in some circumstances, just as some plants once seen as weeds have become cultivated plants. Rye (*Secale cereale* L.), for example is widely held to have spread into Europe as a weed of wheat (*Triticum* spp.) and barley (*Hordeum* spp.) crops, gradually ousting the other cereals to become the principal crop in mountainous districts with poorer soils (Renfrew 1973). There are many examples of plants that are weeds in some circumstances, and valued plants in others. One such is annual ryegrass (*Lolium rigidum* Gaudin), an excellent pasture grass widely cultivated in Australia in the heyday of the

pastoral industry. But the plant was always a crop weed, and a change in agricultural practice from pasture to cropping has revealed a ryegrass weed problem across millions of acres of cropping land (Powles 2007). The dual nature of the species has long been recognised. The 1925 Supplement to Ewart's *Weeds etc.* recorded it as naturalised in Victoria, 'widely spread in the north western and south western districts', describing it as 'It has a high carrying capacity for stock, maintaining itself readily by seed, but is injurious to wheat cultivation' (Audas and Morris 1925). Recent weed lists, however, have moved from the equivalent of conventional warfare on traditional weeds to what is in effect total war as hundreds of plant species, which have been cultivated in gardens for many years, are now said to be *environmental weeds*, *alien invasive species* or just *weeds* (Richardson *et al.* 2011).

These new categories are radically different to traditional weeds. The consequences of inventing these new classes of weeds have been profound. It is not just introduced plants which are under attack, although the campaign against naturalised exotics has become pretty remorseless, inviting the label *xenophobia*. In a bizarre attempt to save the bush from itself, native plants are being removed as weeds if they seem to be too successful. The, at times, fragile consensus as to which plants are weeds has broken down. The absence of a firm basis for distinguishing weeds from non-weeds is of increasing significance.

PROPAGANDA

Given the emotions associated with weeds, it is also understandable that they should be a field of psychological warfare. Feelings such as fear, disgust, guilt, hatred and xenophobia can easily be manipulated. We may be conscripted into the war on weeds without an opportunity to consider that there may be a better way to respond to this aspect of nature's realm.

A disturbing aspect of the war on weeds has been the use of propaganda. It has long been remarked that false and exaggerated claims about the enemy are common in times of war. As the epigraph to the English MP Arthur Ponsonby's *Falsehood in Wartime* put it, 'When war is declared, Truth is the first casualty' (Ponsonby 1991). In our age the dissemination of propaganda has become part of waging war. It is not surprising that the war on weeds has to some degree been waged by the dissemination of exaggerated claims about the threat of weeds, which go beyond the scientific evidence, and are calculated to garner support for the war effort through feelings of fear and insecurity.

The natural tendency of uncontrolled or uncontrollable weeds to frighten us has been reinforced by

Government propaganda. Literature from government agencies about the threat of so-called *sleeper weeds* provides a good example (Cunningham *et al.* 2006). What are sleeper weeds? The term comes from a paper by Richard Groves in 1999, in which he introduced the expression *sleeper weed* as a label for 'invasive plants that have naturalized in a region but not yet increased their population size exponentially' (Groves 1999). In 2006 Groves acknowledged that the concept of sleeper weed had gained a level of general acceptance and *misuse* before the science had been done (Groves 2006). I have argued elsewhere that this much-abused expression should be abandoned, and will not repeat the detail here (Dwyer 2008).

There is no reliable way to identify which of the 2500 plus naturalised exotics in Australia are *sleeper weeds*, or to establish whether the label can properly be applied to any of them. The expression 'sleeper weed' is calculated to attract feelings of fear of possible harm from plant invasions that may never happen, and which weed science cannot reliably predict. To invoke the term without a sound basis for the existence of sleeper weeds is to engage in propaganda. Government agencies should not engage in psychological warfare against their own citizens as part of their war on weeds.

COLLATERAL DAMAGE

United States forces use the term *collateral damage* as an acknowledged aspect of warfare. The expression is a euphemism used to refer to 'unintended' damage to people or facilities as a result of military action against enemy targets. Collateral damage is also a feature of the war against weeds. The damage may be direct, or indirect. As an example, aerial spraying of herbicides has often damaged plants other than those targeted, by spray drift. Other environmental harm such as contamination of water supplies has also been caused.

Another type of collateral damage which has been noted is the replacement of the targeted species by another unwelcome plant, particularly in grasslands. In North America, programs to control spotted knapweed (*Centaurea maculosa* Lam.) have often resulted in an upsurge of cheatgrass (*Bromus tectorum* L.). There are many reasons to question the value of attempting to manage the plant composition of natural areas. It has been acknowledged that 'within natural systems, *all management actions have side effects* due to the complexity of natural systems and the limited specificity of the tools employed' (emphasis added) (Pearson and Ortega 2009). Unwelcome 'side effects' demonstrate both the complexity of ecological systems and the difficulties of avoiding harm by any human intervention.

HERBICIDES AS WEAPONS OF WAR

The herbicides 2,4-D and 2,4,5-T (2,4,5-trichlorophenoxyacetic acid), developed during the 1940s, had become widely used as selective weed killers in agriculture by the 1950s. Sometimes referred to as *phenoloxyl agents*, these synthetic chemicals work within a plant by interfering with the plants' physiology for long enough to kill it. They are known as systemic herbicides because their mode of operation is by translocation within the targeted plant (King 1966). The new chemical weed controls seemed magical in their efficacy, and were part of a new era of agriculture based on increased mechanisation, the wider availability of fertilisers and pesticides, and improved crop varieties (Zimdahl 1999). Unfortunately, long developed skills of farm husbandry, such as crop rotation and cultural control of weeds, were abandoned in the revolution, and it was only gradually understood that the new agriculture was unsustainable (Fryer 1983).

Herbicides were used as instruments of war in the 20th century. During the 1960s the U.S. military in Vietnam adopted a strategy against the Viet Cong and North Vietnamese of defoliating large areas of jungle to hamper movement of troops and supplies, and to destroy food crops. Aerial spraying over large tracts of the country was carried out, using millions of gallons of herbicides such as 'Agent Orange' and 'Agent Blue'. This was not just war on weeds but war on an entire environment by what the German philosopher Peter Sloterdijk called *terror from the air*, a mode of warfare that he says began with the use of poison gas by the German Army in 1915 at Ypres in Northern France (Sloterdijk 2009). Long after the Vietnam War, the herbicides continue to have serious, long-term harmful effects on the people of Vietnam and on the U.S. and allied troops involved in the spraying.

Most chemical pesticides are harmful to humans and the environment (Carson 2000). Pesticides are now seen as another form of atmospheric and environmental pollution together with acid rain and nuclear fall-out. Are any weeds so nasty that the bad effects of herbicides should be tolerated? Of herbicides it has been said that they have created as many problems as they have solved because reliance on chemicals has masked the underlying causes of weed problems, and because 'chemical dependency perpetuates ecologically unsound farming practices' (Evans 2002). The spraying of roadsides with herbicides, instrumental in the selection of glyphosate resistant weeds, is hard to justify. Roadside weeds should be tolerated unless there is good reason to intervene. If control is necessary, slashing is preferable to the use of poisons. The problems inherent in the use of herbicides as a weapon point to the self defeating nature of the war on weeds.

WEED RESISTANCE

Weed warriors might characterise resistance as weeds fighting back. One account describes the development of weed resistance in Canada as mounting 'a successful counter attack' (Evans 2002).

Weed resistance to herbicides is just another chapter in the long co-evolution of humans and weeds. From the plants' point of view, resistance should be seen as immunity from poison developed by the plant over generations. By repeatedly killing large populations of a plant with herbicide, humans select those members of the plant population with natural immunity to the herbicide. The immune varieties become more numerous and replace the varieties susceptible to the herbicide. Herbicide resistance is just one example of weed adaptation to cultivation practices. If weeds are seen as our enemy, humans have shaped the enemy and are at least in part responsible for what the enemy does.

Although not fully anticipated by weed scientists (Barrett 1983), herbicide resistance has now occurred world-wide. The most widespread and severe occurrences are said to be in the southern Australian grain belt, where resistant weeds are now encountered beyond cereal cropping areas in orchards, pastures, roadsides, railways, perennial lucerne fields, and other areas where herbicides have been used repeatedly. Resistant populations of some 22 species are known in Australia (Preston 2000). We should ponder the lessons to be learned from this aspect of the war on weeds.

CONCLUSION: A CALL FOR A TRUCE IN THE WAR ON WEEDS

As the development of herbicide resistance in weeds demonstrates, what may seem to be victories over nature have a way of being illusory. As Friedrich Engels (1820–1895) wrote more than 100 years ago in a much quoted essay, 'Let us not however flatter ourselves overmuch on account of our victories over nature. For each such victory it takes its revenge on us. Each of them, it is true, has in the first place the consequences on which we counted, but in the second and third places it has quite different unforeseen effects which only too often cancel the first... Thus at every step we are reminded that we by no means rule over nature like a conqueror over a foreign people, like someone standing outside nature...' (Passmore 1980).

As horticulture and agriculture depend on the co-operation of nature, without which we can grow nothing, ideas of conquest over nature are simply inappropriate. Successful gardening and farming require that we should seek to know and understand nature's ways on which our efforts depend. But we should not hope to subjugate nature to achieve our ends.

Weeding has been a necessary feature of horticulture and agriculture from the earliest times that humans engaged in these activities. But an indiscriminate war on weeds is far from necessary. Weeding does not require a warlike attitude or the use of the weapons of warfare, such as the broadcasting of the synthetic herbicides developed since the 1940s. That weeds should take advantage of the opportunities presented by the horticultural and agricultural activities of humans and the waste-lands they create to reproduce and flourish is an understandable feature of the natural order. We may need to accept that the plants we call weeds are inevitably part of nature's realm.

If it is understood that our approach to weeds should be part of our relationship with nature, the overriding question becomes: 'Does the threat posed by weeds justify the extreme measure of waging all out war on them?' The doctrine of proportionality, so often disregarded in the conduct of war, should be applied in our dealings with weeds.

We call plants weeds when we want to attack them, just as we call members of an opposing military force *the enemy*. What makes weeds the enemy lies not in the plants themselves but in the humans' desire to eliminate them, whatever the basis for that desire. A different approach would be to stop being frightened of weeds, to acknowledge their virtues and their place in the realm of nature, to seek a more peaceful co-existence. We should adopt the well-known motto of Marie Curie, 'Nothing in life is to be feared, it is only to be understood' (Wood 2011). Now is the time to understand weeds more so that we may fear them less. This should not be seen as surrender in the war on weeds, rather to make peace. It is in any event time to declare a truce.

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