

# Non-herbicidal Weed Control Strategies Implemented by City Parks Staff in the Northwest: Maintaining Tree Wells

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### **Cover Photo:**

**Blue fine fescue in this tree well out-competes weeds while providing visual contrast to the surrounding turf in Amazon Park in Eugene.**

# MAINTAINING TREE WELLS

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# INTRODUCTION

## Purpose

Parks maintenance employees look to their peers for strategies that have worked well to control weeds. This report is one in a series that offers effective, non-herbicidal strategies used by city parks maintenance staff in the Northwest, in both wet and dry climates, to control weeds in and around the following park areas:

- shrub beds and landscaped areas
- hardscapes and fence lines
- tree wells
- turf (excluding golf courses and high profile athletic fields)

This report covers effective, non-herbicidal weed control strategies specifically for maintaining tree wells. All reports are posted on the NCAP website: [www.pesticide.org](http://www.pesticide.org). The material in these reports is also being presented in training sessions for pesticide applicators, featuring parks maintenance staff whose practices are described in the reports.

Definitions of “effective” weed control is subjective, varying not only among cities but also among employees within a single parks department. A particular strategy was deemed effective if the maintenance employee using it and his or her supervisor felt satisfied with the degree of weed control, safety, resources, and environmental impact involved. This research study was not exhaustive, meaning that other effective strategies may be used currently in the Northwest. Also, what works in one location may not work in another location because of differences in climate, soil type, budget, planning processes, public opinion, or level of volunteerism. Nevertheless, a strategy that works in one city may be adapted without too much effort elsewhere. The intent of this report is to share with you the expertise, innovations, and

inspiration of other parks staff. We encourage you to experiment on your own as resources allow.

## Methods

Cities from northern California, Oregon, Washington, Idaho, and Montana were selected to achieve variety in climate, geography, and size. Parks maintenance employees and their supervisors, who manage either developed parks or natural areas in the selected cities, were surveyed. Parks maintenance employees responded to an initial survey that asked which park areas they manage using herbicides and how often herbicides were applied in these areas. They were also asked for which areas in parks they are most interested in learning about effective, non-herbicidal weed control strategies. Upon receiving these responses, the five most problematic areas for weed control were identified: landscaped areas, fencelines, hardscapes, tree wells, and turf.

In a second survey, parks maintenance employees were asked to provide the names of weeds that are most problematic in these areas and to describe any effective, non-herbicidal strategies for these areas or to target a specific weed. Strategies that could be implemented by other parks staff with limited resources were selected from among these, with preference given to strategies that had been used over long periods of time or tested in an experimental setting. Also, strategies from both wet and dry climates were selected so that parks staff from both climates would benefit.

To witness the effectiveness of the strategies and document them firsthand, site visits were conducted during August and September of 2007 in the following cities: Eugene, Portland, and Bend, Oregon; Seattle, Washington; San Francisco, California; and Boise, Idaho. The results from the surveys and site visits are compiled in this and the other reports in this series.

## MULCHING

Mulching tree wells is as much about maintaining healthy trees as suppressing weeds, explains Barb DeCaro, Resource Conservation Coordinator of the Seattle Parks and Recreation Horticulture Program.<sup>1</sup> Mulch retains moisture for tree roots, keeps light from reaching weeds below, and is also an inhospitable substrate for weed seeds that land on top. Martin Nicholson, Pesticide-Free Parks Program Coordinator with Portland Parks and Recreation, says that the diameter of the mulched area surrounding the tree should extend as far as the roots are visible, but mulch should not cover the roots.<sup>2</sup> The visual boundary created and additional space between turf line and tree roots enables mowing staff to avoid damaging the roots with mowers. Damaged roots make trees more susceptible to disease. The reason roots should not be covered is that the moisture trapped by the mulch provides an ideal environment for root rot (fungus), according to Nicholson. Some staff interviewed noted that mowing around tree wells spreads the chips further from the trees, although Nicholson did not observe this phenomenon in a trial that he performed.<sup>2</sup>

### Wood Chips vs. Bark Mulch

Of the various weed control strategies that Nicholson (Portland) tested in a controlled, comparative trial, mulching with composted wood chip mulch was the most effective treatment.<sup>2</sup>

The trial also included application of a vinegar-based product, clove oil-based product, bark mulch over fabric, various types of mulch without fabric, and Roundup + Surflan. By adding wood chip mulch at least two inches deep and five to ten feet in diameter around mid-sized and larger trees, or three to five feet in diameter around small trees, he effectively smothered pre-existing weed seeds and prevented new seeds from germinating.<sup>2</sup>

Although many parks maintenance employees still use bark mulch, those who have

compared it experimentally to wood chips all greatly prefer wood chips. As explained by Eden Belanger, Horticulture Manager with Boise Parks and Recreation, bark mulch becomes a barrier to water intended for tree roots because it has finer particles that break down more rapidly, supporting a mat of mycorrhizae (a symbiotic association of the mycelium of fungus with tree roots) that is impermeable to water or air.<sup>3</sup> If bare and hard, the mat is less hospitable to weeds, but dirt and other material may soon cover the surface, which retains nutrients and water above it for the benefit of weeds. Weeds will generally not grow in wood chips, which are larger in size and break down much slower than bark mulch fibers.<sup>4,5</sup> As Rob Hallett, Turf and Grounds Manager with Eugene Parks and Open Space, stated, wood chips have bigger air pockets than bark mulch fibers, thereby resulting in poorer weed seed-to-soil contact.<sup>4</sup> Wood chips can provide excellent long-term weed suppression, given the right conditions and management of the area, without harming trees as bark mulch can do, according to Steve Maki, Horticulturist for Portland Parks and Recreation Department.<sup>5</sup> Maki believes in the importance of educating people about the problems with bark mulch and the benefits of using wood chips as an alternative.<sup>5</sup>



**Composted wood chip mulch effectively prevents weed growth and retains moisture for this tree in Arbor Lodge Park, a pesticide-free park in Portland.**

Maki (Portland) produces wood chips from hardwood or conifer, using the city's own equipment.<sup>5</sup> He composts the wood chips before using them to kill weed seeds, making a mixture of about 80 percent wood chips and about 20 percent softer organic matter that will break down faster than wood, helping to raise the temperature of the compost pile. He uses "beast grindings," recycled weed and other non-tree plant material that have been ground by a "Beast Grinder" machine and have already gone through a composting process once. He wets the chips with a sprinkler as needed and turns the whole pile about once per week over at least a three-week period to ensure the temperature gets up to at least 140°F. Maki states that the literature he has read gives 140°F as an adequate temperature to kill most weed seeds. Using "beast grindings" that have not been adequately composted literally helps to spread weed seeds. These grindings, which are full of weed seeds, need to go through the composting process twice to kill the seeds.<sup>5</sup>

### **Mulch Thickness**

Taking care not to mulch too thickly is important to tree health. Mulching too thickly, even with wood chip mulch, around a well-irrigated young tree can cause the roots to grow shallowly in the wet mulch rather than growing deeper below.<sup>6</sup> This is true more so with frequent light irrigations (as in typical turf settings) than infrequent, deep irrigations. As noted by Bob Fiorello, a San Francisco Recreation and Park Department Gardener and Pest Control Advisor at the San Francisco Botanical Garden, care and forethought must be taken when mulching around trees. Excessive mulch above the crowns and in contact with the bark of trees can provide an ideal moist environment for various pathogenic fungi to thrive. "Add to that any kind of wound to the cambium, and infection is likely," says Fiorello. "The source of the infection is probably not from the mulch itself. It's the environment it creates," he adds.

Sometimes staff can be overzealous in their effort to thwart weeds around trees and simply pour on the mulch.<sup>6</sup> Nicholson (Portland), adds that the mulch should taper down to contact the soil level directly against the tree trunk and not be piled up toward the trunk, helping to ensure deeper root growth.<sup>2</sup> The standard mulch depth for the City of Seattle is two to four inches.<sup>7</sup>



**In this tree well in Arbor Lodge Park in Portland, composted wood chip mulch tapers slightly away from the tree base.**

### **Replacing Mulch**

Also for the purpose of maintaining healthy root zones, mulch replacement, rather than just addition, is important, notes John Reed, Pest Management Program Coordinator and Botanical Specialist of Portland Parks and Recreation.<sup>8</sup> Hallett (Eugene) admits that although mulch replacement for trees is scheduled to occur every one and a half years for parks of a certain mode or maintenance regime, sometimes more time elapses because of limited resources.<sup>4</sup>

## Mulch Sources

Parks departments used to spend thousands of dollars per year to purchase bark mulch, but most cities now have the chipping equipment to make wood chips from trees removed from parks and other areas of the city. Nevertheless, as Belanger (Boise) noted, this supply is not adequate to mulch landscaped areas and their parks' many tree wells.<sup>3</sup> Hallett (Eugene) says that his department has enough wood chips but not enough labor.<sup>4</sup> Other departments lack the space needed to store trees to be chipped, the chipping machinery, and the wood chips themselves. Often parks departments supplement their own supply with free wood chip



**A bare tree well in Maury Jacobs Park in Eugene might benefit from wood chip mulch to keep grass from encroaching.**

donations from private tree service businesses, although they sometimes still pay for transport.<sup>9</sup> Leaves left where they fall or raked into the tree wells can be an easy and effective substitute for wood chips.



**This New Zealand Christmas Tree in the San Francisco Botanical Garden provides its own leaf mulch.**



**In the autumn, leaves can be a convenient, colorful, and nutrient-rich substitute for wood chip mulch, although they tend to decompose much more rapidly.**

## Which Trees to Mulch

Limits on mulch supply, storage space and labor mean, for many parks, that tree well management is site-specific. For example, as John Reed (Portland), explains, the wells of older trees with a large, dense canopy that keeps light from the ground may not have any weeds if unirrigated.<sup>8</sup> Therefore, park employees mulch the wells of new trees but often do not mulch the wells of older trees if they have no weeds or if they are conifers, as these areas are often dry and compacted and are naturally inhospitable to weeds. As they break down over time, added mulch layers can become receptive to weeds in these areas.<sup>5</sup> Paul Stell, Natural Resource Manager and former Urban Forester of the Bend Parks and Recreation District, agrees that mulch around young trees is beneficial, helping to retain moisture for the tree, as well as providing space between the tree and mowing equipment.<sup>10</sup>

According to Nicholson (Portland), the amount of irrigation around the tree has a major impact on weed pressure.<sup>2</sup> The more irrigated the surrounding turf, the more likely weeds are to grow in the tree well. Therefore, mulching with wood chips is needed to suppress weeds effectively and help to retain water for the tree while allowing deep root growth. Hallett (Eugene) notes that some of Eugene's parks do not have tree wells (either bare or mulched)

and turf grows right up to the trees.<sup>4</sup> Deciding whether or not to create wells and mulch depends on the aesthetic desired for the park, the age/size of the tree, the irrigation regime, and the availability of wood chips, as well as labor to add or replace the chips.



Applying wood chip mulch might be appropriate here, where grass grows in the narrow well between the well-irrigated turf and base of this tree in Columbia Park in Bend.

## GROWING FINE FESCUE

A novel strategy for keeping weeds out of tree wells is to grow something dense in the well that will out-compete weeds and provide a neat and attractive contrast to the surrounding turf.<sup>4</sup> Hallett (Eugene) is currently pioneering the practice of growing blue fine fescue in tree wells and testing it in two different parks. Seeded less than two years ago, he is not yet sure what the longevity or effectiveness of the fine fescue will be. In addition, the level of maintenance needed in the longterm remains to be determined. Simply removing the thatch that develops in the fescue over time with a leaf rake may be enough to maintain it. Otherwise, raking and re-seeding may be needed or stripping the well and re-seeding may be required. Even if the tree well must be stripped and re-seeded every three to four years, “we’re still ahead,” he remarks. Without the need for mulching, hand-pulling, or herbicide application, which would need to occur much more frequently, fine fescue tree wells could result in “a huge savings,” adds Hallett.



Distinctive and able to out-compete weeds, the blue fine fescue growing in this tree well in Amazon Park in Eugene is a promising solution to the problem of a lack of wood chips and/or the labor to apply them.

So far, blue fine fescue has successfully out-competed weeds in the tree wells, created a visual barrier for mowers, and remained attractive. After one year, all of Eugene’s fine fescue trial trees did well and did not need thatching. Eugene Parks and Open Space employees continue to plant fine fescue in tree wells. Because wood chip mulch is not usually available in the quantity needed to mulch every tree well, other city parks departments might consider adopting fine fescue in some of their parks’ tree wells. This will increase the number of trees receiving weed control and help retain moisture. In dryer climates or with other soil types, a different grass may be more appropriate. Hallett (Eugene) will experiment with other varieties of fine fescue next.<sup>4</sup>



Growing on a slope, this fine fescue tree well is a little uneven, exposing more of the brown thatch that will develop over time.

## FLAMING

Flaming using a propane-powered flame weeder is effective for weed removal in tree wells, according to Hallett (Eugene), although care should be taken to avoid flaming exposed tree roots.<sup>4</sup> Also, flamers should be used only during the wet season in wet climates to avoid causing a fire. The most appropriate type of flamer for tree wells is one with a narrow nozzle that shoots a flame from the end, such as the Red Dragon.



Red Dragon flame weeder near tree well.

With the nozzle aimed at a weed, the invisible column of air that extends beyond the flame reaches 2000° F, searing, rather than burning, the weeds.<sup>6,11</sup>

As Josiah Sheehan, Landscape Crew Worker with Eugene Parks and Open Space, explains, from the perspective of a weed, being seared by heat treatment is a slower assault than being cut quickly by a line trimmer, for example.<sup>11</sup> The slower assault by searing is less likely to send a signal to the roots to re-grow. Hence, treatments may not need to be repeated as many times to permanently remove a particular weed. The burned weeds will turn brown within one day during hot weather and two to three days during cooler weather, in contrast to herbicides that can take a few weeks to show results.<sup>2,6</sup> Although effective against broadleaf weeds, flaming can actually stimulate grasses to grow, note both DeCaro (Seattle) and Sheehan (Eugene).<sup>7,11</sup>

While plants perceive flaming to be a slow assault, staff like flaming because it is quick, especially when used against young weeds.<sup>6</sup> For a row of weeds only one to four inches tall, the nozzle can be passed over the weeds at a rate of about one foot per second. Above four inches tall, the weeds require longer treatment.<sup>13</sup> Parks employees differ in their flame weeder model preferences. Some, like Fiorello (San Francisco), prefer the model used with a backpack storing a 10-pound liquefied propane gas (LPG) tank, which may last up to four hours.<sup>6,12</sup> This model allows for more freedom of movement, especially where stairs and slopes are involved and it also increases efficiency, he claims. For others, who do not like the idea of having a flammable liquid strapped to their back, there is a model that attaches via a hose to a 10-pound or 20 pound propane tank strapped to a dolly. Although some staff and parks patrons perceive flame weeding as too dangerous altogether, the safety risks can be minimized when performed at appropriate times, when there are no patrons around and during the wet season, to avoid starting a fire.<sup>12</sup> Staff should wear gloves, pants, and close-toed shoes when flame weeding. Formal training programs are usually required. Done safely, flame weeding is an efficient and effective method for controlling some broad-leaf weeds under moist conditions.

## HAND REMOVAL

Hand removal is an alternative to flaming when conditions are too dry for flaming, Hallett noted.<sup>4</sup> A stirrup hoe, also known as a hula hoe, may be used to remove weeds from tree wells under large trees, but should not be used in tree wells of young trees, according to Nicholson (Portland), in order to avoid damaging young tree roots.<sup>2</sup> Hand pulling rather than hoeing can disturb the soil if the well is not mulched, possibly stimulating new weed seeds to germinate. Another drawback of hand-pulling is that it requires crouching close to the tree, which can result in soil compaction.<sup>2</sup>

## TECHNIQUES THAT WERE NOT EFFECTIVE

### Fabric

In the experiment mentioned above, Nicholson (Portland) noted that the fabric he used, DeWitt ProFib Weed Barrier, got damaged or exposed easily and looked unattractive.<sup>2</sup> Hallett (Eugene) and Fiorello (San Francisco) agree that such fabric barriers are not worth the time or effort, noting that most weeds enter and take hold on the surface, not from underneath the mulch barrier.<sup>4,12</sup>

### Vinegar or Clove Oil-Based Products

As an alternative to conventional, petroleum-based herbicides, some companies have developed herbicides that contain natural ingredients, like clove oil and acetic acid (the active ingredient in vinegar). However these ingredients can pose hazards. For example, Nicholson (Portland) noted that his staff became very nauseated by the strong smell of the EcoExempt Herbicide Concentrate (21% clove oil) product after working with it for a few hours.<sup>2</sup> Moreover, citizens who smelled it became very concerned, as the smell indicated to them that something potentially hazardous had been used. Even more of a safety concern for staff is acetic acid (vinegar)-based products. Nature's Glory (25% acetic acid prior to mixing), which Nicholson used, corroded the bottom seal on his backpack sprayer, spilling onto his pants.<sup>2</sup> Nicholson stresses the importance of thoroughly cleaning out spray equipment following any application using vinegar-based products. This wastewater from rinsing should be applied to landscaped areas allowed on the label, he states.<sup>2</sup> Sheehan (Eugene) shares these concerns.<sup>11</sup> In the concentrated form, before it is mixed, the acetic acid in Nature's Glory can also cause permanent eye injury if it makes contact with unprotected eyes, warns DeCaro (Seattle).<sup>1</sup>

In Nicholson's experiments, neither

clove oil nor acetic acid-based products were as effective in controlling weeds as wood chip mulching and/or hoeing.<sup>2</sup> The viability of the surfactant in these trials may have been a complicating factor in the effectiveness of the clove oil-based products tested. In addition, air temperature is known to be an important factor in determining the degree of weed control. Clove oil works best above 65° F.<sup>11</sup>

Nicholson needed to frequently reapply both the clove-oil and vinegar-based products to achieve the same level of control as with Roundup +Surflan.<sup>2</sup> He achieved better control with thorough hand removal with a hula hoe every three to four weeks than with any chemical product. Having done the cost analysis that includes the time spent applying a product, hand-weeding, and travel cost to and from a site for re-application, Nicholson feels that the use of clove oil and acetic acid-based products requiring frequent re-treatment is not cost-effective. A report covering the results of these Pesticide Enhancement Trials, as well as a cost analysis of the treatments used, will be available after June 2008 by contacting Portland Parks and Recreation, City Nature Services.<sup>2</sup>

Testing some of these same products at the San Francisco Botanical Garden, Fiorello (San Francisco) found that their performance depends on high solar energy and hot weather, both of which can be rare at times in foggy San Francisco.<sup>6</sup> Fiorello adds that staff has had some success with acetic acid-based products and herbicidal soaps in the past. He waits for the warmest, sunniest days to apply these products, but flameweeds during cool, wet weather.<sup>6</sup>

## CONTACT INFORMATION

The following parks departments were referenced in this report:

Eugene Parks and Open Space	541-682-4800
Portland Parks and Recreation	503-823-1636
Seattle Parks and Recreation	206-684-7250
Bend Parks and Recreation	541-388-5435
Boise Parks and Recreation	208-384-4190
San Francisco Recreation and Parks Department	415-831-6306
Port of San Francisco	415-597-7990
Corvallis Parks and Recreation	541-754-1738

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