

## **Emerging Trends in Landscape Weed Management**

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The theme of this year's conference is Biology, Reality and Sustainability. This is also a good description of concepts to consider for weed management plans in commercial landscapes. Biology is certainly a good place to start. Weed management plans should have a biological science foundation. Scientific knowledge is built up over time by testing what is assumed to be true. Repeated hypothesis testing by many people, in many places, with many different methods can be very powerful. Scientists who study weeds can tell us a lot about weed management. They have tested different weed management plans, production systems and herbicides. The science may be incomplete since the scientific method of conducting controlled studies is expensive and time consuming. However, a weed management plan that includes practices that are not supported by the work that has been done by weed scientists will probably fail. An important part of science based problem solving is defining the problem.

What is the biological definition of weeds? A weed is often a plant that is adapted to disturbed habitats, and consequently weeds are often the best adapted plant on the landscape. Definitions like "a plant out of place" are not very useful. People have been disturbing plants and the soil for a long time. This disturbance became extensive when people domesticated grazing animals. Domesticated grazing animals were selected because they are manageable. Almost all species of domesticated large animals had ancestors that share three social characteristics: they live in herds; they maintain a well-developed dominance hierarchy among herd member; and the herds occupy overlapping home ranges, rather than mutually exclusive territories. These characteristics mean that different groups of animals can be bunched up around our ancestral villages, and they will hang around because they imprint on humans as the leader. The plants around the village were more intensely grazed and more intensely "fertilized" than in naturally occurring habitats. One of the adaptations of many weeds is the production of new leaves to replace those grazed off. Another adaptation is response to fertilizer. Grazing results in high amounts of fertilizer to be dumped in small discrete locations (e.g. cow pies). Plants that survived these conditions were presumably those that could use the fertility and turn it into new growth and/or lots of seeds and/or other ways to rapidly propagate in soil dug up by people or their animals.

When developing a commercial landscape there is a lot of soil disturbance. The existing vegetation is removed and the soil is reshaped, compacted and consolidated to remain stable, and for California, to remain stable during an earthquake. This disturbance usually continues as the site development goes through all the phases required to go from the initial state, through temporary roads, utility installation, constructing buildings and to the final landscape. Weeds are not only adapted to disturbance, they usually can maintain their abundance in repeatedly disturbed landscapes. This often creates the situation where a large seed bank is created over the course of site development. These seeds can be viable for many years and will germinate for

many years, especially when soil is re-disturbed in the landscape by digging up weeds, tweaking and repairing irrigation etc. An important part of landscape weed control is not disturbing the soil once the landscape is installed.

Weeds probably initially evolved their invasive characteristics in natural disturbances such as erosive water flows, big trees falling over, earthquakes and landslides. As discussed above, people and their domesticated animals have been disturbing climax vegetation for many thousands of years. Many weeds adapted to grazing and Mediterranean climates are hard to control. The roots and other underground parts usually need to be controlled. Short of extensive digging, soil pasteurization or soil fumigation, the only way to do this is with systemic herbicides. Many hard to control weeds in the West are:

- Adapted to fire - weeds are tolerant of losing their tops either by burning off using flaming or herbicidal soaps, or mechanically with hoes.
- Adapted to drought - many broadleaf weeds immediately grow a large root system which makes them tolerant of losing their tops from flaming, contact herbicides, or hoeing.
- Adapted to intense grazing by sheep and goats - which makes them tolerant of losing their tops from flaming, contact herbicides, or hoeing.
- Many weeds from Europe have gone through intense selection from the ice ages squeezing all life into small areas between the ice and the Mediterranean Sea. This also is where people and their grazing animals have been for many thousands of years.

That is some biology of weeds. What about the second part of the Weed Conference theme, Reality. What is the reality of managing weeds for the landscape maintenance business? Probably the most important part of landscape maintenance business is that landscapes need to look good and be maintained at a competitive price. The standard for commercial landscapes like business offices, shopping centers and condominium or apartment complexes is a neat and clean appearance. Most landscape maintenance clients expect at least “Green grass, no weeds, no trash, pretty flowers”. They might not know much about plants, but they “know” weeds do not belong in the landscape. A landscape maintenance term for this attention to neat and clean is “detailed”. From a weed management perspective the “detailing” should not include soil exposed to sun and should not disturb the soil. A common example of a detail that can encourage weeds is edging that leaves a gap between a curb, wall or walkway. This kind of detailing conflicts with sustainability.

Sustainability is the third part of this year’s Conference theme. Business sustainability goals started with recycling, carpooling, lights that shut off automatically and other energy saving encouragements and building enhancements. However, these sustainability goals have now moved to the landscape with IPM programs, irrigation mandates and other policies that

impact use of herbicides and other aspects of weed management. Landscape maintenance clients are now addressing weed concerns in ways other than “I shouldn’t see any”.

There are now sustainability terms and concepts commonly used by clients, the media and product marketing. These terms include Green, LEED, native, carbon footprint, natural organic, food web, healthy soil etc. Everyone thinks they know what these terms mean. They are widely used by the media to tell stories and marketing departments to sell products. However, they are not really operational terms. Discussions with clients all too often end with the landscape maintenance account manager asking, “What exactly do you want us to do differently?” Most of the “real” part of sustainability is already incorporated into landscape maintenance. Part of sustainability is don’t waste energy and water. A term for this part of sustainability is efficiency; efficiency is almost always part of business. After all, most savings on utility bills or water bills drop straight to the bottom line. It is no different with herbicides. Herbicides are expensive, as is the training and equipment to apply the herbicides. Much of the time weeds can be efficiently and effectively controlled by not disturbing the soil, never letting soil be exposed to the sun and allowing the surface layer of the soil to dry out as much as possible. These practices do not require extra labor and can be part of regular landscape maintenance. They are part of “working smarter” which good management always promotes. When weeds are encouraged, such as by not using mulch or keeping the soil surface wet, the weeds have to be controlled with labor and herbicides. Just like an electric bill that includes waste, avoidable use of herbicides and/or extra labor reduces profits.

The problem of not being able to define sustainability concepts well enough to develop a sustainable landscape maintenance plan has given rise to various rating systems. The largest national one is LEED (Leadership in Energy and Environmental Design). This is a scoring system devised by the non-profit organization dedicated to sustainable building design and construction called the US Green Building Council. It provides an “agreed upon” system to achieve a sustainability rating. It is important to recognize that it is a consensus based rating system, not a science or evidence based system. Benefits of achieving a LEED rating can include tax breaks, or favorable attention by planning departments. The part of LEED that has the most impact on weed control plans is called Sustainable Sites (SS). The two that include weed control are:

- SS Credit 3: Integrated Pest Management, Erosion Control and Landscape Management Plan. 1 point
  
- SS Credit 5: Site Development — Protect or Restore Open Habitat. 1 point

A common requirement of LEED and other sustainability plans is to keep organic “debris” on site. The organic material is supposed to be composted or used as mulch. The process of achieving stable, weed and disease free compost is difficult on a commercial landscape site. Composting requires equipment and a site where the organic landscape debris can be chopped and mixed and then composted with temperature and moisture control. Using “raw” landscape debris on landscapes has aesthetic problems, and can easily spread weed seeds and stolons.

The water conservation part of sustainability plans, often include drip irrigation. Robust and reliable drip irrigation systems can be designed, installed and managed. However economics and ignorance often results in landscape drip systems that are not that robust and they often develop leaks and clogs. Also, with drip irrigation systems you cannot water in preemergent herbicides and cannot do “grow and kill” to reduce weeds. Any irrigation system and landscape should be designed for irrigation cycles that allow the soil surface few inches to get dry between cycles. The irrigation has to be designed for the very slow infiltration rate on soils that have been engineered for stability.

Even though many landscape designs include specifications to loosen construction compacted soil in the areas to be planted, these are not evidence based specifications. In other words, no one has done before and after measurements to prove they are effective. They are just “accepted practices”. Remember that civil engineers specified soil modification by heavy machinery to last the life of the buildings, associated infrastructure and hardscape. By design, this soil compaction is very hard to undo. In my experience, most post construction ripping, tilling and amending of areas to be planted does not result in much lasting improvement of the soil water infiltration rate. Physics tells me that if you change the soil from 95% compaction to 70% compaction, the soil volume will expand and soil will have to be moved to maintain the design contours or not overflow planting beds. Microbiology tells me that incorporated organic amendment is food for microorganisms and they will quickly consume the carbohydrates. This causes the soil to subside, often resulting in depressions that accumulate water, which supports weed seedlings and can cause aeration deficits and poor plant health. When the microorganisms consume the carbohydrates they release a lot of nutrients like phosphate that the landscape plants do not need and cannot use. If these excess nutrients leave the site, they can degrade aquatic systems downstream. Soil science tells me that Western clays are geologically young, very reactive and will stick much tighter to itself than organic amendment. One result of dense soil and shallow rooting is that frequent irrigation cycles are required. This is very favorable for weeds. In spite of the widespread practice and requirement, amending soils for trees and shrubs with organic matter has no scientific support.

IPM plans usually require details on how dependence on traditional herbicides can be reduced. Often non-traditional herbicides are encouraged. These are typically “burn down” type materials. These are usually hazardous, and in the case of acetic acid very hazardous materials for employees to use. Their mode of action is direct plant tissue damage. This mode of action is generally biocidal and the materials are just as damaging to human eyeballs and mucous membranes as they are to weed leaves. These burn down materials require high volume applications and are very expensive. However, as discussed above, weeds can be managed without herbicides, traditional or non-traditional much of the time. To use no herbicides at all, even for establishment greatly increases the amount of landscape labor. Unfortunately, no herbicides is part of many IPM programs promoted by agencies and sustainability consultants. What should be in an IPM program?

The IPM plan should include using shrubs in the landscape design. As discussed before, weeds are the usually the best adapted plants on the landscape. Shrubs are usually next best

adapted, and increasing the use of shrubs can reduce weeds. Use shrubs that tolerate hard pruning. Examples of shrubs for California could include Xylosma, Rhamnus, Ligustrum, non-invasive Cotoneaster species, Pyracantha, Rhamnus, Cotinus, Dodonea, Grevillea, Mahonia, and Pittosporum. There are others. These shrubs can be kept relatively short while maintaining a continuous cover to shade the soil. Also, many planting beds are too small for trees. Other parts of a weed control plan are 4 inches of coarse mulch or 3 inches of finer mulch. If aesthetically acceptable, chipped branches from pruning can be used. They are also good food for the soil food web. Irrigation that wets the entire soil surface will benefit the plants and allow fertilizer and preemergent herbicides to be watered in. Herbicides are very important for establishment or re-establishment after repairs or landscape enhancements. Weeds in the root ball of establishing plants exacerbate water deficit problems new container plants often have.

Fertility is an important part of weed control. Soil testing labs have no calibration data for woody ornamentals in California or the West in general. This means they cannot really interpret the results of their soil tests. They typically do not want to have no interpretation and they typically do not want to recommend nothing, so they often recommend fertilizer when it is not needed. In particular, P is rarely needed by woody ornamentals, and surface applied P is unfortunately a “starter” fertilizer for weeds. Unless the soil P level is less than 5 ppm do not apply it, or at least do not make a surface application.

Herbicides become less important when adapted landscape plants are used. The plants should be adapted to compacted, engineered soil. Shrubs usually are best. The plants should grow well with shallow roots and tolerate both dry soil and saturated soil. Again this is usually certain shrubs. Native and “xeriscape” plants are often poorly adapted. They are not usually adapted to soils engineered for earthquakes.

### **Engineered slope, trees failed from weeds**

