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Controlling Competing Forest Vegetation

BY BRUCE P. ALBER

For over a century, forest managers have understood the importance of controlling vegetation that competes with their trees. In Filbert Roth's *First Book of Forestry* in 1902, he stated: "In a garden we should hardly tolerate these bushes, but would rather grub them out as weeds; and yet they are hardly more useful herein the woods, for surely they will never grow into trees, and in all cases may hinder young trees from starting or choke off the seedlings of our useful trees."

Subsequent research has shown the benefits of controlling competing vegetation in the forest setting to include more available light, soil moisture and nutrients, which lead to better seedling survival and growth. These benefits may also lead to reduced animal damage effects, faster green up of harvest units, and allowing genetically improved seedlings to reach their full potential. Vegetation management can reduce the spread and impact of noxious and invasive weed species. Lastly, faster growing seedlings will capture the site and look like a vigorous forest sooner, which is good for public relations.

Logging, broadcast burning or wildfire often damages the underbrush without killing it. Most brush species readily resprout from such top damage due to well-established root systems. These same disturbances usually create bare soil, which is ideal for the germination of existing or wind-blown seeds. Once sunlight reaches the brush and soil, the race is on to dominate the disturbed site. Brush, broadleaf weeds and grasses often get a head start over seedlings that are planted, and competition for light, moisture and nutrients begins.

PHOTO COURTESY OF BRUCE ALBER

A healthy young stand of Douglas-fir on Hampton Tree Farm land in the Oregon Coast Range, thanks to excellent vegetation management.

Methods of controlling vegetation

Many methods are available for controlling competing vegetation: chainsaws, loppers, hoes, tractors, domestic animals, broadcast burning and herbicides.

The manual methods of cutting brush involve the removal of the above-ground part of the plant, which leaves the root system intact. Again, most brush species and many perennial plants will resprout new tops vigorously. A bigleaf maple can grow new stems over six feet tall in one year! One notable exception is that cutting smaller red alder in June or July will often kill the plant and it will not resprout.

Tractor or excavator scarification can remove the tops and roots of smaller, shallow-rooted brush such as vine maple, but the soil disturbance can result in compaction and bare ground for seed germination. This method is effective for removing slash and opening the ground for more planting spots, but is limited to flat or gentle slopes, and is very expensive per acre. Tractor hazards to the operator include noise, vibration, exhaust fumes and roll-over injuries.

Chainsaw removal of brush is labor

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Controlling Competing Forest Vegetation

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intensive and the effects are temporary. Hazards to the operator include saw cuts, trips and falls, noise, exhaust fumes and vibration injuries.

Sheep and goats have been used as brush or herbaceous weed control tool for a long time with varied success. Properly done, the animals need to be continuously managed to prevent overgrazing, damage to tree seedlings, and degradation of riparian areas and water resources. I have seen large herds of sheep tended by herders from South America in Washington state. The herders are with the animals all the time, protecting them from predators and keeping them moving across the landscape.

Biological weed control is done primarily against invasive weed species where an insect has been imported to control only that weed. The process of ensuring that an imported insect will only damage and destroy a certain weed is very thorough and is coordinated and approved by the state department of agriculture. Some examples of biological controls are the cinnabar moth, *Tyria jacobeaae*, which eats tansy ragwort; *Bruchidius villosus*, a beetle that eats Scotch broom seeds; and a seed feeding fly, *Urophora stylata*, that consumes bull thistle seeds. Biological controls work best in areas hard to reach that are also undisturbed. They do not eliminate a weed, but rather, reduce its population and reproduction to a lower level.

Broadcast burning was the primary method of post-logging site preparation until the 1990s. This method was effective in reducing slash amounts, killing the tops of brush and creating planting spots. It was curtailed to a great extent due to smoke management concerns and regulations.

Herbicides are chemicals that control plants and have been used in forestry since the late 1950s. Hobe Jones and Dr. Mike Newton pioneered their use in forestry in the Pacific Northwest. Hobe Jones earned his Masters of Forestry degree from Oregon State University in the study of agricultural chemicals for forestry use. Hobe went on to work for Wilbur-Ellis Company for the next 34 years. Dr. Mike Newton is a professor emeritus at Oregon State University where he studied forest vegetation management and authored countless papers on his research findings.

Modern forest herbicides are used at very low amounts per acre and are regulated by the U.S. Environmental Protection Agency (EPA), as well as the state departments of agriculture and under state forest practices laws. Application permits are usually required to apply herbicides to forestlands. For example, in Oregon, permits are required for both ground and aerial applications, while in Washington, a permit is only required for aerial applications. Some herbicides work through the soil when the plant absorbs it into its roots, while others are absorbed through leaf surfaces, and some work both ways. Some herbicides are soil active where the chemical binds to the soil surface and germinating seeds absorb it and do not develop.

Today, forest vegetation management is done using a combination of tools—mechanical, biological and chemical—in a process called Integrated Vegetation Management, or IVM. The forester assesses the vegetation in the timber stand before harvesting, and again after logging. Decisions are then made as to which methods of control would be the most effective to achieve the goals of the landowner. The following should be considered when choosing the proper tool or tools to use in a situation: the species of trees to be planted; adjacent land uses; wildlife and fish resource needs; soil types and water resources; required state rules and regulations; and the species of plants that need to be controlled or prevented.

With IVM, all tools and methods of control are considered, and then the best options are chosen and implemented. Herbicides are applied using a variety of methods including backpack hand foliar spray, truck-mounted power sprayers, hack and squirt through the bark, backpack basal bark spray and aerial spray.

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Society of American Foresters
4033 S.W. Canyon Rd. • Portland, OR 97221 • 503-224-8046 • FAX 503-226-2515
rasor@safnwo.org • michele@safnwo.org • www.forestry.org/wf

Editor: Lori Rasor • **Assistant:** Michele Docy

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301-897-8720

Next Issue: Cooperatives in the Northwest

In recent years, the importance of the prevention and early weed control has been better understood. This gives freshly planted seedlings a near weed-free environment to grow and develop. Before the late 1980s, many foresters considered overtopping by brush to be the only problem for young seedling survival and growth. Research conducted through Oregon State University and others has shown the tremendous benefits of starting seedlings out with less than 30 percent ground cover. The seedlings survive at much higher rates, their roots develop faster to capture moisture and nutrients, and as they grow, they out compete other plants, close crowns with other trees faster, and exhibit growth rate increases that last for many years.

Prevention of vegetative competition begins with good site preparation before planting, typically a combination of herbicides that control brush, broadleaf weeds and grasses. Glyphosate (Accord® XRT, Razor® Pro) is the foundation of most combinations. It is a foliar herbicide that controls a broad spectrum of deciduous brush, green grasses and broadleaf weeds. For units that have more difficult-to-control species such as maples, salal and many evergreen species, imazapyr (Arsenal® AC, Chopper®) can be added. With this combination, most plants are well controlled since glyphosate and imazapyr have different modes of action within the plant cells. They are very mobile within the plant and when applied in the mid-summer to early fall, they move to the growing points in the roots and shoots and kill the plant.

Herbaceous weeds are controlled by glyphosate if emerged and growing, and by several soil active chemicals. These products include atrazine, sulfometuron methyl (Oust®), metsulfuron methyl (Escort®) and hexazinone (Velpar®). Often, a tank mix of glyphosate, imazapyr, sulfometron methyl and metsulfuron methyl are used for a very thorough site preparation mix, sprayed in July through early October. The unit is then planted with conifers the following winter or spring. The seedlings then have a fairly weed-free environment in which to get established, grow and thrive.

Follow-up treatments can be done to keep the area from being invaded by herbaceous weeds for the next few years. These are spring applications on the westside of the Cascades and fall applications on the eastside of the Cascades or the Inland Empire. Since the site preparation usually controls the brush species, only herbaceous weeds are targeted in the year or two after planting.

Late sprouting and invasive brush can become a problem in replanted areas several years after a site preparation spray. Bigleaf maple, blackberries and Scotch broom are common problems for westside foresters. For bigleaf maple, a mix of triclopyr (Garlon®) and a basal oil is sprayed on the lower stems of the sprouts. The triclopyr penetrates through the bark and is then translocated within the plant to control it. Smaller bigleaf maple resprout clumps can be treated with a foliage spray from a backpack. This mix is of imazapyr, water and surfactant and is applied in late summer and early fall.

There are a wide variety of species, conditions and sites that determine the method of control used against competing vegetation. Consider all the available options and ask the opinions of fellow foresters, licensed pesticide consultants, university Extension agents, and licensed applicators to help you do the best job possible. ◆

Bruce P. Alber, CF, is a licensed pesticide consultant for Wilbur-Ellis Company, headquartered in Wilsonville, Ore. He can be reached at 503-227-3525 or balber@wecon.com.

Challenges for Nursery Fumigation

BY MARK TRIEBWASSER

Soil fumigation in forest nurseries is an important practice to ensure the production of vigorous and uniform seedlings free from diseases and injurious pests. The impact of the Montreal Protocol and new rules by the EPA will make this best management practice more difficult. Continuous production of conifer seedlings results in a buildup of root fragments from undercutting, wrenching and lifting that become a source of inoculum for disease. Unlike agricultural crops, tree seedlings have not been selected for disease resistance. Weeds that are not controlled with herbicide applications can increase to levels that are damaging to the seedlings. Soil fumigation can effectively reduce levels of pathogenic fungi, weeds, weed seed, insects and nematodes to levels that allow production of healthy, pest-free seedlings. Repeated pesticide applications are not as effective as soil fumigation and have the potential to develop populations that are resistant.

The most common fumigant used in Oregon and Washington nurseries is a mixture of methyl bromide and chloropicrin. Methyl bromide is an organic halogen compound. It is a toxic, colorless and odorless gas, and is also an ozone-depleting substance. All methyl bromide must contain at least two percent chloropicrin, also known as tear gas, as an indicator of the presence of gas. Chloropicrin (PIC) is also a very effective fungicide; the mixtures used for nursery fumigation contains from 20-50 percent chloropicrin. Douglas-fir roots are extremely sensitive to any residual chloropicrin remaining in the soil after fumigation. Lower rates must be used for spring fumigation when cooler and wetter soils slow dissipation of the gas. Higher rates of chloropicrin can be used in the fall when soils are warmer and dryer, and there is a longer period prior to sowing or planting.

The fumigant is applied by injection into the soil at a depth of 10 inches and the soil is immediately covered with plastic tarps. The strips of plastic are glued to each other to create a solid single cap. The tarp is left in place for at least five days before it is cut into strips and removed. After tarp removal, the soil is aerated by periodic tillage for a minimum of 10 days.

The first challenge to our ability to continue the practice of soil fumigation comes from the Montreal Protocol on Substances that Deplete the Ozone Layer. This treaty, signed by 191 nations and originally passed in 1987, established targets to reduce and eliminate all ozone-depleting substances. The U.S. phaseout date for production and consumption of methyl bromide was January 1, 2005.

Now, only two classes of uses are allowed—Quarantine and Preshipment Exemption (QPS) and Critical Use Exemption (CUE). The critical uses and levels of production are adjusted yearly. The cost for gas used for CUE applications is 25 percent higher than gas used for QPS applications. Forest seedling nurseries are partially covered under both exemptions. In Oregon, the state has issued an Administrative Rule (603-052-1205) that seedlings for commercial forest plantings be free of noxious weeds, and methyl bromide fumigation is recognized as the most effective control method until a technically viable and economically feasible alternative is developed. This allows all fumigation in a nursery, even if the material will

be used within the state, as QPS. This rule is set to be reviewed or repealed at the end of 2013. A Washington rule is in process.

The second challenge is the EPA Re-registration Eligibility Decision (RED) for many fumigants. These rules will severely impact all users of soil fumigants. The rules will require buffer zones for tarped applications of all fumigants. The size of the buffer is dependent on the number of acres fumigated, mixture and pounds of material used. Buffer credits, which allow for a reduction in buffer size, are provided for treatments or practices that reduce the potential for risk to people or the environment. A reduction in the buffer requirement is reduced for each of the following: 25 percent for using Virtually Impermeable Film (VIF); 10 percent for organic matter content of greater than three percent; 10 percent for soils having at least 27 percent clay; for chloropicrin, five percent for applying a water seal with potassium thiosulfate (see Table 1).

PHOTO COURTESY OF MARK TRIEBWASSER

Soil fumigation is a technique used in forest nurseries to control pests and weeds.

Table 1. Buffer zones for fumigant mixtures and acres.

Acres	Mixture	Lbs./ Ac.	Critical Chemical	Buffer Zone (Feet)	Buffer w/max credits (Feet)
10	67 MBr:33 Pic	350	MBr	385	250
10	50 MBr:50 Pic	300	Pic	350	175
20	67 MBr:33 Pic	350	MBr	625	406
20	50 MBr:50 Pic	300	Pic	550	275

The buffer zone requirement expands to .25 miles from sensitive sites such as schools, hospitals and day cares. If there are offices, including the nursery office, or homes within the buffer zone, they must be vacated for 48 hours after application and the air sampled twice before re-entering. If a buffer zone includes neighbor property, written permission must be obtained and they must agree to keep all persons out of the buffer zone. This action may require providing lodging for them during this period.

The REDs also add requirements for monitoring the air of operators during application and the buffer zones during application and hourly for the next 48 hours. The costs for this monitoring would be over $2,000 for each application, regardless of area treated. Requirements for management and emergency response plans, notification and training are also included.

The new REDs are considered to be extreme and not based on solid science. Many grower groups, including the nursery cooperatives in the west and south, National Governors Association with regard to state nurseries, Washington Red Raspberry Commission, other commodity groups and various members of congress have asked the EPA to review these requirements based on the severe impact they will have on reforestation and agriculture. As much as 30-50 percent of nursery space could be removed from production if the rules are not amended. As of now, these new rules go into effect in 2010.

New research in cooperation with the USDA-Agriculture Research Service, OSU Nursery Cooperative and several nurseries is being conducted to find alternative fumigants and fumigation methods that are safer and will allow for smaller buffers. In addition to methyl bromide-chloropicrin, tests are underway with methyl iodide-chloropicrin, metam sodium-chloropicrin, and dimethyl disulfide-chloropicrin mixtures. Some are being tested using a VIF film. Metam sodium and dimethyl disulfide have very strong odors, which have resulted in complaints from neighbors. At present, there is not an efficient method for gluing the VIF film.

The fumigation rules are final and will go into effect in 2010. Fumigation users have expressed concern to the EPA and Congress about the severity of the new rules. All would like to see a delay in the effective date of the rules to give more time to investigate alternatives and provide more data for use in their models. Many have commented that the rules are based on a worst-case scenario from warm southern areas of the country. The buffers for cooler northern locations could be smaller and still effective. Nurseries hope to be able to continue to fumigate in a safe and effective way until other means to sterilize nursery soil are developed. ◆

Mark Triebwasser is nursery manager for Weyerhaeuser Company in Aurora, Ore. He can be reached at 503-266-2018 or mark.triebwasser@weyerhaeuser.com.

"Toxic Assets" (Pesticides) in Forestry: Fears, Facts and Philosophy

BY PAUL W. ADAMS

Highly poisonous substances often come to mind when we see or hear the term "toxic," but another definition may fit better when the word is used in a forestry context: "extremely harsh, malicious or harmful" (Merriam-Webster Online). Although visible public concern has cycled up and down over the years, the use of "toxic" pesticides on forestlands continues to fuel substantial controversy and criticism, sometimes including harsh or even malicious feelings toward chemical users. Such feelings are better understood when the perceptions and fears behind them are recognized.

For those who remember even a bit of the 1960s, DDT, Rachel Carson's book *Silent Spring*, and Vietnam's "Agent Orange" serve as markers of the awakening of public concerns about the environmental and human health hazards of pesticides. A few years later and closer to home, the "Alsea (Oregon) Miscarriages" led to multiple protests, legal actions and studies on the use of herbicides and other chemicals on forestlands in the Pacific Northwest. Then, as now (e.g., SB 902 in the 2009 Oregon Legislature), powerful images of children at risk helped convey the weight of concerns about human health. And although no clear, science-based "smoking gun" in forestry was found, among the persistent results of the Alsea controversy was the near-complete elimination of pesticide use on federal forestlands in the region.

From the beginning to today, confusion about the important difference between hazard and risk has been a hallmark of the pesticide issue. A recent (March 2009) story in the *Newport* (Oregon) *News-Times* describes how the Waldport City Council voted to send a letter to an industrial forest landowner asking for written assurance that the company would not aerially spray herbicides on their land. The story quoted a concerned activist who became ill when exposed to ordinary household chemi-

Position Paper Online

Oregon SAF (OSAF) recently updated its position statement on "Using Pesticides on Forest Lands," which includes the following core position: The OSAF supports the careful use of pesticides that are registered for forest use. When used properly, pesticides are a safe and important tool to protect the health and productivity of forests by controlling competing vegetation, non-native invasive species and other harmful, unwanted pests. Additional supporting discussion and a downloadable pdf of the complete statement can be found at www.forestry.org/or/position/chemicals.php.

cals: "These herbicides are even more dangerous… By law, salmon must have a buffer to exposure… and bald eagles… are legally protected. But human beings are not protected, and we are more important than eagles."

Another local activist said, "Herbicides put citizens at risk. The EPA calls this 'an acceptable risk,' but when you're dealing with lives, it's not." But herbicides used in forestry include glyphosate, whose toxicity (e.g., LD_{50}) is comparable to table salt, which suggests that for some there is never an acceptable risk when it comes to herbicide use. As such, the issue of pesticide use moves outside the realm of science into philosophy, not unlike the "nature-good, humans-bad" view of forest functions and values and the role of human activities. If such philosophical differences can be more openly acknowledged, perhaps the nature and quality of public discussions about pesticide use can be shifted and improved.

Appeals for more restrictions on the use of pesticides and other chemicals in forestry also often give preference to conservative approaches when questions of human or environmental health are involved, e.g., "erring on the side of caution" or following the "precautionary principle." This preference may be stated even more emphatically: "Until we can be completely sure this activity won't cause any harm, we shouldn't do it." At this point the discussion again shifts from science to philosophy because research can never prove with absolute certainty that something won't happen. Science and experience (i.e., "empirical" observations) can only show that certain things can and do happen, and this type of knowledge is what forestry professionals normally rely upon to make decisions about management practices.

Unfortunately, even science has some limitations in addressing concerns about pesticide use, as scientists themselves can fail to make careful and objective assessments of the behavior and effects of pesticides. In a detailed discussion of six peer-reviewed papers on glyphosate toxicology (Environ. Sci. Pollut. Res. vol. 15, p. 443-447), OSU Emeritus Professor Frank Dost highlights major flaws in study methods and conclusions, which reflect poor quality in both the research and the peer reviews that allowed the six papers to be published. In the same journal issue (p. 439-442), OSAF member and OSU Emeritus Professor Mike Newton discusses how emotions, personal agendas, political pressure and institutional factors can influence how scientists approach their research and report their findings.

But for every flawed paper there are likely to be several good quality reports that can be useful to forestry professionals. A study of chemical drift in the Oregon Coast Range, co-authored by OSAF member George Ice (AWRA 2008 Summer Specialty Conf. Proceedings), showed that the legally required stream buffers were effective in reducing stream deposition from aerial spraying. Similarly, an Oregon Department of Forestry monitoring report (Tech. Report 7, 2000) found the forest practices rule requirements were effective in protecting water quality, with no pesticide levels above one part per billion in collected water samples. And, Oregon's Pesticide Use Reporting System shows that forestry represents a small fraction of the potential human and environmental pesticide exposure based on use, e.g., 2.8 percent of the annual total pounds applied statewide in 2007.

Forestry professionals use many techniques and tools, including pesticides, to manage forest conditions and related resource benefits. No single tool is a cure-all—an array is needed to effectively deal with the wide range of forest sites and management needs. SAF provides a vital voice for the professional community in helping maintain the availability of pesticides and other management options in the face of major forest resource challenges such as the growing problem of invasive species. ◆

Paul W. Adams currently chairs the Oregon SAF Policy and Legislation Committee. He also is a professor and Forest Watershed Extension specialist in the Forest Engineering, Resources and Management Department at Oregon State University. He can be reached at paul.adams@oregonstate.edu.

Safe Use of Herbicides to Manage Forest Vegetation

BY JEFFREY JENKINS

Herbicides are often the preferred method to manage forest vegetation. Proper use of forestry labeled herbicides can result in effective and environmentally sound vegetation management. However, their use remains controversial. Prior to registering herbicides, the EPA must evaluate the impact of each use practice on human health and the environment.

Laboratory Testing

Before pesticides are registered by the U.S. EPA, they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed high enough doses to cause toxic effects. These tests help scientists judge how these chemicals might affect humans, domestic animals and wildlife in cases of overexposure. When pesticide products are used according to label directions, toxic effects are unlikely to occur because the amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

LD_{50}/LC_{50}

Acute toxicity is commonly measured by the lethal dose (LD) or lethal concentration (LC) that causes death in 50 percent of treated laboratory animals. LD_{50} indicates the dose of a chemical per unit body weight of an animal and is expressed as milligrams per kilogram (mg/kg). LC_{50} is the concentration of a chemical per volume of air or water and is expressed as milligrams per liter (mg/L). Chemicals are highly toxic when the LD_{50} or LC_{50} value is small and practically non-toxic when the value is large. However, the LD_{50} and LC_{50} do not reflect potential health effects such as cancer, birth defects, or reproductive toxicity that may occur at levels of exposure below those that cause death.

The evaluation includes four steps:

1) ***Hazard Identification.*** Hazard identification involves identifying all plausible adverse health effects that can be caused by exposure to the chemicals being studied.

2) ***Dose-Response Assessment.*** This is an evaluation of the potency for various forms of toxicity exhibited by the chemicals being reviewed. Potency is determined by the dose-response relationship, which describes how the likelihood and severity of adverse health effects are related to the amount and conditions of exposure to the chemicals. These findings, along with an evaluation of exposure pathways, can be used to characterize acute and chronic exposures that do not exceed a level of concern.

3) ***Exposure Assessment.*** Exposure assessment involves measuring or estimating the magnitude, frequency and duration of human exposure to chemicals being studied. It may also include estimating the size, nature and type of populations (i.e., workers, bystanders) exposed to the compounds. EPA considers likely routes of exposure, and both acute (single high-level exposure) and chronic (repeated low-level exposure) scenarios.

PHOTO COURTESY OF JOHN H. GHENT, USDA FOREST SERVICE, BUGWOOD.ORG

Helicopter spraying at dawn.

4) ***Risk Characterization.*** Risk characterization involves integration of the information on toxicity and exposure into an estimate of the human or environmental health risks posed by the chemicals under the conditions assumed in the exposure assessment.

When considering a new pesticide product label, or a new use of an existing product, EPA uses the risk characterization in deciding whether to allow a use, and the terms of use. Labeled

Table 1. Toxicity Category and Signal Word

	High Toxicity - I (*Danger*)	Moderate Toxicity - II (*Warning*)	Low Toxicity - III (*Caution*)	Very Low Toxicity - IV (*Caution*)
Oral LD50	Less than 50 mg/kg	50-500 mg/kg	500-5000 mg/kg	Greater than 5000 mg/kg
Dermal LD50	Less than 200 mg/kg	200-2000 mg/kg	2000-5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Less than 0.05 mg/l	0.05-0.5 mg/l	0.5-2.0 mg/l	Greater than 2.0 mg/l
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible in 7 days	Minimal effects, gone in 24 hours
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

uses almost always include mitigation measures designed to ensure that the use will not result in unreasonable adverse effects on human health or the environment. Mitigation measures can range from the use of protective clothing in the workplace to application restrictions to protect water quality.

Table 2. Signal Words for Commonly Used Forestry Herbicides

Trade Names	Common Name	Signal Word
AAtrex, Atrazine 4L	atrazine	Caution
Accord, Foresters, Razor	glyphosate	Caution
Arsenal, Chopper, Polaris	imazapyr	Caution
Escort XP, Patriot, MSM	metsulfuron methyl	Caution
Garlon, Tahoe, Pathfinder	triclopyr	Caution or Danger
Oust XP, Spyder	Sulfometuron methyl	Caution
Tordon	picloram	Caution
Transline	clopyralid	Caution
Velpar	hexazinone	Danger
Weedone LV-6, Low Vol 6	2,4 D	Caution or Danger

Once registered, as new scientific information becomes available EPA periodically re-evaluates pesticide product risks. Based on this re-evaluation EPA may choose to revoke some or all of the labeled uses, or stipulate new mitigation measures.

For example, in 2006 EPA finalized requirements for modifying the atrazine label for certain forestry uses. Closed systems are required for mixing and loading in support of aerial application of liquid formulations at rates greater than three pounds of active ingredient per acre. This engineering control is in addition to the full protective clothing requirement (long-sleeve shirt, long pants, shoes, socks, chemical-resistant gloves and chemical resistant apron). This combination of mitigation measures was deemed necessary based on new information on the toxicity of atrazine, which lowered the acceptable exposure level to workers during mixing and loading.

Most herbicides labeled for forestry use do not require such extreme measures to comply with agency concerns regarding worker health risks. However, as the greatest opportunity for exposure is often associated with the handling in the undiluted product, risk can always be reduced by taking precautions to minimize exposure.

Signal words on the label help inform the user as to the level of risk associated with handling the product (see Table 1). The signal words advise the user as to the acute toxicity of the undiluted product (see sidebar). Signal words for commonly used forestry herbicides are given in Table 2. Most forest herbicides are classified as having low or very low toxicity and their product labels contain the signal word Caution. The exceptions are products containing hexazinone, the triethylamine salt of triclopyr, and acid and salt forms of 2,4 D, which are classified as Category I (signal word—Danger) for primary eye irritation. As pesticide applicators, forestry vegetation managers are required by law to obey all conditions of use contained on the product label. While the product label may be considered the primary mechanism used to ensure proper use, each forestry setting is unique and often requires the applicator's professional judgment to ensure that there is effective vegetation management while meeting society's goals for protecting human health and the environment. ◆

Jeffrey Jenkins is professor, Environmental and Molecular Toxicology, Oregon State University, Corvallis. He can be reached at 541-737-5993 or jeffrey.jenkins@oregonstate.edu.

Trends in Forest Chemicals

BY BRUCE P. ALBER, CF

Forest chemicals are an important tool for foresters who work to improve seedling survival and growth, as well as manage forest roadside vegetation and noxious weeds. Herbicides are often the best choice for managing vegetation in terms of low environmental impact, low cost and effectiveness. This article will look at four trends in the chemical industry and what they may mean to forestry in the Northwest.

Trend #1: Due to cost and time, few new products are being developed. Some companies are developing combination products to meet foresters' needs.

The process to bring a forest herbicide to market is expensive and time consuming. First a molecule is synthesized in a manufacturer's laboratory. It is then screened with thousands of others to determine if it has herbicidal effects on a variety of weed and crop species. If it looks promising, it is run through a battery of toxicological tests that look for animal toxicity, environmental safety and physical characteristics such as water solubility, soil absorption, stability and breakdown of byproducts.

To be approved for sale and use by the U.S. Environmental Protection Agency, over 120 tests are conducted to show that when used properly, the product will not pose a risk to the user or the environment. These tests take 7-10 years and over $70 million to complete. If approved, specific uses are written to the product label, which is a legal document on how to use the product. Labels give specifics as to how a product can be used, on which crops (such as forestry seedlings) and sites (such as reforestation areas), seasons to apply, rates of product per acre, and the species of weeds and brush to be controlled.

In the 1980s, several new herbicide molecules were developed and labeled for forestry use. After EPA approval, we foresters had to learn how to use them effectively by determining the best time of year to spray, the proper growth stage of the plant, and the safety, if any, of spraying over the top of seedlings in our Pacific Northwest forest situations.

Often, combinations of these herbicides are used to control a wide variety of plants. Several manufacturers have developed products that are a combination of two or more herbicides to make it easier to mix and spray.

Since the 1980s, only a few new herbicide molecules have been approved for forestry uses. One new product is aminopyralid with the brand name of Milestone® VM. Aminopyralid has excellent environmental qualities of very low animal toxicity and low use rates per acre. The EPA has designated it a "reduced risk pesticide," which is rare. It is a powerful broadleaf herbicide that works well on thistles and many noxious weeds. In combination with triclopyr it affords superior control of Scotch broom and other brush species.

Extensive research plots to evaluate the effectiveness and safety to seedlings throughout the Pacific Northwest were conducted by vegetation management specialists. Try as we might, we were unable to find a time of year or growth stage of conifer seedlings that was consistently safe enough to spray them over the top without causing tree mortality. We then conducted testing to determine if the product could be used as a site preparation spray. Replicated spray plot treatments were made, then conifer seedlings of several species were planted into the site at intervals of time after. The following summer, evaluations were made to determine if the seedlings had normal growth and what level of weed control had been achieved.

The manufacturer used this data to decide how to label the product for

forestry use. Milestone VM is currently only registered for non-crop and roadside spraying, but a combination product, Milestone VM Plus, is labeled for site preparation spraying as well. A new product containing aminopyralid and metsulfuron methyl may be available this summer for site preparation called Opensight™.

Trend #2: Get involved, make a difference!

After an herbicide is registered for use, it is periodically reviewed by the EPA. A data call is made for new information about the toxicology, environmental performance and any complaints about the use of a specific product. The EPA reviews the information and negotiates changes to be required in the product label with manufacturers. The label is the set of instructions on how to use the chemical. In November 2008, the EPA completed the Re-registration Eligibility Decision (RED) for sulfometuron methyl (Oust® and other brand names).

In its RED, it was proposed that the label be changed to require wider unsprayed buffers in an effort to protect aquatic vegetation. A 100-foot buffer would be required for streams, ponds, lakes and other water ways for all ground spray applications. For aerial applications, a 500-foot buffer would be required.

These new label requirements would make it impossible to use this valuable herbicide in Pacific Northwest forestry, as well as most roadside and railroad uses. The comment period to express concerns to the EPA was from November 12, 2008, to January 12, 2009. We learned about this RED on December 10 and began to mobilize foresters and applicators about the issue.

The EPA had reviewed research that showed sulfometuron methyl would damage or kill certain aquatic vegetation at a low rate, which was not a surprise since it is an herbicide. The EPA then used a spray drift computer model to calculate the buffer distance needed to keep the herbicide from reaching that aquatic vegetation. In the drift model they used a fixed-wing aircraft, spray nozzles that produced fine, driftable droplets, and wind speeds that exceed those operators spray in. Another odd assumption is that these buffers are to be left both upwind and downwind of the aquatic vegetation; however, spray droplets cannot "swim" upwind, thus streams upwind should have smaller buffers.

Foresters from Oregon, Washington and Idaho wrote their comments to the EPA with excellent details about

Using the "Toolbox" to Fight Invasive Species

PHOTO COURTESY OF MICHIGANNATURE.ORG

An article describing Oregon's battle with the gypsy moth is available on our joint OSAF/WSSAF website at www.forestry.org/wf. Written by Lisa A. DeBruyckere, owner of the communications company Creative Resource Strategies, the article is interesting from both chemical and public relations aspects, as it describes options to treat and monitor gypsy moth infestations, and the decision to spray *Btk* with a new certified organic formulation of *Foray48B* to eradicate this invasive pest.

We regret that this article could not be included in print in this issue; but with low advertising levels due to the poor economy, this issue of the *Western Forester* is just 16 pages in length instead of the usual 24 pages.

how these new buffers would make it impossible to use the herbicide. Some foresters included site maps with the buffers over the streams, showing how the entire unit would be buffered. My personal comments pointed out that the EPA erred in using a fixed-wing aircraft in the spray drift model since the current product label requires the use of only helicopters, which fly lower and slower, creating less driftable droplets. The EPA did not show any data that aquatic vegetation was being damaged by the current uses of sulfometuron methyl. Comments pointed out that in 2000, the Oregon Department of Forestry sampled 26 operational aerial spray units and found no herbicide residues in the water in 24 of them. Of the residues in the other two units, the values were far below the amount allowed by the EPA. ODF further reported that there was no evidence of damage to the riparian or aquatic vegetation from the use of the standard 60-foot aerial spray buffer. The current state regulations and best management practices are already protecting the resource.

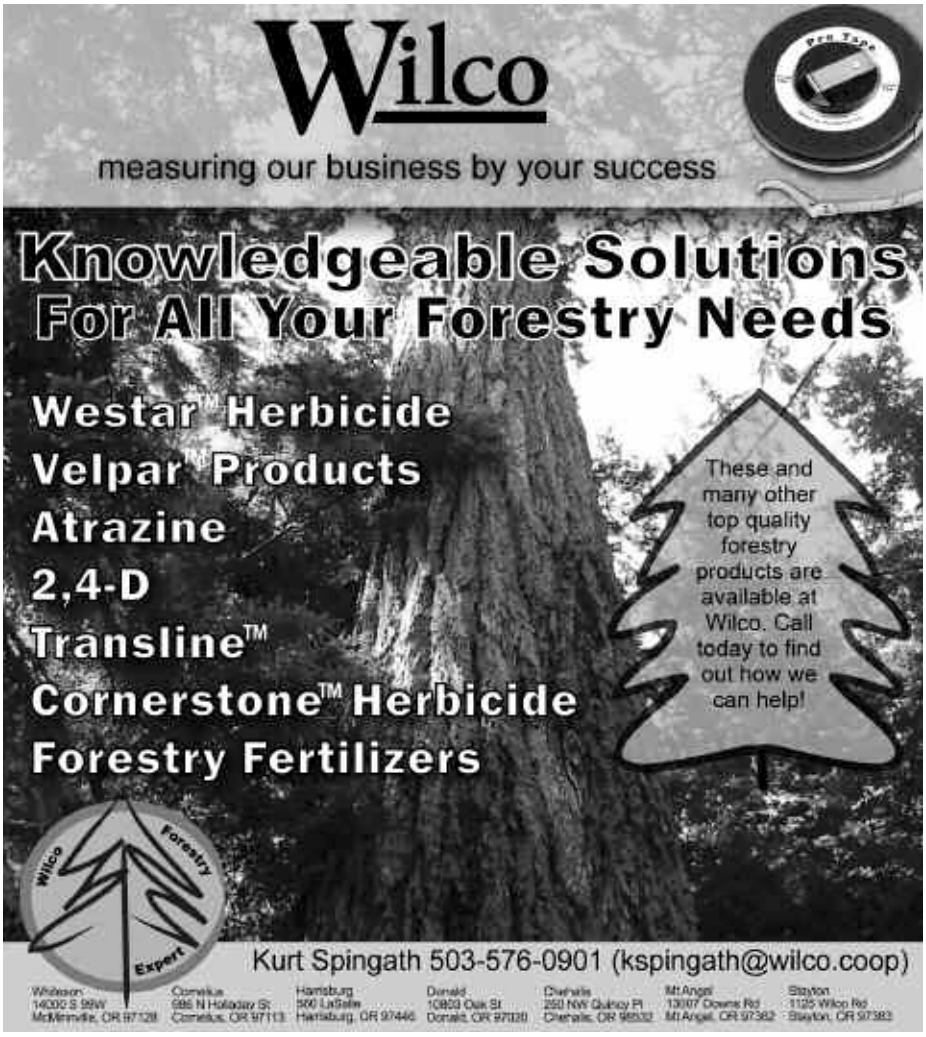
After the comment period closed, I reviewed the 278 submitted comments. Fifty comments were clarifications by the EPA and five were from people opposed to the use of herbicides in general. These five comments had no specific data or reasons to not use the product.

Of the remaining 223 comments, 101 were from foresters and applicators from the Pacific Northwest! The other comments were from noxious weed control boards, railroad users, roadside managers, foresters from the rest of the country, and forestry associations. Had we not gotten involved, the EPA would not have heard from those who use the product in a safe and responsible manner that does not harm our aquatic resources. Over the next few months, the EPA will review all of the comments and hopefully they will re-consider the wider, unnecessary buffers.

Trend #3: Spray drift research and application

When herbicide spray droplets move away from their intended targets, damage can be done to sensitive plants near water ways, neighbor's plants and crops, and affect water quality. This violates the herbicide label directions, and state and federal laws. Off-target damage can result in lawsuits, unhappy neighbors, fines from regulatory agencies, and wasted chemical. Spray drift can occur from a spray helicopter, a roadside spray truck or even a backpack sprayer.

Great strides have been made the past decade in understanding how small, driftable droplets are generated while spraying and how to prevent or control them. Weather conditions that favor spray drift are better understood and recognized by good spray applicators. Spray nozzles come in several different designs, and when set up properly they can produce a droplet that falls rapidly to the ground, covering leaves with enough droplets, while at the same time producing very few fine, driftable droplets. Today, helicopter spray contractors have refined their set up of spray nozzles to this goal. The nozzle design, pump pressure, nozzle orientation into the air stream and boom



width all contribute to good weed and brush control while reducing drift.

Trend #4: Generic herbicide products

Since most of the standard herbicides introduced in the 1980s are now off patent, several generic products have been introduced into the market. The prices of most products, generic or not, has decreased, making it possible to treat more acres for the same cost. The disadvantage has been that the support from many generic manufacturers has been low or non-existent. Several generic suppliers have come and then gone out of business. In a worst case scenario, if a neighbor complains that you have impacted them with your spray application, there may not be any help from a generic supplier. Major manufacturers of herbicides have assisted users in the past when these difficulties arise.

Secondly, there have been some cases of poor product quality from some generic suppliers where the active ingredient percent is higher or lower than listed. This can result in either damage to your trees or lack of performance. The EPA has assessed huge fines to more than one supplier when the product did not match the label. A strong traditional manufacturer produces high quality products, develops new formulations, and conducts the basic research needed to produce new chemicals to fit our needs in the future. ◆

Bruce P. Alber, CF, is a licensed pesticide consultant for Wilbur-Ellis Company, headquartered in Wilsonville, Ore. He can be reached at 503-227-3525 or balber@wecon.com.

Calendar of Events

Learn ArcPad in One Day, June 9, Tualatin, OR. Contact: Resource Supply, 503-707-6236, jon@resourcesupplyllc.com, www.resourcesupplyllc.com.

Council on Forest Engineering annual meeting, June 15-18, Lake Tahoe, CA. Contact: Bruce Hartsough, 530-752-5714, brhartsough@ucdavis.edu.

Western Mensurationists' Meeting, June 21-23, Vancouver, WA. Contact: WFCA.

Oregon SAF Foundation Golf Tournament, June 27, Trysting Tree Golf Course, Corvallis, OR. Contact: Craig Richards, 541-294-0366, craigrichards1998@hotmail.com, www.forestry.org.

IUFRO Diseases and Insects in Forest Nurseries Meeting, July 10-17, Hilo, Hawaii. Contact: WFCA.

Western Forest Genetics Assoc. Annual Meeting, Aug. 10-13, Asilomar, CA. Contact: Tongli Wang, 604-822-1845, tlwang@interchange.ubc.ca.

Who Will Own the Forest? 5, Sept. 14-16, Portland, OR. Contact: Angie DiSalvo, 503-488-2137, adisalvo@worldforestry.org, www.worldforestry.org.

ArcPad Seminar, Sept. 23-24, Beaverton, OR. Contact: Atterbury.

Growth and Yield Workshop, Sept. 23-25, Corvallis, OR. Contact: FBRI.

SAF National Convention, Sept. 30-Oct. 4, Orlando, FL. Contact: SAF National Office, www.safnet.org.

NAAEE Annual Conference, Oct. 7-10, Portland, OR. Contact: Ashley Dayer, 541-324-0281, www.eeao.org/naaee2009.aspx.

Professional Timber Cruising Seminar, Oct. 21-22, Beaverton, OR. Contact: Atterbury.

Planning Workshop, Nov. 4-6, Corvallis, OR. Contact: FBRI.

Water and Land Use in the PNW: Integrating Communites and Watersheds, Nov. 4-6, Stevenson, WA. Contact: www.swwrc.wsu.edu, watercenter@wsu.edu.

Contact Information

Atterbury: Atterbury Consultants Inc., 3800 SW Cedar Hills Blvd., Suite 145 Beaverton, OR 97005, 503-646-5393, pwroe@atterbury.com, www.atterbury.com.

FBRI: Forest Biometrics Research Institute, PO Box 1688, Corvallis, OR 97339, 541-754-1200, www.forestbiometrics.com.

WFCA: Western Forestry and Conservation Association, 4033 SW Canyon Rd., Portland, OR 97221, 503-226-4562, richard@westernforestry.org, www.westernforestry.org.

Send calendar items to the editor, *Western Forester*, 4033 SW Canyon Rd., Portland, OR 97221; fax 503-226-2515; rasor@safnwo.org.

Policy Scoreboard

Editor's Note: To keep SAF members informed of state society policy activities, Policy Scoreboard is a regular feature in the Western Forester. *The intent is to provide a brief explanation of the policy activity—you are encouraged to follow up with the listed contact person for detailed information.*

OSAF Shares Forest Issues Booklet, Drafts New Positions. From May 2008 through January 2009, the OSAF Executive Committee approved revised and updated position statements on five important forestry topics: "Salvage Harvesting," "Using Pesticides on Forest Lands," "Clearcutting," "Active Management to Achieve and Maintain Healthy Forests," and "Landslides on Forest Lands." OSAF has compiled these and three other active positions into a booklet titled "A Professional View of Forestry Issues in Oregon." In early spring the booklet was sent to each of the 90 members of the Oregon Legislature. The booklet also is expected to be useful for sharing OSAF's views with Oregon's federal representatives and other key policy and decision makers.

OSAF is working on two new position statements, one on "Forestry and the Wildland-Urban Interface (WUI)," and the other on "Thinning." The increasing numbers and presence of homes and people in Oregon's WUI areas have raised a number of diverse and unique issues for forest policy and management. The position statement on thinning was prompted in part by recent legislative and other policy or management proposals to limit timber harvesting on public lands solely to thinning. In addition, there is concern about the effectiveness of silvicultural prescriptions when relatively arbitrary age- or diameter-based harvest restrictions are imposed by current or proposed policies. All OSAF position statements, as well as a .pdf of the Forestry Issues booklet, are available at www.forestry.org and draft positions may be posted in the "members only" section. Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu.

WSSAF Policy Updates. House and Senate leaders plus Governor Christine Gregoire's office, at press time, are working to complete the 2009-2011 biennial budget to close a projected $9 billion budget gap by the end of the legislative session on April 26. These leaders are proactively trying to deal with sizable reductions in sales and business tax revenues as a result of the recession. Heavy cuts in state agency spending, programs, cost-savings and utilizing $3 billion in federal stimulus funds are being proposed. All agencies are looking at dramatic cuts that will reduce services and could lay off an estimated 8,000 employees statewide.

For example, the Department of Natural Resources general fund budget is proposed to be reduced by almost 25 percent, in addition to budget reductions resulting from lower revenues from state timber sales and other products. The Department of Fish and Wildlife general fund budget reflects a proposed 27 percent reduction.

At the time of this writing, legislative leaders are considering a voter referendum later this summer that could create a one percent income tax on high earners (>$500,000) or an increase in state sales tax to offset costs of education and human services needs.

On a brighter note, SB 5562, titled, "Protecting the ability of forest landowners to continue active forestry operations" has passed both the House and Senate and has been sent to the Governor.

Biomass has been on the minds of legislative members with two Senate bills pending (SB 5441 and 5442) in the Senate Ways and Means Committee. But recently, these two bills have been rolled into SB 6170—Environmental Tax Incentives bill. Section 401 of SB 6170 proposes to provide a ramped $0/green ton forest derived biomass incentive credit for business and occupation taxes from October 1, 2009, to June 30, 2010, then a $3/green ton credit from July 1, 2010, to June 30, 2013, and a $5/green ton credit from July 1, 2013, to June 30, 2015, with up to two years of carry over. This section would expire on June 30, 2015. Sections 402 and 403 of SB 6170 propose to exempt hog fuel transactions from state sales and use tax and would expire on June 30, 2013. Readers are encouraged to go to www.leg.wa.gov to learn about passed and pending legislation. Contact: John Walkowiak, WSSAF chair-elect, jewalkowiak@harbornet.com. ◆

Developing Forest Inventory Guidelines to Meet the Requirements of the Chicago Climate Exchange

BY STEPHEN E. FAIRWEATHER

Mason, Bruce and Girard, Inc. (MB&G), under contract to the Woodlands Carbon Company (Woodlands Carbon), is developing forest inventory guidelines and protocols to satisfy the requirements of the Chicago Climate Exchange (CCX). Woodlands Carbon was established by the Oregon Small Woodlands Association (OSWA) in partnership with the American Forest Foundation (AFF) to aggregate and trade sequestered carbon credits from managed forestlands. Participants in the Woodlands Carbon pool must be forest owners enrolled in a CCX-recognized certification program, such as the American Tree Farm System.

Developing inventory guidelines that meet the requirements of the CCX and are also amenable to small properties is challenging. The guidelines must result in baseline inventory estimates that are not only cost-efficient and verifiable, but precise, because the CCX will actually discount estimates of annual carbon sequestration by the minimum of either 20 percent or two times the statistical error of the baseline inventory estimate, where the statistical error is defined by the 90 percent confidence interval. For example, if the 90 percent confidence interval for the inventory is plus or minus eight percent, the discount would be 16 percent.

The challenge in achieving this kind of precision on small properties is that with typical cruising methods, the number of plots required may be cost-prohibitive. For example, depending on the variability in the forest stands on a property, the sample size required to achieve a statistical error of +/- 10 percent at the 90 percent confidence level may be anywhere from 100 to 200 plots. While Woodlands Carbon may be able to offset the cost of cruising for an interested participant, that number of plots will be difficult to establish on an ownership of, say, 50 acres.

MB&G is preparing guidelines both for the establishment of new inventories and for the qualification of existing inventories. Some of the larger participants in the pool have forest inventories established some time ago, and these have been useful for management planning and valuation purposes. But will they meet the requirements of the CCX? For example, can a confidence interval be developed for the total inventory estimate? If an inventory forester was assigned the task of verifying the current estimate, is there a good chance he or she would agree with it? Has the ownership been delineated by stand, and does every stand have an estimate? Are inventory design and cruising methods well documented? How has the inventory been kept up to date to show changes due to harvesting and growth? Is there sufficient detail in the inventory data to allow the inventory to be grown with the Forest Vegetation Simulator, the only growth model currently approved for use by the CCX?

The inventory guidelines being developed for Woodlands Carbon will be in place by early summer. We expect they will address an array of topics ranging from stand delineation, typing and establishing a stands layer in GIS, to tree observations on a plot. The guidelines will be targeted toward consulting foresters, who we expect will be helping most of the family forest owners with establishing (or improving) their inventory estimates. We expect the guidelines will advocate for the use of stratification as one of the most effective ways to achieve cost-effectiveness and greater precision. If different ownerships within a pool can be stratified similarly, we may be able to leverage inventory estimates developed for one owner and use them, with some adjustments, for other owners. Stratification, or typing stands by categories of species mix, tree size and stocking, may be one of the most effective tools we can bring to the table.

Forest inventories in the Woodlands Carbon pool will actually be delivered to Forecon, Inc., before they are passed to the CCX. Forecon will determine carbon equivalents in each inventory using their CCX-approved methodology. Woodlands Carbon and MB&G will be responsible for delivering to Forecon updated inventories each year for each landowner in the pool, along with supporting documentation as to inventory establishment and updates.

We believe the consulting forester community will find the inventory guidelines to be flexible enough to accommodate many current practices, yet stringent enough to satisfy the requirements of the CCX. ◆

Stephen E. Fairweather is president of Mason, Bruce and Girard, Inc., in Portland, Ore. He can be reached at 503-224-3445 or SFairweather@masonbruce.com. Questions can also be addressed to Mike Gaudern, president and CEO, Woodlands Carbon, Salem, Ore., 503-588-8356, woodlandscarbonco@gmail.com.

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Western Forester
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