



DEPARTMENT OF
NATURAL RESOURCES
FOREST REGULATION DIVISION
OLYMPIA, WA
360.902.1400
WWW.DNR.WA.GOV

January 19, 2022

TO: Forest Practices Board
FROM: Marc Ratcliff, Forest Regulation Division *MR*
SUBJECT: Board Approval of Board Manual Section 12

The Washington State Legislature passed Senate Bill 5597 in 2019 creating the Aerial Application of Herbicides in Forestlands Workgroup. The workgroup recommended several improvements to the Forest Practices Program regarding forest chemical spray applications. One of the recommendations was for DNR to involve stakeholders to assist in the development of new guidance and update existing best management practices (BMP) in Board Manual Section 12, *Guidelines for Application of Forest Chemicals*. Section 12 is the technical guidance to Chapter 222-38 WAC.

I am pleased to announce that those updates are complete. I will be seeking the Board's approval for the recent amendments to Section 12 at the upcoming February meeting.

The DNR-convened workgroup met between July 2021 and January 2022 to accomplish this task. This was a multi-faceted group – approximately eighteen individuals – consisting of several TFW Policy caucus representatives, forest landowners, agency staff, industry experts, academia, and staff from a pesticides awareness organization. The amendments to Section 12 include:

- A new part encouraging landowners to communicate their planned aerial spray activity with adjacent property owners including potential discussion topics to help neighbors understand a proposed activity.
- A new part with a description of what to include on the notification signs that are placed adjacent to spray units and examples of strategic posting locations.
- A new part with a description of the required residence and agricultural land buffers in rule.
- A new part providing alternative management options for conducting site preparation and for controlling competing vegetation in lieu of forest chemicals.
- Updated BMPs and processes for identifying surface waters prior to herbicide applications.
- Updated language describing how equipment affects spray applications.
- Updated BMPs for how various weather factors affect herbicide drift.

Included is the current Section 12 for reference, and the draft Section 12 that will be presented at the February Board meeting.

Attachments
MR/

Section 12

Guidance for Application of Forest Chemicals

PART 1. BEST MANAGEMENT PRACTICES1
PART 2. NOZZLE, EQUIPMENT, AND OPERATIONS1
PART 3. MAINTENANCE OF PESTICIDE RECORDS.....2

PART 1. BEST MANAGEMENT PRACTICES

Forest management operations and Christmas tree operations using herbicides should apply the following best management practices (BMPs):

- Nozzle Orifice:** Minimum size of D10 (0.156") when core plates are used.
Minimum size of D7 (0.109") when no core plates are used.
- Core Plate:** Size # 46 or larger.
- Nozzle Orientation:** Maximum of 45 degrees downward and backward from the direction of flight.
- Operating Pressure:** Not to exceed 30 pounds per square inch.
- Boom Length:** Maximum length of 6/7 of rotor span for rotors less than 40 feet, and ? of rotor span for rotors 40 feet or greater.
- Airspeed:** Not to exceed 60 miles per hour.
- Release Height:** Minimum height consistent with safe operations. Nozzles must be shut off when ascending or descending over an obstacle that would alter the application release height by more than 10 feet, unless buffer-width adjustments have already been made on initiation of the flight line or swaths are adequate distance away from areas needing protection based on release-height buffer specifications in Tables 1 and 2 under **WAC 222-38-020(4)(a)(i and ii)**.

Forest management operations and Christmas tree operations using insecticides or fungicides should apply the following best management practices (BMPs)*:

- Nozzle Orifice:** Minimum size of D8 (0.125") when core plates are used.
Minimum size of D4 (0.063") when no core plates are used.
- Core Plate:** Size # 46 or larger.
- Airspeed:** Not to exceed 60 miles per hour on swaths adjacent to spray buffers.

*Recommendations on nozzle orientation, operating pressure, boom length, and release height for insecticides and fungicides are the same as those stipulated above for herbicide operations.

PART 2. NOZZLE, EQUIPMENT AND OPERATIONS

The nozzle size restrictions (nozzle orifice and orientation), equipment limits (boom length), operations restrictions (air speed, weather, and release height), and buffer requirements, in combination, are set to minimize drift off-target. Use of different aerial application equipment which produces an equivalent or lower volume-based percentage of droplets in the less than 150

micron size range or other equipment or operations restrictions which result in less drift off target, will be considered under Alternate Plan provision **WAC 222-12-040**.

Applicators should apply the following best management practices to weather conditions:

- Wind Speed:** Do not apply when wind speed exceeds 7 miles per hour.
- Favorable winds:** For purposes of determining the appropriate buffers and offsets described under **WAC 222-38-020(4)(a)(i - iii)**, favorable winds are those where wind direction effectively moves the spray cloud away from the water, RMZ, or WMZ based on visual observation of spray drift (or other commonly used indicators such as smoke) at the site of application.
- Unfavorable winds:** For purposes of determining the appropriate buffers and offsets described under **WAC 222-38-020(4)(a)(i - iii)**, unfavorable winds are any winds, which are not clearly favorable (see above) including calm conditions, inversions, or conditions of highly variable wind conditions.
- Temperature:** Do not apply when ambient air temperature exceeds 70 degrees Fahrenheit for ester formulations or 85 degrees Fahrenheit for other pesticides.
- Relative Humidity:** For Western Washington (**WAC 222-16-010**), do not apply when relative humidity is below 50% for ester formulations or below 40% for other pesticides.
- Precipitation:** If applying pesticides during early foliar or dormant seasons, when precipitation runoff events are most common, avoid direct over-spraying of temporarily dry segments of Type 4 or 5 waters. Do not apply pesticides directly to temporarily dry Type 4 or 5 waters during the 24 hours before a predicted rainfall accumulation event of 1/4" or the 24 hours after an actual accumulation event of more than 1/4".

PART 3. MAINTENANCE OF PESTICIDE RECORDS

Pesticide records should be maintained by the landowner in compliance with **WAC 16-228-190, Applicator Requirements**. The records should also include copies of the approved forest practices applications showing all streams within and adjacent to the application area and indicating which streams were buffered. Direct observation to determine the presence of surface water in Type 4 or 5 waters is recommended, although this is not intended to preclude best professional judgment of the field forester. Direct observation may include walking all streams or a representative sample of the stream segments, checking culverts for flow, provided that the culverts are in a suitable downstream location, and the use of infrared aerial photography. Aerial surveillance is not adequate if the stream segment is obscured by slash or vegetation. Direct observation can be made by a landowner representative, pesticide applicator, or a state agency or tribal representative.

Section 12

Guidelines for Application of Forest Chemicals

PART 1. INTRODUCTION	1
PART 2. MAINTENANCE OF SPRAY RECORDS	2
PART 3. COMMUNICATING SPRAY ACTIVITIES TO ADJACENT PROPERTY OWNERS	2
PART 4. POSTING SIGNS FOR AERIAL SPRAY OPERATIONS	3
Figure 1. Example Chemical Application Notice.	3
PART 6. IDENTIFYING SURFACE WATERS	4
PART 7. EQUIPMENT BEST MANAGEMENT PRACTICES	5
PART 8. WEATHER BEST MANAGEMENT PRACTICES	6
Table 1. Visual Wind Indicators - Modified Beaufort Scale.....	6
PART 9. ALTERNATIVE VEGETATION MANAGEMENT PRACTICES TO USING HERBICIDES IN YOUNG FORESTS	7
Part 9.1. Site Preparation Methods In Lieu of Using Herbicides.....	8
Part 9.2. Controlling Existing Vegetation in Advanced Regeneration Stands.....	9
Part 9.3. Seedling Selection and Reforestation Timing for Outcompeting Vegetation	9
APPENDIX A – FOREST CHEMICAL APPLICATION AND PERMITTING RESOURCES.....	10
APPENDIX B – VEGETATION/PEST MANAGEMENT RESOURCES	11

PART 1. INTRODUCTION

Forest chemicals are an important silvicultural tool in the management of forestlands, including the control of competing vegetation for regenerating new forests, fertilization to enhance tree growth, and the control of harmful forest insects and diseases. The Forest Practices Rules regulate the handling, storage and application of forest chemicals to ensure that public health, land, fish, wildlife, aquatic habitat, and wetland and riparian management zones are not significantly damaged, and to ensure water quality will not be endangered by contamination ([Chapter 222-38 WAC](#)). Used safely, herbicides help meet the requirement of controlling vegetation for reforestation purposes and the growth of commercial tree species.

Board Manual Section 12 contains best management practices (BMP) to assist landowners and applicators in the proper application of forest chemicals. This section includes BMPs for posting treatment units, communicating activities with adjacent landowners, identifying surface waters prior to spraying, and considerations for minimizing drift and ensuring maximum deposition on targeted areas. Additionally, this section includes alternative vegetation management options to use in lieu of chemical applications. Like all Board Manual sections, this information serves as an advisory technical supplement to the Forest Practices Rules.

The Forest Practice Rules define pesticides as any insecticide, herbicide, fungicide, or rodenticide (the definition does not include fertilizers). The term pesticide is used broadly by state and federal agencies for a variety of chemical products used to control unwanted pests, diseases, or vegetation. Aerial spray applications on forestlands primarily involve herbicides. For the purpose of this section, herbicide use will be the focus of the BMP descriptions, unless the term ‘pesticide’ is specifically used in regulatory context.

Regulatory Structure

While the Department of Natural Resources (DNR) administers the rules for the application of forest chemicals on private forestlands, other state and federal agencies oversee the regulation of pesticides and the licensing of applicators.

Washington State Department of Agriculture (WSDA) is responsible for ensuring that pesticides/herbicides are safely and legally used in Washington. WSDA is responsible for registering all pesticides, including adjuvants, plant growth regulators, defoliant, and desiccants, maintaining a licensing program for applicators, conducting inspections, and investigating complaints of alleged pesticide misuse.

The Environmental Protection Agency (EPA) is responsible for federal pesticide registration under the Federal Insecticide, Fungicide, and Rodenticide Act. Pesticides registered with the EPA must also be registered with WSDA prior to distribution and use in Washington. Minimum risk pesticides that are exempt from federal registration (e.g. citric acid, corn gluten, garlic, mint oil) must still be registered with WSDA.

Pesticide product labels provide critical information regarding the approved use for a product and any necessary precautions. EPA requires extensive scientific data on the potential health and environmental effects of an herbicide before allowing a product to be marketed. The directions are legally enforceable and carry the statement: “It is a violation of Federal law to use this product in a manner inconsistent with its labeling.”

The Department of Ecology is the designated coordinator for chemical spills in Washington State – all chemical and oil-based spills must be immediately reported. Emergency response teams are located throughout the state to provide year round, 24-hour response services. Information for reporting spills can be found on Ecology’s website at:

<http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm>.

PART 2. MAINTENANCE OF SPRAY RECORDS

WSDA requires certified applicators and those applying herbicides to more than one acre per year, to keep records for each application. The necessary information and record retention schedule is outlined in WAC 16-228-1320. Maintaining records will assist the applicator in documenting how their activity followed herbicide label requirements and was conducted in compliance with the rules.

PART 3. COMMUNICATING SPRAY ACTIVITIES TO ADJACENT PROPERTY OWNERS

Transparent communication is a proactive approach to promoting good working relationships with adjacent property owners. Although direct communication is not required under the Forest Practices Rules, it is recommended that landowners, or their representative, notify adjacent property owners prior to the application of herbicides, particularly aerial applications.

Discussing plans with adjacent property owners will help alleviate the surprise of unexpected activity and provide an opportunity to clarify any concerns they may have. In some situations, property owners may not be fully aware of the safety precautions taken during applications. Depending on the relationship with adjoining property owners, landowners planning aerial herbicide operations can utilize a variety of methods to communicate their expected plans including: in-person contacts, phone calls, email, or informal letters. If the adjacent property owner is unknown, most county assessor websites provide parcel search platforms for obtaining contact information.

Consider these topics when discussing a planned spray activity with adjacent property owners:

- purpose of the activity
- herbicide being applied and how the application will occur
- map(s) of the application area

- proposed date(s) of operations
- how the activity will comply with the Forest Practices Rules and any operational BMPs used for avoiding drift
- information regarding how all herbicides must be tested and registered for use with EPA and WSDA, and the license requirements applicators must follow
- landowner or company's representative contact information

PART 4. POSTING SIGNS FOR AERIAL SPRAY OPERATIONS

Forest Practices Rules for aerial herbicide applications require forest landowners to post spray notices at least **5** days in advance of the treatment activity and ensure the posting remains in place at least **15** days after spraying is complete (see WAC 222-38-020(4)(g)). Notices must be posted at significant points of entry to the treated area, such as designated trails and roads accessing the treatment area. Posting is also required at formally signed trailheads adjacent to the units being treated. The signs inform adjacent property owners, forest workers, and recreational users (hikers, horse riders, berry pickers, hunters, etc.) when an area will be treated and when to avoid entry. Advance notice is not required when applying herbicides by ground methods.

The information on the posted sign must include:

- name of the product being used
- date of the treatment
- company or landowner contact telephone number
- applicable restrictions

The sign should be made of heavy stock paper and/or laminated to ensure readability through various weather conditions. Bright colors and a graphic such as a stop sign will increase sign visibility and help indicate that the information is important and should be followed.

NOTICE OF CHEMICAL APPLICATION	
BRAND NAME OF CHEMICAL / ACTIVE INGREDIENT	
BRAND NAME OF CHEMICAL / ACTIVE INGREDIENT	
BRAND NAME OF CHEMICAL / ACTIVE INGREDIENT	
DATE OF APPLICATION	DATE RE-ENTRY ALLOWED
APPLICABLE RESTRICTIONS	
EMERGENCY CONTACT INFORMATION	
CONTACT PHONE	

Figure 1. Example Chemical Application Notice.

PART 5. APPLYING SPRAY BUFFERS FOR RESIDENCES AND AGRICULTURAL LAND

WAC 222-38-020(4)(e) states that operators applying aerial herbicides are to leave at least a 200-foot no application buffer around residences and a 100-foot no application buffer adjacent to lands used for agriculture. These distances do not apply when the forest landowner applying chemicals owns the residence or agricultural land, or if the activity is acceptable to neighboring property owners. Unless the herbicide label prescribes a wider buffer, or WSDA's Use Restricted Herbicide Rules requires specific limitations in eastern Washington (see Chapter 16-230 WAC), the following examples meet the intent of aerial application buffers under the Forest Practices Rule:

For residences, the 200-foot buffer would begin from the edge of a house or building where individuals live.

For agricultural land, the 100-foot buffer would begin from the edge of crop fields, orchards, vineyards, pastures, feedlots, etc.

If the residence or agricultural land is close to a shared property line, the buffer must extend into the landowner's property who is conducting the aerial spraying in order to meet the required buffer distances. However, if the residence or agricultural land is greater than 200-feet/100-feet away from the property line, the spray activity by default must stop at the property line (It is unlawful to apply herbicides/pesticides under conditions that might allow drift to cause damage to adjacent lands, see WAC 16-228-1220). Applicators and landowners may consider applying a buffer from the shared property line when it is unclear if an area is used for agriculture.

Many forest landowners choose to contact adjacent landowners with their plans for conducting aerial spray activities before conducting an herbicide application. This not only provides opportunities to share anticipated activities, but can also help identify and delineate areas frequently used by neighbors and to identify the boundaries of agricultural areas.

Landowners conducting spray operations are required to identify the units to be sprayed and the locations on the ground where a no-spray buffer is applied (for example, surface waters or riparian areas). Similar to the delineation of no-spray buffers for streams and wetlands, any intended residential or agricultural buffer should be clearly identified on the Forest Activity Map when submitting the aerial spray Forest Practices Application/Notification (FPA/N).

PART 6. IDENTIFYING SURFACE WATERS

In order to eliminate the potential for direct entry of herbicides to the surface water of Type Np (non-fish perennial) or Ns (non-fish seasonal) waters during aerial applications, it is strongly recommended that these areas be evaluated by direct observation to determine the presence or absence of surface water. This is an important step because some Type Ns streams, although typically dry later in the year, may have running surface water during some early season aerial applications.

Evaluation practices and tools may include, but not be limited to:

- walking all Type Np or Ns streams or a representative sample of the stream segments prior to or as close to the time of planned application, taking into consideration current precipitation events,
- checking culverts for flow, provided that the culverts are in a suitable downstream location,
- aerial surveillance by drone or helicopter,
- use of infrared aerial photography, or
- some combination of the above.

Stream evaluation can be performed by a landowner representative, herbicide applicator, or a state agency or tribal representative. The best professional judgment of the field forester or aerial operator may override stream evaluations in order to ensure appropriate resource protection.

All surface waters for Type Np or Ns streams and any associated buffering necessary to adequately prevent herbicides from entering water should be clearly identified on aerial application field maps, photomaps, or in shapefiles. The locations of streams should be communicated to the aerial operator for their review during flight reconnaissance and prior to treatment.

PART 7. EQUIPMENT BEST MANAGEMENT PRACTICES

Herbicide product labels include specific instructions and limitations for applying herbicides in order to minimize risk and maximize efficacy. Labels specify application rates, spray quality (i.e., droplet size), optimal sprayer configuration, and environmental restrictions. By law, applicators are required to follow the specifications outlined on the label.

The following information provides a brief overview for how spray equipment components affect herbicide applications. Note: Christmas trees cultivated by agricultural methods should refer to WSDA for additional information regarding pesticide use laws.

(<https://agr.wa.gov/services/licenses-permits-and-certificates/plant-services/christmas-trees>)

Spray Nozzles

Spray nozzles perform three functions: (1) regulate flow, (2) convert the liquid into droplets (liquid partials) and (3) project those droplets in a spray pattern. Nozzle selection, spacing, orientation, boom length, and operating pressure all work together to ensure uniform coverage and reduce off target drift. Operators should calibrate for the coarsest droplet size that still produces the most effective result. Compared to finer droplets, coarser droplets descend faster and with more predictability, as well as resist evaporation.

Nozzle Orientation

Nozzles should be orientated parallel to the airflow. Nozzles oriented with a deflection greater than 45 degrees will increase droplet shear, which produces a greater amount of fines and increases the potential for off-target movement.

Operating Pressure

Changing the nozzle pressure affects the rate of flow, the spray pattern and the droplet size. The ideal operating pressure is determined by the airspeed, nozzle type, and desired droplet size.

Boom Length

Many product labels contain specific boom length and rotor blade diameter ratios. Longer booms release spray closer to the aircraft's wingtip or rotor tip, where spray vortices draw spray out of the swath, reducing spray coverage and increasing drift potential.

Airspeed and Release Height

Airspeed and release height should be considered together. The aircraft pilot should apply safe practices that are appropriate for the treatment site, while permitting the proper dispersal of the herbicides. Factors that influence speed and release height include obstacles, leave trees, buffer widths, slope, and adjacent downwind sensitive sites.

Shut off nozzles when ascending or descending over an obstacle that would alter the application release height by more than 50 feet, unless buffer-width adjustments have already been made on initiation of the flight line or when swaths (flight paths) are an adequate distance away from

areas needing protection based on release-height buffer specifications in Tables (i) and (ii) under WAC 222-38-020(4)(a).

Equipment Calibration

The components of the spray equipment and flight patterns work together to determine the best outcome for effective coverage. A spray pattern/deposition test should be completed prior to the season to ensure proper calibration and droplet spectrum and size for the application being performed. Routine inspections throughout spray operations and adjustments (if needed) should occur to maintain established spray pattern and effective spray coverage for a given area.

PART 8. WEATHER BEST MANAGEMENT PRACTICES

Weather conditions such as temperature, humidity level, wind speed, presence of atmospheric inversion, and precipitation have the potential to affect herbicide coverage. This is especially true for aerial applications. Similar to how herbicide labels specify equipment configurations and restrictions, labels often provide parameters for weather conditions needed to ensure application success.

It is important to anticipate weather conditions prior to beginning operations and monitor real time changes throughout the application period. This will assist applicators in making informed decisions should adjustments to the operations need to occur. Apart from obtaining forecasts for specific areas of application ahead of time, radar-based mobile weather applications (apps) can assist with localized precipitation events. Keep in mind, most apps need cellular coverage to work.

The following information provides context for how weather factors may affect herbicide movement:

Wind Speed

Wind speed is an important consideration for reducing the potential for spray to drift into non-target areas. Local terrain and weather conditions can greatly vary in the forest environment, requiring the need to apply offsets as outlined below. Wind speed is typically lower during the early morning hours before daytime temperatures increase. Lack of wind may indicate an inversion that could result in spray moving off-target, whereas spraying during a light wind will help keep the spray on targeted areas. Wind direction should be considered if streams having flowing water are present on the lee side of a flight pattern. Refer to chemical labels for recommended wind speed directions.

Handheld wind gauges provide a relatively inexpensive means for determining on site wind speed in the field. See Table 1 for estimating wind speed from visual indicators observed on site. Additionally, direct observation of droplets will indicate how wind direction/speed is influencing the application in reaching target areas.

Table 1. Visual Wind Indicators - Modified Beaufort Scale

Speed (mph)	Wind description	Visual indicators/clues
0-1	calm	no foliage movement; smoke rises vertically
1-3	light	foliage sways gently; grass and weeds sway and bend; directions of wind shown by smoke drift but not by heavier items
4-7	Light breeze	wind felt on face, leaves rustle
8-12	Gentle breeze	leaves and small twigs in constant motion; wind extends small flag or air sock

Favorable and Unfavorable Winds

Buffers are required along all Type S (State waters) and Type F (fish waters), where surface water is present for Type Np and Ns streams, and Type A and B wetlands to ensure that herbicides do not enter water. For maintaining the appropriate buffer and riparian management zone offsets described under the Forest Practices Rules (WAC 222-38-020(4)(a)(i-iii)), use the following guidelines as it relates to wind:

- *Favorable winds* are those where wind direction effectively moves the spray away from the water, riparian management zone, or wetland management zone based on visual observation of spray movement (or other commonly used indicators such as smoke) at the site of application.
- *Unfavorable winds* are those having the potential to move the spray in the direction of surface water or sensitive features, including conditions of highly variable winds or conditions that indicate a temperature inversion.

Inversion Layer

Most herbicide labels prohibit spraying when temperature inversions exist. Inversions are more common in valley settings where colder air remains closest to the surface and is unable to mix into warmer air at higher elevations. Because air movement during an inversion is vertical rather than horizontal, stable air can suspend fine chemical droplets, which then have the potential for moving off-target when extremely low wind velocities exist. Observable signs of inversions include ground fog in low-lying areas, smoke columns that remain horizontal without any lift, and dew on vegetation.

Temperature and Relative Humidity

Temperature and relative humidity are mutually inclusive and should be taken into consideration together. When applying during times of high heat and low humidity the applicator should use more caution when spraying near sensitive sites. The combinations of high heat and low humidity can create the potential for off-target movement due to vapor drift and evaporation of the droplet before it reaches the target site. The use of a larger droplet spectrum greatly reduces the drift potential in these conditions. An advantage of planning for early morning operations allows operators to take advantage of favorable temperatures and humidity levels while providing flexibility if conditions are not ideal.

Precipitation

Avoid direct spraying over temporary dry Type Np or Ns stream segments if applying herbicides during early foliar or dormant seasons when precipitation runoff events are most common. Do not apply herbicides directly to temporarily dry streams during the 24 hours prior to a predicted rainfall accumulation event of 1/4 inch or more. Also, do not apply forest herbicides directly to temporarily dry streams 24 hours after an actual accumulation event of more than 1/4 inch.

PART 9. ALTERNATIVE VEGETATION MANAGEMENT PRACTICES TO USING HERBICIDES IN YOUNG FORESTS

The Forest Practices Rules require that harvested sites be reforested following harvest (Chapter 222-34 WAC). In most cases, applying herbicides by aerial application is the most efficient and cost-effective way to prepare sites for reforestation, increase seedling survival to meet reforestation standards, and to control competing vegetation in young plantations. Backpack sprayers are an option, but generally reserved for isolated situations or smaller acreages.

The silvicultural goal of any site preparation or plantation release method is to control competing vegetation to the extent necessary for the establishment and survival of commercial tree species and

to achieve a "free-to-grow" status for a reforested stand. Choosing a treatment method should include careful consideration of the vegetation components within the harvest area prior to and following harvest, desired level of vegetation control, proximity to sensitive areas, adjacent land uses, expense involved, and routine maintenance required.

Safety precautions for the applicator/operator should be considered in determining the best management methods. Although aerial applications can minimize herbicide exposure to applicators, backpack spraying may expose workers to more direct contact with herbicides. Conversely, mechanical treatments and saw work eliminate herbicide exposure, but may introduce hazards associated with working around motorized equipment or chainsaws/axes.

The following information provides options for forest landowners electing to either minimize the use of herbicides in certain situations or the choice to forgo herbicide use altogether.

Part 9.1. Site Preparation Methods In Lieu of Using Herbicides

Site preparation can be accomplished in a variety of ways, each with advantages and disadvantages. Landowners need to determine what amount of site preparation and slash dispersal is necessary to meet reforestation requirements, as well as their own objectives and preferences.

- *Manual clearing or tree mats for site preparation* – manual scalping (i.e., clearing) plantable areas involves removing vegetation in selected locations prior to reforestation. This involves clearing an area down to mineral soil extending an approximate 1.5 to 2-foot perimeter from the location where seedlings are to be planted. Hand clearing may be ineffective in areas with heavy brush. Tree mats/mulch mats act as fabric barriers that prevent/minimize competition by reducing weeds and vegetation from establishing around the base of seedlings.

Both techniques are expensive and manually intensive and may provide only short-lived vegetation control because weeds and grasses can quickly re-invade cleared areas. Such practices are best suited on a small scale in localized areas. It is important that such sites be frequently revisited to monitor competing vegetation growth around seedlings.

- *Distribution of logging slash* – leaving logging slash scattered on the ground may help to reduce the potential for invasive plant species from occupying a site. The slash acts as a natural mulch layer limiting the amount of suitable surface area for weed germination. However, heavy slash loading can make reforestation challenging if plantable spaces are reduced and/or difficult to access.
- *Forest Mastication* – Forest mastication is a fuel reduction treatment commonly used for wildfire purposes, and can be a beneficial practice for preparing extremely brushy sites for reforestation. Mastication breaks down and reduces woody vegetation to smaller pieces while adding nutrients to the soil. Although the benefit is that nutrients and biomass remain on site, costs can be high per acre and sprouting is common for certain species if not maintained.
- *Mechanical site preparation* – Pulling woody understory stumps while harvesting equipment is on site can be an effective way of reducing thick brush and minimizing competition reforestation. This is especially beneficial where vine maple, hazelnut or big leaf maple are dominant in the stand. Removing the stump removes the potential for regrowth or spouting, and reduces the need for either herbicide use or manual cutting later. As with most equipment use, the added cost to pull stumps during harvest can be expensive and time consuming and if done during wet weather, may contribute to erosion and soil compaction.

Part 9.2. Controlling Existing Vegetation in Advanced Regeneration Stands

- *Manual brushing* – Using brush saws (heavy-duty weed eaters) to control woody vegetation can take the place of herbicides applications once seedlings have had a few years of growth. This assumes the planted stock is well established and readily recognized to avoid accidental damage to young trees.
- Chainsaws or axes can be used to control broadleaf or woody vegetation to minimize plant competition by increasing light to younger trees and minimizing overcrowding. The appropriate timing for cutting trees/brush must be considered to minimize the sprouting of cut stems such as big leaf maple, madrone or alder. The best time to cut hardwoods, especially red alder, is typically in late spring and early summer when the tree is actively growing. For species such as big leaf maple and alder, cutting when the tree is dormant, although easier to see without foliage, is not recommended, as they are likely to sprout more vigorously in the spring.

Both practices however, inherently increase risks to the operator and can be expensive if performed over larger areas.

Part 9.3. Seedling Selection and Reforestation Timing for Outcompeting Vegetation

Typically, the larger the caliper (lower measured stem diameter) and root mass of a seedling, the greater potential it has to outgrow competing vegetation. Although larger bare root seedlings can compete well on brushy sites, they are not as readily available from nurseries and are more difficult to plant properly. Keep in mind, selecting the appropriate seedlings depends on many factors including management goals, site preparation, elevation, site conditions (moisture, soils, amount of vegetation, etc.) and whether the site is located on the westside or eastside of the Cascades.

For westside sites with adequate soil depth and soil moisture, large bare root seedlings such as 1+1 and P+1 usually perform well. On shallow, dry rocky sites, and sites east of the Cascades, container seedlings such as P10 or P15 are generally better suited. Selecting the most appropriate stock types – both species and tree size – can be coordinated with landowner assistance foresters. It is critical to contact the tree nursery in order to have seedlings available at time of harvest.

An important strategy for increasing seedling survival without using herbicides and to minimize later competition control is to plant seedlings as soon as possible after harvest. This strategy can increase the potential for the seedlings to outcompete existing vegetation and to become established before competing vegetation depletes soil moisture. Since herbaceous vegetation and grasses will readily fill the void left by ground disturbance, the goal is to establish the desired stock before competing vegetation takes over a site. Planting into “green slash” (before the needles have browned and fallen off logging slash) may be a viable option.

APPENDIX A – FOREST CHEMICAL APPLICATION AND PERMITTING RESOURCES

- The Forest Practices Application Review System (FPARS) streamlines the processing of Forest Practices Applications/Notifications (FPA/N) and improves the public's ability to review proposed forest activities. Users can sign up to receive an email notification when forest practices activities are proposed in their area of interest. <https://www.dnr.wa.gov/programs-and-services/forest-practices/forest-practices-application-review-system-fpars>
- *Forest Practices Illustrated* is a reference designed to help forest owners, loggers, and others better understand Washington State's Forest Practices Rules and how they protect fish, water, wildlife, state and municipal capital improvements and other public resources. This resource provides additional information and complementing illustrations meeting DNR's forest chemical rules. <https://www.dnr.wa.gov/forest-practices-illustrated>
- The Forest Practices Program provides a website containing a brief overview of the regulatory structure and provides several forest chemical related links. <https://www.dnr.wa.gov/forest-chemical-applications>
- WSDA's Licensing Section provides information on applicator licensing and recertification processes. <https://agr.wa.gov/services/licenses-permits-and-certificates/pesticide-license-and-recertification>
- WSDA's Waste Pesticide Program provides information for applicators to properly dispose of cancelled, suspended or otherwise unusable pesticides. <https://agr.wa.gov/departments/pesticides-and-fertilizers/pesticides/waste-pesticide>

APPENDIX B – VEGETATION/PEST MANAGEMENT RESOURCES

- Integrated Pest Management (IPM) is a science-based decision-making process that combines tools and strategies to identify and manage pests (includes vegetation). IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. For more information:
 - United States Dept. of Agriculture provides guidance for conducting IPM practices. <https://www.usda.gov/oce/pest/integrated-pest-management>
 - Washington State University Extension, Integrated Pest Management Program. <http://treefruit.wsu.edu/crop-protection/opm/ipm-overview>
 - Pennsylvania State University Extension Integrated vegetation (IVM) management resources. <https://extension.psu.edu/>

- The Pacific Northwest Handbook website provide several handbooks/resources on vegetation management, pest control, diseases specific to the northwest. <https://pnwhandbooks.org/>

- The Pacific Northwest Research Station provides scientific study information on natural resources. They provide and communicate impartial knowledge to help people understand and make informed choices for natural resource management and sustainability. <https://www.fs.usda.gov/pnw/page/about-station>.

- Forest landowners and commercial applicators must follow Worker Protection Standards (WPS) when applying pesticides. The requirements provide protections for employees (workers and handlers). <https://agr.wa.gov/departments/pesticides-and-fertilizers/pesticides/worker-protection#regulatory>.