2000 Powell Street, Ste. 600
Emeryville, CA 94608 USA
+1.510.452.8000 main
+1.510.452.8001 fax

Temporary Derogation to Use an FSC 'Highly Hazardous' Pesticide

Guidance on Completing the Application Form

All clients wishing to apply to the FSC for a temporary derogation to use pesticides on the FSC Highly Hazardous Pesticides List must provide the information requested in the table below. Guidance on how to answer some questions is presented in **RED** in the table below. Please review the guidance before filing out the application.

When you are finished completing the application form you may delete the guidance and send the application to SCS. We will review your application to ensure all required information is present and may send the form back to you to if we feel that additional information will improve the chances of your derogation being approved. When the derogation application is ready for submission we will notify the FSC on your behalf.

All decisions regarding derogation approval and conditions are made by the FSC Pesticides Committee. SCS will notify you of their decision (derogation approved or denied) and will send you the relevant derogation documents. Please note that by applying for a temporary derogation you acknowledge and agree to the derogation processing fee; an invoice for this service will be sent to you by SCS following the final decision regarding your application.

PART 1. General Information	
Application Submission date:	December 15, 2015
Name, and contact details of certification body submitting the application:	SCS Global Services 2000 Powell St., Suite 600 | Emeryville, CA 94608 USA tel: 510.452.8049 | fax: (510) 452 6882 bgrady@scsglobalservices.com www.SCSglobalservices.com
Active ingredient for which a derogation is being requested:	Oxyfluorfen
Trade name and formulation type of the pesticide:	Pindar GT (liquid, 40.31% active ingredient).
Method of application, application equipment and intended quantities:	Aerial helicopter application, and application using hand operated backpack sprayers.
Common and scientific name of the pest species: (or description of the problem /issue, as applicable)	*Achillea millefolium* | Common yarrow *Arctostaphylos patula* | Greenleaf manzanita *Arctostaphylos viscida* | Whiteleaf manzanita *Artemisia* tridentate | Sagebrush *Ceanothus cordulatus.* | Whitethorn

	Ceanothus cuneatus | Buckbrush *Ceanothus integerimus* | Deerbrush *Ceanothus prostrates* | Mahala mat *Ceanothus velutinus.* | Snowbrush *Centaurea solstitialis.* | Yellow Star Thistle *Chimaphilia umbellata* | Pipsissewa *Cirsium spp.* | Common thistle *Claytonia parviflora ssp.* | Miner's lettuce *Cornus nuttallii* | Pacific dogwood *Chrysolepis Sempervirens* | Chinquapin *Dietes iridiodes* | Wild iris *Dodecatheon hendersonii* | Shooting star *Equisetum spp.* | Horsetail *Ericameria* nauseosa | Rabbitbrush *Erodium cicutarium* | Redstem filaree *Fragaria vesca* | Wild strawberry *Hypericum perforatum* | Klamath weed *Lactuca serriola* | Prickly lettuce *Lathyrus vestitus* | Wild sweat pea *Lupinus ssp.* | Wild Lupine *Mentha arvensis* | Wild mint *Pachistima myrsinites* | Oregon boxwood *Prunus emarginata* | Bitter cherry *Prunus virginiana* | Chokecherry *Pteridium auilinum* | Western bracken fern *Purshia* tridentate | Bitterbrush *Rosa ssp.* | Wild rose *Ribes ssp.* | Gooseberry *Rubus ssp.* | Blackberry *Salix ssp.* | Willow *Sidalcea malviflora* | Checker bloom *Symphoricarpos albus* | Snowberry *Symphoricarpos mollis* | Creeping snowberry *Taraxacum officinale* | Dandellion *Toxicodendrum diversilobum* | Poison oak *Trifolium depauperatum* | Clover *Verbascum Thapsus* | Common mullen *Wyethia mollis* | Mule's Ears Miscellaneous grass and forb species
Name and FSC certification codes of certificate holders requesting a temporary derogation. Please indicate scale category and whether it qualifies as SLIMF.	Red River Forests LLC c/o W. M. Beaty & Associates, Inc. PO Box 990898 Redding, CA 96099-0898 SCS-FM/COC-00023N Shasta Forests Timberlands, LLC, et al. c/o W. M. Beaty & Associates, Inc. PO Box 990898

	Redding, CA 96099-0898 SCS-FM/COC-00024N
Scope for which a temporary derogation is being requested (Please, attach map if possible)**:**	Oxyfluorfen may be applied as a site preparatory application prior to planting or as a release application after planting to reduce the competition from herbaceous weeds (grasses and forbs) and brush. Red River Forests LLC and Shasta Forest Timberlands, LLC both own timberlands across a wide geographic area (with a 110 mile latitudinal range). Both companies utilize uneven-aged silviculture for the vast majority of timber harvesting, with rehabilitation and even-aged management also accounting for a small proportion of planned timber harvesting. However, over the last 20 years, both companies have experienced a large number of catastrophic wildfires, whose location cannot be predicted. As such, this derogation is requested for the entire ownership of both companies, as large scale reforestation efforts utilizing oxyfluorfen may be necessary anywhere based upon future fires, in addition to planned reforestation following timber harvesting. Derogation applications should be submitted at the smallest applicable geographical range, such as a particular cutting block or portion of the FMU, if feasible. Include maps that situate the Forest Management Unit within the relevant catchment/sub catchment area. Include a brief description of the maps (e.g. buffer zones, sensitive areas, nature reserves, water bodies, etc).
Type of forest, species and expected forest area where use of the HHP is intended:	Natural coniferous forests in Northeastern California, United States. Species include ponderosa pine, Jeffrey pine, sugar pine, Douglas-fir, red fir, white fir, incense cedar, giant sequoia, and lodgepole pine. Forest areas where use of the Highly Hazardous Pesticides (HHP) is intended includes all areas where artificial regeneration is possible, including areas burned in catastrophic wildfires, understocked areas, brush field conversions, clearcuts, group selections, seed tree areas, shelterwoods, and variable retention areas. Please describe the location, type of forest (Natural forest, Semi- Natural Forests, Mixed Forest Plantations, etc) and expected forest area where use of the 'highly hazardous' pesticide is intended. Please be as specific possible.

PART 2. Specific Information

1. Demonstrated Need

a. Please describe briefly the silvicultural system (methods for site preparation, practices for harvesting, regeneration, time between rotations) in the MU(s) included in the scope of the requested derogation.

Silviculture systems include emergency salvage of fire-damaged areas, rehabilitation of understocked areas, clearcuts, group selections, seed tree areas, shelterwoods, and variable retention areas.

Site preparation usually includes a directed foliar pre-harvest spray of existing brush, followed by a post-harvest broadcast application of a pre-emergent product. Occasionally site preparation also includes fuel reduction treatments (including piling & burning of fuels, and/or chipping of small diameter sub-merchantable material).
Regeneration is usually achieved via artificial regeneration, specifically hand planting (and occasionally machine planting) of containerized one year old conifer stock, or one to two year old bareroot stock. Infrequently, natural regeneration is used, although unreliability in this method limits its usefulness.

Time between rotations could be as early as 50 years on Dunning Site Class I lands, but is generally 60 to 120 years. It is anticipated that many even-aged planted forests will be transition to uneven-aged management, which have no time between rotations.

b. Please describe the Integrated Pest Management (IPM) system in place, including the plan to monitor the distribution and density of the targeted pest organisms in the MU(s).

The first and largest component of the IPM system in place is the use of single tree selection silviculture (which accounts for the vast majority of planned timber harvesting across both ownership). The utilization of single tree selection negates the need for almost any pesticide use (i.e. "avoids the problem" in the IPM framework) across the vast majority of the MUs, except for occasional road maintenance, and the control of noxious weeds.

If the decision is made to harvest an area using a silvicultural system which may require artificial regeneration, the IPM in place minimizes the impacts of pesticide use. First, "take no action" is considered. Usually, there are not a sufficient number of established conifers to consider this option, but some group selection units have not required any pesticide use due to sufficient residual conifer stocking, along with acceptable understory shrubs and hardwood levels. If it is determined that brush and herbaceous vegetation control is needed, non-chemical methods are considered. While these are occasionally used in specialized situations, they are far more costly, far less efficacious, and are more likely to result in injuries to forest workers. Situations in which non-chemical control has been used includes the hand pulling or cutting of small infestations of noxious weeds, as well as the release of conifer trees in areas which are too windy to safely apply herbicides.

If it is determined that synthetic herbicides must be utilized, a number of mechanisms are involved which ensure that the least amount of chemical over the fewest possible applications are used. These mechanisms include the use of California Registered Professional Foresters (RPFs), and California licensed Pest Control Advisors (PCAs) who evaluate each individual unit for herbicide needs, and who then develop a pesticide recommendation tailored to that site. This recommendation utilizes the lowest chemical level needed to control the weeds present, while using the most efficacious (i.e. lowest use rate) and narrowest spectrum herbicide available. Furthermore, both Red River Forests and Shasta Forests are members of two forest management research cooperatives which fund research on determining minimum efficacious herbicide use rates, effective herbicide combinations which result in lowered use rates for equal efficacy, and the use of new chemicals which are either a) less hazardous, or b) have lower use rates. The results from these research cooperatives guide the chemical use recommendations used on MUs. A company biologist is consulted prior to the use of herbicides for regeneration, to determine if any

special status species (either plants or animals) may be impacted by such use. In one instance on the 2001 Bell Fire, a special status plant was identified, was protected from herbicide use, and the population was found to fair better (due to it effectively being released from other competition) than the adjacent population on another landowner which used no herbicides.

The RPF/PCA reevaluates sites after application, and determines if any follow-up treatments may be necessary. Generally, herbicides are only used for the first five years after the establishment of conifers, with only three to four actual herbicide applications being used over the life of the stand. Since the rotation age of most of these stands is 60+ years, this use of herbicides is very limited temporally, and after conifers are established, native vegetation is allowed to recolonize the site. The RPF/PCA may also locate retention areas within units, where less or no herbicide is used to encourage unique plants or habitat components. Examples of this include oak retention areas, aspen retention areas, or in geologically unstable areas where extra vegetative cover is desired to maintain soil stability.

The use of herbicides is done in accordance with all state, federal, and FSC® guidelines which are discussed below. Meticulous records are kept by both the management organization (W. M. Beaty & Associates, Inc.) and by the applicator, who is required by regulation to submit use reports to the State of California. These records are also useful in guiding future pesticide use, as rates can be adjusted based on past usage and results. It should also be noted that historic records and photos indicate that the brush component in most of the forests being managed is significantly higher than pre-fire suppression levels, as frequent low severity fires used to consume much of this brush on a 5 to 15-year cycle. Current concerns over fire liability, smoke, carbon release, and safety effectively preclude the use of prescribed fire in these ecosystems, which in part necessitates the use of herbicides as a surrogate for such fires.

c. Please indicate the thresholds above which, the damages caused by the targeted pest organisms are classified as severe and how they have been established.

Damages caused by target pest organisms (i.e. weeds which inhibit conifer establishment and growth) are classified as severe when conifer establishment cannot be achieved, or where established conifer growth is significantly stunted due to competition. 40+ years of field experience with artificial regeneration and weed control in planted forests, along with numerous scientific studies have found that in relatively dry forests (such as those in the MUs) reliable conifer regeneration cannot be achieved without vegetation control during the first two years of conifer establishment. Furthermore, even when conifers are established, severe competition from brush can result in extreme stunting of growth, and even mortality caused by insects and disease, where trees are overly stressed from competition with brush for light, nutrients, and water. Additionally, with climate change and the increased prevalence of high severity fires in coniferous forests, large brush components in artificially regenerated forest areas significantly increase the risk of fire, and fire severity in such planted forests, by increasing fuel loads, fuel continuity, and ladder fuels to conifers.

d. Please indicate the population size of the targeted pest organism in the MU(s).

Population size varies dramatically across the MUs, based on geographic area, aspect, rainfall, vegetation type, seed bank, fire history, etc. Former brush fields with an extensive seed bank may have thousands of targeted organisms per acre, while other forested areas may only have a few dozen targeted organisms per acre.

e. **(Fill in only if you represent a large-scale MU)**

Please indicate the conclusions of the comparative Cost/Benefit Analysis of using the requested pesticide versus other non-highly hazardous control alternatives,

The cost – benefit analysis shall include, at minimum, the following scenarios:

- no action vs. remedial control (short-term)
- no action vs. preventive practices (long-term)

Statement of Pest Problem

Shasta Forests is comprised of approximately 140,000 acres of natural and planted mixed conifer and eastside pine forests in northeastern California. Red River Forests is comprised of approximately 130,000 acres of natural and planted mixed conifer and eastside pine forests in northeastern California.

Most planted forests are the result of reforestation of areas destroyed by stand replacing wildfire or less frequently, following regeneration harvests that occur to restore a more natural species mix (i.e., where shade tolerant white fir has invaded shade intolerant native pine stands). Without post-fire reforestation, large areas would become dominated by brush species (as natural conifer regeneration is unpredictable and sporadic). As such, to maintain native species composition, newly planted areas require some form of weed control to ensure their growth to maturity. Hand grubbing and/or grazing are less effective than herbicide treatments and can result in increased environmental degradation and reduction of vegetative diversity (McDonald et al. 1996). A discussion of non-chemical alternatives (including relative costs and efficacy) is provided in Section 3a below, and is summarized in Table 1 below.

Control of annual, perennial, and woody weeds is essential for the successful establishment and growth of young conifers in forest planted stands and in maintaining historical and or desired forest species composition on Red River Forests and Shasta Forests. Without weed control, commercial conifer seedlings may die due to inability to compete for water and nutrients or growth rates may be so low that timber production is not economically viable. Effects can range from widespread mortality in young forest stands to severe suppression of entire stands for indefinite periods that exacerbates fire hazard. Young trees that are stressed by weed competition are much more susceptible to insect attack and therefore the judicious use of herbicides to control competing vegetation greatly reduces the need for later use of much more toxic insecticides. The effects of weed competition on conifer seedlings is well documented in Lewis et al. (1993).

Early vegetation management in planted forests is the most critical factor for achieving success in the long-term reforestation of native commercial forests. This is especially true for hot arid climates where available soil water is the single most important limiting factor. Powers & Ferrell, 1996, showed three to four fold increases in ponderosa pine stem volume eight years after treatment with herbicides compared to untreated controls. They also found significant gains in nutrient availability and soil moisture where competing vegetation was controlled. The study was replicated over a range of site qualities, with the largest gains appearing on average to low sites. Long-term growth projections using System 1 (Ritchie & Powers, 1994) resulted in 200 percent increases in stand volume at 50 years for stands which had been treated with herbicides compared to those that had not.

Oxyfluorfen: Mode of Action and Reason for Highly Hazardous Listing

Oxyfluorfen is a diphenyl-ether herbicide which provides for broad spectrum pre- and post-emergent control of annual broadleaf and grassy weeds (USA EPA, 2015). Field trials in northern

California indicate oxyfluorfen also provides pre-emergent control of certain germinate woody brush species. Multiple field trials also indicate oxyfluorfen has no harmful effects on any native conifer species (including ponderosa pine, sugar pine, incense cedar, Douglas-fir, or white-fir). Oxyfluorfen is included on the FSC® list of 'highly hazardous' pesticides because the USA EPA has described it as "likely to be carcinogenic to humans."

Need for Oxyfluorfen

Products containing oxyfluorfen would be of great value to both MUs for a number of reasons. As stated above, competing vegetation must be controlled for conifer establishment and growth to be ensured. Second, oxyfluorfen and other chemicals are an invaluable part of an integrated vegetation management program to prevent the build-up of hazardous fuel loads within planted stands on the MUs. Third, there is currently no viable alternative to oxyfluorfen which does not cause unacceptable damage to a number of native conifers. Fourth, oxyfluorfen has more flexibility with regards to the timing of application than hexazinone, which allows forest managers to better cope with unplanned catastrophic wildlife occurrences. Fifth, oxyfluorfen is a more economical option in some circumstances than current herbicides in use. Sixth, Pindar GT has a reduced risk of immediate injury to applicators over some of the products currently being used.

The need for controlling competing vegetation is outlined above, in the "Statement of pest problem." There are numerous real-world examples in Red River Forests and Shasta Forests' specific reforestation history prior to their use of effective pre-emergent herbicide use that demonstrate not only a severe reduction in growth from competing vegetation but in many cases a complete loss of the reforestation investment on several hundred acres. These losses occurred during the long dry summer and early fall periods the first year after spring planting due to moisture stress on seedlings that was greatly exacerbated by competing vegetation (e.g. 1977 Pondosa Burn, 1978 Whitmore Burn, etc.). Manual scalping on these planted stands was conducted but it was expensive and did not significantly reduce mortality due to stress from competing vegetation because the competing vegetation rapidly re-sprouted. On the 1977 Pondosa Burn plantation, losses also occurred several years after "establishment" due to insect attacks (i.e. pine reproduction weevil) on sapling size trees that were under severe moisture and nutrient stress from competing brush during a drought in the late 1980's (extended droughts such as this occur periodically in Northeastern California). Trees on adjacent areas that were more vigorous because they were free of competing brush where chemicals were used were able to survive the attacks from the pine reproduction weevil. Conifer mortality losses on the Pondosa Burn plantation cost Red River Forests and Shasta Forests tens of thousands of dollars due to the direct loss of reforestation investment along with the significant additional site preparation costs incurred because brush that had time to become well established prior to re-planting needed to be cleared at a cost of $250 per acre or more. Financial losses also occurred in areas where conifers survived the brush competition because of the significant reduction in growth, which greatly lengthens the opportunity cost until a return can be expected.

Red River Forests and Shasta Forests planted stands which were established without the use of herbicides to control competing vegetation are also at a significantly greater financial risk of investment loss from wildfires due to the significant brushy fuel loading intertwined with slow growing, stressed conifer trees. Managing hazardous brushy fuel loads is very important in a region like northeastern California that is practically rainless for several months between the late spring and summer and experiences prolonged hours of extremely low humidity during many of those days. Planted stands that are stagnated in brush are subject to many more decades of exposure to risk of complete loss of investment compared with faster growing conifer planted

stands that have been treated for brush control early in the establishment phase. Empirical evidence and many computer models predict a warming climate in the next century, which will likely exacerbate wildfire risk. Recent wildfire data suggests that we are already entering a period of much greater fire danger; with larger, hotter fires, and longer fire seasons becoming the new norm. Furthermore, Red River Forests has experienced some of it is first significant loss on planted stand investment, when wildfires have destroyed trees which were planted following a previous wildlfire or rehab project (2012 Chips Fire, 2015 Day Fire). These losses highlight the need to manage fuel loads to protect the investment in planted trees.

Oxyfluorfen has better conifer tolerance than any other pre-emergent herbicide available for forestry use in California. Multiple field trials, as well as numerous operational trials of oxyfluorfen have found no damage to conifer seedlings (Sierra Cascade Intensive Forest Management Research Cooperative Annual Report, 2014). Even incense cedar, and sugar pine, which are both very sensitive to most herbicides, showed no signs of damage. This outstanding conifer tolerance means that the MUs could expand the planting of both sugar pine and incense cedar, should oxyfluorfen be approved for use. At present, very low quantities of these two species are planted, as they are intolerant to hexazinone, which is the primary pre-emergent in use for reforestation. When managers do elect to plant sugar pine or incense cedar, no pre-emergent is used, which requires each individually planted tree to be released by hand using a foliar treatment of glyphosate. Such a direct hand release is both expensive in the long term (generally requires multiple treatments for the same efficacy), less effective, has a narrower window for timing (which limits its practical use), and can result in damage to trees from drift.

Oxyfluorfen may require less rainfall than hexazinone to work into the rooting zone of target weeds, which could allow for more flexibility in application timing. Hexazinone is typically applied in the spring on high rainfall lower elevation sites, and in the fall on high snow areas. Eastside pine sites are generally sprayed in fall, as spring rains may not be sufficient to work the chemical into the soil. The ability to apply Oxyfluorfen in spring on some sites, which traditionally require fall spraying gives managers of the MUs more flexibility with reforestation timing post wildfire. For example, if salvage operations occur into fall, managers may utilize an oxyfluorfen application in spring to control brush. With hexazinone, managers would likely have to wait until the following year to site prep the area.

The use of oxyfluorfen has the potential to reduce costs across the MUs. The table below estimates costs of various site preparation treatments (or combinations thereof). Oxyfluorfen costs less per acre than any alternative prescription currently in regular use on the MUs with the exception of a glyphosate only treatment. As mentioned above, glyphosate has a narrow timing window, and is less effective and no residual soil activity which frequently results in much higher long-term costs and total chemical use. Non-chemical treatments may be used, but have limited efficacy, and are generally very costly.

Table 1: Relative Costs of Site Preparation Treatments

		Treatment Cost ($/Acre)			
Treatment	**Rate/acre**	**Chemical**	**Application**	**Total**	**Comments**
PindarGT (pinoxsulam, oxyfluorfen) + Accord XRT II (glyphosate) + MSO (adjuvant)	PindarGT: 3 pints Accord XRT II:3 qts. MSO: 1 qt.	$80	$40	$120	Can be used with all native conifer species. Cost savings over other treatments.

Velpar DF (hexazinone)	3.5 lbs.	$100	$40	$140	Operational standard. Tolerance issues to all species but ponderosa pine.
Velpar DF (hexazinone) + Milestone (aminopyralid)	Velpar DF: 2.5 lbs. Milestone: 7 oz.	$90	$40	$130	Improved conifer tolerance vs. Velpar DF (still cannot plant SP or IC). Less effective than Velpar DF at controlling established brush & perennial grasses.
Accord XRT II (glyphosate) + MSO (adjuvant)	Accord XRT II: 4 qts. MSO: 4 qts.	$30	$80	$110	Usually results in significantly higher release treatment needs (due to low efficacy), requiring multiple applications. Timing is critical, and window to treat grasses and forbs adjacent to planted trees is narrow. Low efficacy results in less conifer survival and growth.
Hand grubbing	-	$0	$400	$400	Narrow timing window. No residual control, resulting in less conifer survival and growth. Many species re-sprout. Costly.
Mastication	-	$0	$500	$500	Does not control re-sprouting brush. Does not control grasses and forbs (therefore follow-up chemical use is required). Costly.
VH Mulcher	-	$0	$200	$200	Generally still requires chemical follow-up. 4' circle created by mulcher is smaller than desirable. Increased gopher problems.
Mulching	-	$0	$250-$1985 (includes materials)	$250-$1985	Costly and labor intensive to install. Longevity of control varies. Seedling damage a concern.
No-Action	-	$0	$0	$0	Results in conversion of productive timberlands to brush fields, eliminating any future economic returns. See text analysis for details.

Pindar GT carries a caution signal word, while Velpar DF (hexazinone) carries a danger signal word due to potential irreversible eye damage. Using Pindar GT in place of Velpar DF therefore lowers potential risks to applicators.

General Benefits to Pre-Emergent Herbicide Use

By effectively controlling a broad spectrum of weeds prior to germination or in the very early stages of post germination growth, the use of pre-emergent herbicides such as oxyfluorfen significantly reduces the number of subsequent foliar weed control treatments as well as overall chemical use that would be needed to successfully establish a planted conifer forest. Additionally, pre-emergent weed control is essential in the climatic region of Red River Forests and Shasta Forests where during most years there is no significant rainfall from late spring through early fall when seedlings are growing and newly planted seedlings need all available soil moisture during their first growing season to become established. Also without pre-emergent control of introduced exotic species (such as European cheat grass which can effectively remove all soil moisture in the top several inches of the soil profile) prior to planting conifers, the shallow roots of planted seedlings do not have access to adequate soil moisture. Applying a post-emergent foliar contact herbicide after planting is not a viable alternative because seedlings may be susceptible to damage at this stage and the applications must be delayed until the competing vegetation is actively growing and by then it is too late to significantly reduce competition for available soil moisture.

Pre-emergent herbicides, such as oxyfluorfen, are by far the most important herbicides for conifer establishment and early growth in Mediterranean climates. Temperatures range between 90 to 115 degrees Fahrenheit in summer months, and rainfall occurs between November and March. Soils in northern California are mostly well-drained volcanic sandy loams with fairly low moisture holding capacities. Water is the main limiting factor regarding tree survival and growth. Products containing oxyfluorfen are primarily used for herbaceous control, but can also control some brush species when individual plants are small. The importance of herbaceous weed control has been demonstrated by many (White et al., 1990, White & Newton, 1989). Herbaceous weed control with pre-emergent herbicides (hexazinone) increased noble fir survival by roughly 100 percent and increased noble and Douglas-fir diameters by 38 and 25 percent, respectively after two years (White et al., 1990). White and Newton, 1989, demonstrated that herbaceous competition negatively affected both conifer and manzanita growth by the third year following treatment. Pre-emergent herbicides have been shown to increase ponderosa pine and Douglas-fir stem volume by as much as 387 and 650 percent and seedling survival by 45 and 10 percent, respectively (Dimock et al., 1982). A study by Oester et al. 1995, showed a tenfold increase in ponderosa pine stem volume five years after treatment compared to untreated controls and an 887 percent increase in seedling survival. Roth & Newton, 1996, demonstrated a fourfold increase in stem volume after two growing seasons when using pre-emergent herbicides on Douglas-fir and as high as a 65% percent increase in seedling survival, compared to control plots.

f. **(Fill in only if you represent a large-scale MU)**

Please provide a review carried out by independent experts of the Cost/Benefit Analysis in e).

Refer to the attached: Review of W. M. Beaty & Associates, Inc. Cost/Benefit Analysis of Pindar GT Compared to Alternative Chemical and Non-Chemical Methods.

g. **(Fill in only if you represent a medium or small-scale MU)**

Please describe possible non HHP alternatives to the use of the requested HHP and explain why they are not considered feasible to control the targeted pest organisms.

N/A

h. Please include an estimate of the amount of area over which the pesticide is to be applied and how

much of the pesticide is expected to be used annually.

Due to the unpredictable episodic nature of catastrophic wildfire, it is impossible to predict total annual use. Annual use from planned timber harvests is expected to occur on approximately 200 acres, with a use rate of 3 to 4.5 pints per acre, for a total estimated annual use of 75 to 115 gallons of Pindar GT (295 to 440 lbs. of oxyfluorfen).

i. **(Fill in only if you are applying for the renewal of a derogation)**

Please attach a report on the implementation of the IPM system during the previous derogation period, covering at minimum:

- Brief description of the silvicultural system in the MU(s) included in the scope of the requested derogation.
- A list of the monitored pest organisms.
- The results of the annual monitoring of the target species in relation to the defined thresholds.
- Quantitative data of the use of 'highly hazardous' pesticides per year for the full period of the existing derogation, areas of application and application method.
- A description of the programs that have been implemented to investigate, research, identify and test alternatives to the 'highly hazardous' pesticide, and the results.

N/A

2. Specified measures to prevent, minimize and mitigate impacts

a. Please describe the best management practices (BMP) that will be implemented in the MU(s) to prevent, minimize, and mitigate negative social and environmental impacts of the application of HHPs during the requested derogation period, covering at minimum: application method, watercourses, land use or terrain and weather conditions.

W. M. Beaty & Associates, Inc. has a well-developed process and operational procedures for the use and handling of herbicides such as oxyfluorfen that comply with State and Federal Government requirements. Use of products containing oxyfluorfen are reduced because applications on Red River Forests and Shasta Forests employ voluntary watercourse exclusion buffers for products containing oxyfluorfen that exceed regulations and label requirements.

Controls include an Integrated Pest Management Plan approach, detailed site operation plans and site-specific consideration to ensure the most appropriate control measures are applied in each instance where it is necessary to apply products containing oxyfluorfen. Some examples include ongoing staff training, detailed edaphic, climatic and weather prescriptions and buffers, and monitoring systems to ensure the protection of sensitive crops, vegetation and stream water quality.

The majority of planted coniferous stands on Red River Forests and Shasta Forests are established in response to catastrophic wildfire and are grown to rotations of 60 to >120 years (or for transition to uneven-aged stands with no set rotation). Products containing oxyfluorfen are anticipated for use primarily on mixed conifer stands with application occurring in the spring, although fall application is a possibility on drier east side stands. Unlike agricultural applications of products containing oxyfluorfen, forest applications are not followed by irrigation. So in most situations where oxyfluorfen would be used on Red River Forests and Shasta Forests almost all of the water would fall on the soil after application would be taken up by plant transpiration and soil evaporation and not available for movement into groundwater. Application of products containing oxyfluorfen would likely occur once at the commencement of the rotation as a pre or post planting application. At maximum broadcast rates this equates to approximately 2.2 lbs. of active

ingredient per acre per year.

In some instances, the product may be applied as a strip, or in spots, with as little as 10% to 20% of the total area being treated.

Compliance with Regulations

Products containing oxyfluorfen are approved by federal and state agencies for applications in forest and plantation management. California's Pesticide Regulatory Process is one of the world's most stringent. To mitigate potential hazards, the proper handling and application of the product is identified on the herbicide label and Material Safety Data Sheet.

Forest applications are carried out in accordance with the US Environmental Protection Agency and the California Department of Pesticide Regulation licensing and permitting procedures and all proposed treatment areas are examined by a PCA. As required by law all applications of products containing hexazinone are reported to the appropriate county agricultural commissioner.

Site Specific PCA Recommendations

All applications of products containing oxyfluorfen on Red River Forests and Shasta Forests are prescribed by a PCA after an onsite visit and consideration of alternative treatment methods. The PCA recommendations consider alternative treatments (both pesticide and non-pesticide), and include a description of location, most appropriate chemical, rate, hazards, use restrictions, identification of sensitive areas within or near the project area and mitigations that many times exceed minimum regulations or label requirements.

As managers for Red River Forests and Shasta Forests, W. M. Beaty & Associates, Inc. evaluates all environmental conditions when determining whether to apply products containing oxyfluorfen. When applications of products containing oxyfluorfen are necessary to meet the objectives of Red River Forests and Shasta Forests, a PCA recommends when, where, and how products containing oxyfluorfen will be applied based on site-specific circumstances. Professionally trained foresters and wildlife biologists are consulted. Information concerning impacts to non-target organisms (particularly threatened or endangered species) is evaluated and mitigations applied as necessary. Label instructions, regulations and the PCA recommendation are followed on all applications by a Licensed Pest Control Operator (PCO).

Application is limited consistent with the weather parameters and timing restrictions identified on the label and as recommended by a PCA. Minimum effective rates are applied.

Watercourse Buffers

Buffer widths adjacent to watercourses and lakes are established specifically for products containing oxyfluorfen that exceed minimum label requirements and regulations. Aerial application buffers for perennial watercourses (or any other classification of watercourse that is running water at time of application) are at least 100 feet and for dry ephemeral watercourses are at least 50 feet. Ground application buffers for perennial or intermittent watercourses are at least 50 feet and for dry ephemeral watercourses are 25 feet. Although these exceed requirements in regulation, even wider buffers are established if the PCA determines that conditions (soils, slope, climate etc.) require it. During operations the W. M. Beaty & Associates, Inc. forester monitoring the application and/or the Licensed Pest Control Operator conducting the application can further widen the buffers should wind conditions (speed and direction) at the time of application warrant it.

Timing

Timing of applications of products containing oxyfluorfen is carefully planned such that most of the rainfall that occurs within 6 months after application is enough to activate the chemical but not enough to leach out of the rooting zone of vegetation that uptakes it with the soil water. In most areas the application of products containing oxyfluorfen will occur in spring, with late spring rains activating the product. On particularly dry east side sites, applications may need to occur in fall, so that activation occurs from early-mid spring rains (as late spring rains are not guaranteed on these sites). Very little precipitation occurs between late spring and early fall in NE California and irrigation is not used on Red River Forests and Shasta Forests. So, during these months while products containing oxyfluorfen are degrading, the movement of it in the soil profile is primarily upward with soil water being taken up by vegetation.

Experience

As managers for Red River Forests and Shasta Forests, W. M. Beaty & Associates, Inc. has planned and successfully implemented reforestation projects on tens of thousands of acres over the past four decades utilizing safe and effective applications of products similar to oxyfluorfen.

Mitigations

See mitigations for products containing oxyfluorfen noted above and also the specific controls outlined in the following "W. M. Beaty & Associates, Inc. Vegetation Management Policy and Pesticide Use Guidelines":

The judicious use of herbicides when combined as part of an integrated pest management program is an important tool to achieve forest management objectives. These objectives include sustaining the growth and production of large diameter sawlogs, maintaining the diversity and viability of natural vegetative community structure and composition, and minimizing the risk of catastrophic loss due to fire, insects and pathogens. It is therefore W. M. Beaty & Associates, Inc. policy to integrate the wise use of the most appropriate vegetation management tools available which consider silvicultural, biological (wildlife), environmental (air, soil, water), economic and social factors. An integrated program will consider all tools including silvicultural, chemical, prescribed fire, manual, mechanical, and biological means to control vegetation and include guidelines for their use.

The following are guidelines for the use of pesticides on W. M. Beaty & Associates, Inc. managed lands:

1. Pest management decisions will include an evaluation of economic, environmental (water, soil, air), biological (wildlife and habitat), silvicultural (forest health, growth, stocking), and social factors. Professional input from licensed PCAs, Registered Professional Foresters (RPF), and certified Wildlife Biologists (CWB) will be utilized in the decision making process.
2. Written recommendations will be prescribed by a licensed PCA for all pesticide applications. All PCA recommendations will be based upon on-site visits and will include at least the following information: specific location of treatment, most appropriate method of application, pests to be controlled, name(s) of most appropriate pesticide to use, descriptions of hazards, restrictions, schedule, time and/or conditions of proper application, locations of all watercourses in or adjacent to treatment area with minimum buffers stated, proximity to and likelihood of recreational or residential use by humans, presence of livestock, and consideration of alternative treatments.
3. All applicable federal and state laws and regulations and all label requirements as regulated by

the California Environmental Protection Agency Department of Pesticide Regulations and the local County Agricultural Commissioner will be complied with. For all counties in which spray operations will be performed, W. M. Beaty & Associates, Inc. will annually register with each County Agricultural Commissioner to obtain landowner identification numbers and restricted materials permits.

4. All applications will be conducted by licensed Pest Control Businesses.
5. Prior to all spray applications Pest Control Businesses will be shown all boundaries and sensitive areas.
6. Buffers will be established which meet and often exceed labels and regulations. For all aerial applications a minimum of at least 100 foot buffers will be used on all watercourses with running or standing water. Watercourses that are dry at the time of application will have minimum buffers of at least 25 feet. Should specific chemical, site (slope, soil type, beneficial uses of water, vegetation etc.) or climatic (wind speed & direction, thermal etc.) conditions warrant, then this minimum buffer may be increased in the prescription and/or at any time during application.
7. All treatments will consider community concerns, particularly neighboring landowners. To the greatest extent feasible all adjacent landowners will be notified prior to treatments and their concerns will be considered when establishing chemical use, application methods and property line buffers. In situations where neighbors have expressed concern, have not been contacted or have not responded, methods will be selected and minimum buffers established to insure no off-site drift or movement of chemical will impact their property. In these situations a minimum buffer of two swath widths will be used for aerial and mechanical applications. Should site (slope, soil type, vegetation etc.) or climatic (wind speed & direction, thermal etc.) conditions warrant, then this minimum buffer may be increased in the prescription or at any time during application.
8. Records of all treatments will be kept including maps, chemicals and methods used and completed W. M. Beaty & Associates, Inc. Daily Spray Report forms. Pest Control Operators shall submit Pesticide Use Reports to the appropriate counties and shall send copies of all use reports to W. M. Beaty & Associates, Inc. to keep on file.
9. Applications will be appropriately monitored for effectiveness and compliance. W. M. Beaty & Associates, Inc. personnel will be on-site to the greatest extent feasible to monitor all aerial applications. This will include recording chemical, application and climatic information on the W. M. Beaty & Associates, Inc. Spray Report form. In some environmentally or socially sensitive situations this may include the use of spray droplet detection cards and/or water quality monitoring. All treatment areas will be revisited by W. M. Beaty & Associates, Inc. personnel at least once to monitor compliance with and effectiveness of the prescription. Any suggestions for improvement of developing or implementing future prescriptions will be communicated to the W. M. Beaty & Associates, Inc. Project Forester.

Pesticide Registration

Prior to any pesticide being available for use, it must first go through a comprehensive federal registration process. The Federal Environmental Protection Agency regulates pesticides under two major statutes, Federal Insecticide, Fungicide and Rodenticide Act and the Federal Food, Drug and Cosmetic Act. The registration process involves over 120 tests on product chemistry, human and environmental assessment for food safety, tolerance information concerning pesticide residues on

food, and proof the manufacturing process is reliable. In addition to the Federal registration process, the state of California through the Department of Pesticide Regulation requires a pesticide registrant to go through California's pesticide registration process. This involves more testing and data gathering specific to California. In 1996, the Federal Worker Protection Standards were also adopted to further protect applicators, field workers, mixers/loaders and other people that may come in contact with treated areas. Primarily, the act increased the scope of people who require pesticide safety training, increased restricted entry intervals, and broadened the requirement for personal protective equipment.

Regulations

On a local level in the State of California, pesticide applications are monitored and enforced by the County Agricultural Commissioner. Field inspections are carried out by qualified county staff for both ground and aerial applications. Use reports of all pesticide applications must be filled out by operators and submitted to the County Agricultural Commissioner within seven days of application.

All applications made on Red River Forests and Shasta Forests adhere strictly to the pesticide label, federal laws, state and local regulations, and requirements in a written pest control recommendation prepared by a California licensed Pest Control Advisor. It is a violation of federal law to apply a pesticide in a manner inconsistent with its labeling. The intent of the pesticide label is to give clear and concise directions for use while minimizing risks to human health and the environment. The label has specific directions for rates used, personal protective equipment, restricted entry intervals, hazards to humans and wildlife, special restrictions near water, lists of active ingredients, directions for container disposal, specific application instructions, and signal word denoting the level of hazard.

The managers of Red River Forests and Shasta Forests, W. M. Beaty & Associates, Inc. adhere to strict guidelines for mitigating risks associated with pesticide applications. All state and federal labels and laws as well as all state and local county regulations in addition to W. M. Beaty & Associates, Inc. Pesticide Use Policy are strictly followed in all pesticide applications on Red River Forests and Shasta Forests. All chemical applications are applied by California licensed applicators only. California applicators are required to pass a rigorous exam to show competence, and may only keep their license after accumulating 20 to 40 hours of continuing education within their two year certification period. No applications are made unless a written recommendation has been obtained by a licensed PCA. The PCA's must have at least a bachelor's degree in forestry, crop science, biology or related field. Pest control advisors must complete 40 hours of continuing education within their two year certification period. The written recommendation must be on site during the pesticide application. Recommendations include such things as pesticide(s) to be used, the rate at which the pesticide is to be applied, dilution, method of application, environmental conditions, hazards and mitigation measures, label precautions, and directions for use. PCA's are also required to consider and evaluate all feasible alternatives and select the most appropriate method and pesticide(s) available.

Water Quality Protection

Water quality protection is of the utmost importance. No ground water contamination from a forestry application has ever occurred through leaching with any of the products used on Red River Forests and Shasta Forests. The protection of water quality is ensured primarily through the use of buffers around watercourses, and other sensitive areas. All pesticide applications employee the use of a buffer, with varying widths based on product used, application method (ground or aerial), slope, soil type and type of watercourse or water body. Generally, buffer zones range from 10 to

200 feet depending on the site specific circumstances. Buffers established for applications of products containing oxyfluorfen are amongst the widest, with a width from 50 to 200 feet. Soil types and slopes are evaluated for runoff and leaching potential prior to application, with well-drained soils with low organic matter percent requiring larger buffers (>50 feet). Steeper slopes are afforded a relatively larger buffer as well. Domestic water sources are buffered 75 to 200 feet. Buffer zones are also established for other reasons (e.g. adjacent landowners, crops, dwellings, etc.) and are generally much greater than required by regulations.

Application Technology

Application technology required of operators applying pesticides on Red River Forests and Shasta Forests also plays a significant role in reducing spray drift. Helicopter applicators are required to use large nozzles, which produce larger droplets which minimize potential for drift. Also, along all water courses, sensitive areas and property lines, split boom applications are required. This is where the side of the boom closest to the sensitive area is shut off and the buffer is flown with the outside boom only, thus eliminating any rotor wash along the edge of the buffer. Nozzle angle is also a critical factor in maintaining droplet size and thereby reducing drift potential. Nozzles are oriented at an angle from forty-five degrees to ninety degrees straight back to reduce wind shear of the spray droplets. Helicopter applications are not flown in wind speeds greater than five miles per hour on units that have watercourses or other sensitive boundaries or buffers. In units without any sensitive boundaries, buffers or watercourses helicopter applications are not flown in wind speeds greater than eight miles per hour. Wind direction is also monitored during applications in order to modify operations to further reduce potential for drift towards sensitive areas by enlarging buffer widths and/or altering timing of spraying near buffers etc. Applications are not flown when wind direction causes spray particles to drift into sensitive areas.

W. M. Beaty & Associates, Inc. and its aerial applicators also utilize GPS, geo-referenced GIS shape files and AgNav in-flight computers to aid in boundary and buffer identification and location of heliports. Prior to spraying all units, a W. M. Beaty & Associates, Inc. forester conducts a pre-spray flight reconnaissance with the pilot. During the pre-spray reconnaissance flight unit boundaries and buffers on the map and helicopter's AgNav shape files are confirmed and if needed modified and/or additional sensitive areas are identified and GPS'd into the AgNav and appropriately buffered. W. M. Beaty & Associates, Inc. foresters have radio communication with the pilot at all times during aerial spray operations, and continuously monitor & record weather conditions (including wind speed, direction, humidity, and temperature).

Method

Where needed to avoid impacts to water quality and other sensitive areas, ground spray operations are used instead of aerial applications. Buffer zones and sensitive areas are flagged ahead of time. Ground broadcast applications are carried out with the nozzles pointed in a downward direction to ensure proper placement of product. Applicators are taught to spray away from water and sensitive areas when doing their buffer passes. Ground applications are not done in winds that exceed ten miles per hour. Large nozzles are also used that minimize drift. If needed, drift control agents may be added to the spray mix.

b. Please describe personal protective equipment's (PPE) for workers handling with HHP.

All personnel including applicators, mixers/loaders, contractors, and W. M. Beaty & Associates, Inc. employees who enter oxyfluorfen treated units within 30 days of the expiration of the restricted entry interval on the pesticide label are all safety trained on an annual basis by licensed professionals in the use and safety of pesticides. Any person applying, mixing, or loading must

wear coveralls over long-sleeved shirt and long pants, chemical-resistant footwear plus socks, chemical-resistant gloves, safety glasses, chemical-resistant headgear when exposed overhead, and chemical-resistant apron when exposed to the concentrate. Workers making early entry into a unit during the restricted entry interval must wear coveralls, chemical-resistant gloves, shoes plus socks, and safety glasses.

During applications, on site decontamination facilities are available which include soap, disposable towels, clean change of clothes, eyewash and wash water. Emergency medical information is posted at the site for the nearest hospital. All spray tanks and backpacks are labeled with the product, rate, signal word, Environmental Protection Agency registration number, manufacturer, and the name, address and phone number of the applicator. All workers are required to wash their hands before eating, drinking or using tobacco. Mixing and loading of restricted materials is only done by a licensed professional.

c. **(Fill in only if you represent a large or medium-scale MU)**

Please describe the training program on the use of the PPE and the application of the HHP that will be implemented in the requested derogation period.

Only state licensed pesticide applicators are contracted to apply pesticides on the MUs. As required by state regulations, the contractor must inform the employee of the pesticide being used, pesticide safety hazards, PPEs and other equipment to be used, work procedure to be followed, and pesticide safety regulations applicable. Such training can is required annually, and training records are kept for two years by the trainer. Only qualified trainers can provide the training (including commercial applicators, PCAs, and others). In addition, contractors on the MUs provide a morning discussion of unit specific safety concerns (should they exist).

d. **(Fill in only if you represent a large-scale MUs and you are applying for the renewal of a derogation)**

Please indicate the conclusions of the environmental and social impact assessment related to the use of HHP occurred during the previous derogation period.

N/A.

e. Additional information (Eg: insurance providing coverages for pesticides related damage to environmental values and human health, etc.)

Ground application contractors are generally required to maintain commercial general liability insurance, with pesticide or herbicide applicator coverage included, in addition to automobile and workers compensation insurance.

Aerial application contractors are generally required to maintain commercial general liability insurance, automobile insurance, workers compensation insurance, aircraft liability insurance, pollution liability insurance, and comprehensive chemical liability insurance.

A supplemental write-up provided by Dow AgroSciences on oxyfluorfen has also been included as an attachment to this derogation application. The Dow write-up highlights a number of important points in regards to the “likely to be carcinogenic” label as it relates to the products use in forestry.

3. Program to identify, investigate, and test alternatives to the ‘highly hazardous’ pesticide (including preventive silvicultural measures)

a. **(Fill in only if you represent a large-scale MU)**

Please describe the research program (individually or in collaboration with other research agencies/institutions or commercial enterprises) and/or field trials of alternative non-chemical or less hazardous methods of pest management that have been planned for the requested derogation period, including devoted resources and expected timelines.

Exploration of Alternatives

W. M. Beaty & Associates, Inc. continually explores alternative methods of vegetation management to establish planted forests and to control unwanted highly hazardous brushy fuel loads. While W. M. Beaty & Associates, Inc. has effectively diminished the number of entries and amount of herbicide applied, complete elimination currently is not economically viable or environmentally responsible. As a result, W. M. Beaty & Associates, Inc. continues to use the safest, most effective, and environmentally appropriate options available to control unwanted competing vegetation and highly hazardous fuel loads, while exploring ways to keep herbicide use to a minimum.

Over the past several decades, W. M. Beaty & Associates, Inc. has conducted monitoring and research on its managed lands as well as collaboratively with other forest managers and research organizations to minimize the use of chemicals. Trials have been conducted and monitored that evaluate manual, mechanical, cultural and chemical use for vegetation control including combinations of methods. Chemical trials include alternative chemicals, surfactants, timing, rates, and application methods to explore feasibility of alternatives such as lower rates, less toxic chemicals, surfactants, methods and/or timing of applications, etc. as well as non-herbicide treatments. These trials are monitored for relative costs, effectiveness in controlling target weed species, and safety to crop trees, human health and the environment. Since many competing weed species resprout, monitoring on many trial sites is usually conducted for more than one year after the trial application.

Certified Forests Cooperative

W. M. Beaty & Associates, Inc. on behalf of Red River Forests and Shasta Forests, developed the Certified Forests Cooperative (formerly the Forest Stewardship Council Research Group) in conjunction with other large forestland managers. The purpose of the cooperative is to cooperatively participate in field trials and research pursuant to the Forest Stewardship Council® (FSC®) United States (US) and individual FSC® Forest Management certificate holders' derogations for the use of FSC® listed "high hazardous" chemicals, and to help satisfy requirements and management objectives of the Sustainable Forestry Initiative (SFI) standard set forth in performance measure 2.2.

Since the establishment of the Certified Forests Cooperative in the spring of 2010, it has been a priority of the group to evaluate new chemistries for forestry site preparation or herbaceous release that may be an alternative to products listed as highly hazardous by FSC®. Chemical trials are general designed to evaluate the effectiveness of a chemical alone, or in combination with other chemicals, and at varying rates. Trials evaluate both the control of unwanted vegetation, but also evaluate the tolerance of various conifer species to the treatment. Treatments are randomized, and data is meticulously collected and carefully analyzed by statistical software programs to determine significant. Some of these trials have also been replicated by other research groups. Currently, work is being done on aminopyralid, aminocyclopyrocholor, and others.

Herbicide Field Trials

W. M. Beaty & Associates, Inc. establishes stand-alone study plots as well as study plots within numerous operational spray projects to evaluate methods that maximize efficacy while minimizing chemical use. Trials examine pesticide, application timing, surfactant rate and type, volume per acre, droplet size, and pesticide rate as factors that influenced control of target vegetation and impact on crop trees and other non-target plants.

Several trials have been established to try and fine tune applications to provide more control with less chemical. Results of these trials have allowed W. M. Beaty & Associates, Inc. to choose the most effective treatment for individual brush species. This should improve control and reduce the number of future treatments.

One such example: "Oust plots at various rates for pre and post emergent weed control in Modoc County on the "Scarface Fire". Plots which were monitored for control of target weeds (grasses forbs and brush species such as manzanita and snowbrush) and for impact on crop trees (ponderosa pine) and non-target plants. Results showed that Oust did not provide as good pre-emergent control and almost no post emergent control versus the hexazinone control plots, which provided excellent pre-emergent and satisfactory post emergent control of most weeds. But more importantly Oust caused unacceptable levels of damage to ponderosa pine seedlings (both visible bud and foliage damage as well as stunted root growth) and products containing hexazinone caused no damage to foliage, buds or roots or negative effect on growth (growth actually was better on plots with products containing hexazinone). Although Oust can be safely used in other regions of the west coast on most other crop tree species, in northeast California with relatively low rainfall and much lighter soils (very low clay and organic matter content) and the ponderosa pine vegetation type, it is not a viable alternative.

Besides Oust, a number of other pre-emergent herbicides have become available for forestry use in California. Atrazine has long been an option, but is on the FSC® list of "Highly Hazardous", and has lost favor over concerns with ground water contamination. Hexazinone is an outstanding option, and is being removed from the FSC® list of "Highly Hazardous" chemicals; however, hexazinone has known tolerance issues with many coniferous species. Additionally, hexazinone must have significant rainfall to put it into the rooting zone of the soil, which generally requires a fall application on east side forest sites. Imazapyr has some promise as a pre-emergent, however, thus far trials have shown severe conifer damage on dry east side sites due to imazapyr. Aminopyralid has recently come into favor, but has limited effectiveness when not combined with other chemicals, particularly when the site is not bare at the time of application. Oxyfluorfen shows great promise as a pre-emergent for two reasons: first, it has outstanding conifer tolerance (with no damaged observed on any species to date); second, it requires less water to activate than hexazinone, suggesting it may be suitable to apply in the spring on the east side, which provides greatly flexibility for reforestation after wildfires (ex. It has the potential to be used on a unit which was logged over the winter, instead of leaving the unit untreated till the following fall as with hexazinone).

There are many herbicides that are registered for forestry use in the other 49 states in the United States but are not registered in California for forestry use (e.g. products containing picloram), because the potential forestry use market in California does not justify the expense to conduct all of the additional field tests and registration costs that California requires in addition to federal U.S. registration. W. M. Beaty & Associates, Inc. has actively campaigned for registration of suitable chemicals which are not labeled for forestry in California; this type of lobbying was done successfully in the case of imazapyr (which is one of the safest, lowest use, and most effective

chemicals for controlling mature brush pre-harvest). W. M. Beaty & Associates, Inc. will continue to work closely with chemical manufactures and government agencies to try and get safe and suitable products registered for use in California.

Manufacturer Trials

To continue to reduce pesticide amounts and find alternatives for products containing "highly hazardous" chemicals, W. M. Beaty & Associates, Inc. actively partners with major manufacturers to conduct trials to evaluate new products that have very low rates and environmentally and toxicologically friendly profiles. Several trials have been conducted in cooperation with DuPont, Dow, Bayer, BASF, and Wilbur-Ellis looking at new low use rate products. Some of the treatments are new soil active products with short residual activity that could replace or reduce the use of "highly hazardous" products. In addition, new chemistry for low use rate products, and new application techniques to minimize worker exposure are under review. Current trials include follow-up aminopyralid trials, oxyfluorfen trials, indaziflam trials, and others to further refine suitability and use of these chemicals.

USDA, USFS, Pacific Southwest Forest Experiment Station

W. M. Beaty & Associates, Inc. has for several decades allowed the USDA, USFS, Pacific Southwest Forest Research Station to conduct numerous studies on lands it manages, including Red River Forests and Shasta Forests. Some of these studies include the effects of alternative fuel reduction treatments, including various herbicide treatments, on forest resources. Some of these studies include the effects of brush on conifer growth and the effects of brush control on forest resources such as soil, soil biota, water, etc.

North Sierra Tree Improvement Association

An important long-term partnership that Red River Forests and Shasta Forests have invested in for three decades is the North Sierra Tree Improvement Association (NSTIA). The NSTIA has been improving natural seedling genetics and conserving a strong diverse natural genetic base through superior tree selection and establishment of a ponderosa pine seed orchard, progeny test sites that have been intensively measured for 20 years. Through controlled breeding in the seed orchard the cooperative is currently in their second generation breeding program. Seed orchard stock is currently out-performing general collection seed sources by twenty to thirty percent. By increasing seedling growth rates, the amount of chemical use is reduced because the trees outgrow the brush in a shorter period of time. The faster the trees can close canopy, the quicker they shade out the competition.

Sierra Cascade Intensive Forest Management Research Cooperative

New research is also conducted by involvement in the Sierra Cascade Intensive Forest Management Research Cooperative, in which Red River Forests and Shasta Forests is a dues paying member and W. M. Beaty & Associates, Inc.'s Project Forester serves on the Executive Committee. As an active and dues paying member of this cooperative we have supported numerous research projects investigating the long-term results of manual treatments vs. chemical treatments in post-fire stands, long-term competition studies looking at various levels of brush control, new application techniques to minimize chemical use, and stock type trials with and without vegetation control. Valuable data has been obtained from this cooperative, much of which supported what was already suspected. Manual or mechanical treatments without chemical use are ineffective and unfeasible in Mediterranean climates. Also striking was how low levels of competition affect planted forest survival and growth in our region. Data from the co-op has also shown that large

seedlings and fertilization can have a short-term effect on growth, but by year three or four after planting, treatment differences disappear. Thus, there may be some benefit from planting large seedlings initially to aid in the reduction of chemical use. Fertilizers also provided a short-term gain, but the fertilizers themselves posed a risk to conifers due to salinity levels increasing and damaging root tissue.

Pre-harvest Site Preparation

W. M. Beaty & Associates, Inc. was one of the first companies in California to conduct pre-clearing and pre-harvest site preparation sprays with products containing imazapyr. This technique has greatly reduced the amount of follow-up herbicides needed, as all mature brush is controlled prior to establishment. Prior to the use of a pre-harvest imazapyr treatment, large, and difficult to control brush (such as chinquapin and snowbrush) often required multiple follow-up treatments. Imazpyr also has the benefit of a low use rate. Futhermore, pre-harvest treatment of brush generally requires less chemical and less time, which reduces worker exposure.

Chemical Reduction Efforts Made by W. M. Beaty & Associates, Inc.

As managers for Red River Forests and Shasta Forests, W. M. Beaty & Associates, Inc. continuously evaluates alternatives to herbicides listed as "Highly Hazardous" by FSC®. In general, we:

1. Consider alternative herbicides registered for forestry use in California that are not designated by FSC® as "highly hazardous".
2. Read and evaluate technical publications and scientific literature regarding state-of the-art research and development in pest control.
3. Attend technical seminars and confer with experts regarding alternative approaches including Integrated Pest Management.
4. Undergo continuous training required to maintain licensures as PCAs and Qualified Applicators.
5. Use Geographic Positioning and Geographic Information Systems to improve application precision thereby reducing application rates on a site specific.
6. Utilize silvicultural systems, which minimize or eliminate the need for artificial reforestation and herbicide applications.

W. M. Beaty & Associates, Inc. cooperates with and is involved in several organizations conducting research aimed at minimizing use of herbicides in general and stays abreast advances in technology. The approach taken by Red River Forests and Shasta Forests to comply with FSC® guidelines includes:

1. Investigating chemical alternatives using products that are not included in the FSC® "highly hazardous" list.
2. Continue to look for chemical use strategies that apply less chemical, more precisely targeted to reduce overall quantity of chemical applied.
3. Continue to look for effective mechanical, fire and biological control methods.

Non-Chemical Methods

Non-chemical vegetation control methods have been evaluated on Red River Forests and Shasta Forests and quite extensively throughout regions with similar climates and forest types over the years and consistently fail to achieve the desired results at an economically viable level. Two of the

more popular non-chemical methods are hand-grubbing and mulch mats. McDonald & Fiddler (1992), looked at over 40 vegetation management studies, 16 of which involved hand grubbing. Costs for complete grubbing in 1990 averaged $410 per acre and ranged as high as $2,000 per acre where repeat treatments were necessary. There were also several problems associated with grubbing, most notable is that it fails to control vegetation that sprouts or has rhizomes. It also needs to be done repeatedly to achieve adequate levels of vegetation control. The studies also noted considerable soil displacement as a result of grubbing.

Hand grubbing trials on Red River Forests and Shasta Forests (e.g. Squirrel Fire) showed considerable costs (more than twice as much cost per treatment and several more treatments are needed than the one chemical treatment that would have been needed) for very short term results (rapid re-sprouting of brush and scarification of brush seed that led to germination of brush seedlings) and much higher negative impacts to the environment (loss of litter layer around seedlings, exposed top soil and increased erosion) and negative impacts to worker safety (dust inhalation and greater risk of physical injury from scalping tools).

An extensive literature review of non-chemical vegetation control methods in forestry was conducted by Thunder Road Resources for the Forest Stewardship Council® Landowners Group in 2010. The use of manual methods in forestry is limited at best. Cost, efficacy, and safety are all potentially prohibitive concerns. Reductions in vegetative cover from the majority of these methods are short-term gains at best and the treatment usually needs to be repeated multiple times to be effective. Public acceptance of these methods appears to be based mainly on perception (E. Fredrickson, 2010).

Biological Control

Biological control agents (plant diseases and defoliating insects) have not been successful in controlling competing vegetation in the Pacific Northwest. Usually, insects are specific to certain species of vegetation and therefore are not suitable for large-scale release opportunities, since only a small portion of the vegetative complex would be affected (Newton & Dost, 1984). Native pathogenic fungi have also been unsuccessful in controlling competing vegetation (Wall & Shuman, 1990).

Mechanical Control

Mechanical site preparation with tractors, excavators, mulching heads or rippers can be useful tools but must be integrated with chemical control to provide adequate vegetation control for cost effective establishment of new forests (and for keeping hazardous fuel levels low). Most brush species in the region of Red River Forests and Shasta Forests re-sprout aggressively after mechanical treatments and many brush and other weed species seed germinate after being scarified by mechanical treatments. Invasion by grasses and geminating brush still require an herbicide application to achieve success (Newton & Dost, 1984). Releasing established planted forests from large brush competition using mechanical methods has also proven ineffective and cost prohibitive (Fiddler et al., 2000). Only when mechanical treatments were followed up with herbicide applications did the researchers note any gains in growth. Mechanical site preparation treatments also cause more top soil disturbance than chemical treatments or mechanical/chemical combination treatments. Properly prescribed chemical treatments reduce or eliminate the need for mechanical treatments to excavate the root systems of re-sprouting brush species; this eliminates topsoil disturbance and erosion, while significantly reducing costs. On W. M. Beaty & Associates, Inc.'s reforestation and hazardous fuel management projects, $50 to $100 per acre chemical treatments have saved $200 to $500 per acre in mechanical clearing costs, and often

eliminate the need for any mechanical clearing.

W. M. Beaty & Associates, Inc. has monitored trials of mechanical treatments including piling, ripping, VH mulching, mastication, and hand grubbing with and without chemical vegetation control. While these mechanical treatments alone initially reduced the amount of competing vegetation present, brush and/or grass re-invaded the sites soon after treatments. Levels of vegetation control necessary to achieve conifer establishment and long-term fuels management were not possible without follow-up chemical treatments. In Mediterranean climates, very small amounts of vegetation can significantly influence success or failure of newly planted forests, and neither mechanical nor manual treatments alone can provide the necessary level of vegetation control. Cost was also a considerable factor, with hand grubbing treatments running as high as $500 per acre with minimal or no gains.

While it has been well established that mechanical treatments alone are not a suitable alternative to chemical treatments, W. M. Beaty & Associates, Inc. evaluates projects to determine under what conditions the combinations of the two may reduce overall chemical use in the long-term.

Mastication: W. M. Beaty & Associates, Inc. has conducted some mastication trials on Red River Forests and Shasta Forests both as the only treatment and in combination with chemical treatments to reduce chemical use. Mastication can be very expensive depending upon site conditions (e.g. rock, slope, access etc.) costing from $300 to $600 per acre or more. Mastication with a chemical follow-up on re-sprouting vegetation appears to work best, and reduces chemical usage, since some vegetation does not re-sprout, and the re-sprouting vegetation requires less chemical to kill.

VH Mulcher: Other mechanical techniques have been tried on W. M. Beaty & Associates, Inc. managed lands including the use of the VH Mulcher. This piece of equipment has a rotating head with blades that grinds slash and brush while incorporating it into the soil. The machine makes planting spots roughly four feet in diameter. The hope was that by incorporating organic matter into the soil along with severely disturbing the root systems of competing vegetation, this treatment would serve a two-fold purpose: control unwanted vegetation and increase water holding capacity and nutrient content in the planting spot. The treatments provided short-term reductions in the amount of competing vegetation and lessened chemical usage, but did not eliminate the need for chemical treatment(s). In order to reduce the high per acre cost of a VH Mulcher treatment (normally $350 to $400 per acre) W. M. Beaty & Associates, Inc. widened the spacing out to fourteen by fourteen feet (222 trees per acre) and sixteen feet by sixteen feet (170 trees per acre) versus the industry norm of ten by ten (436 trees per acre) to twelve by twelve (300 trees per acre). The cost per acre of the VH Mulcher treatment at the wide spacing was still somewhat higher than hoped for at about $180 to $230 per acre. Other site specific problems were discovered with this technique, including increased gopher mortality. This method is still considered by W. M. Beaty & Associates, Inc. but only in very specific situations.

Mulching

Paper mulching studies had costs that ranged from $249 to $1,985 per acre (McDonald & Fiddler, 1992, Kintop, 1992). Treatments tend to be extremely labor intensive and the mats need to be fairly large to achieve adequate vegetation control. Mats vary in their longevity, but long duration mats are typically cost prohibitive. Seedling damage from installation of mats is also a concern. In northeastern California, high winds have also dislodged mats resulting in damage, or covering of conifer seedlings. Another issue with paper mulches is that woody vegetation must be removed prior to mat installation, which further adds to costs.

Prescribed Herbivory

W. M. Beaty & Associates, Inc. evaluated vegetation control methods using animals on the Glass Mountain Tract in the late 1990's. Sheep grazing (under a long-standing grazing permit) was evaluated on the Long Fire Plantation to determine its value at reducing competing vegetation. While the sheep were found to reduce the height and total biomass of vegetation on site, no long-term or significant effects on vegetation or conifer survival and growth were achieved by grazing alone. This is primarily due to the animals only reducing the above ground portion of grazed plants. By not controlling the root systems, water is still removed from the soil profile and unavailable for conifers. Also there is far more soil disturbance and exposed bare soil subject to erosion after intensive grazing treatment than after a herbicide treatment (which leaves dead plant material in place to cover the soil). Prescribed herbivory may still be used when appropriate (and economically feasible), particularly when it fits into existing grazing activities. W.M. Beaty & Associates, Inc. has also been in discussions with large-scale goat operators (such as Lee Hazeltine of Woodland, CA) regarding vegetation management trials using goats, but so far this work has been cost prohibitive.

Prescribed Fire

W. M. Beaty & Associates, Inc. has utilized prescribed fire in the past to reduce herbicide use, and continues to explore the possibilities of its use in the present. Prescribed fire, primarily in the form of piling and burning, was previously utilized on the MUs. This technique reduced herbicide use by uprooting and killing some of the targeted brush species. Often times, follow-up herbicide use was still required to kill partially damaged brush species resprouting from roots. This technique is not employed today, due to the extreme liability associated with prescribed fire, and due to the intensive soil disturbance required to uproot and destroy woody brush.

W. M. Beaty & Associates, Inc. has also utilized prescribed broadcast fire in the past to clear brush within rehab areas. This technique often required a pre-application of herbicide to kill some of the foliage on target brush species within the rehab units, so fire could be utilized when conditions were wetter than when green brush might burn. This technique likely still reduced overall herbicide usage, as some target weeds were killed by the prescribed fire, and others came back but required less herbicide to kill (due to less leaf area, and lower carbohydrate reserves in the root system).

W. M. Beaty & Associates, Inc. continues to explore the use of prescribed fire even today. Reforestation foresters within the company actively seek out assistance in the use of prescribed fire with state forestry experts (Cal Fire). The Cal Fire Vegetation Management Program (VMP) allows private landowners to enter into a contract with CalFire to utilize prescribed fire, with Cal Fire assuming the liability, while also providing expertise and manpower. However, despite frequently reaching out to the local Cal Fire foresters, there is no indication that Cal Fire is willing to utilize this program to assist the MUs with prescribed burning, due to Cal Fire's concerns with liability. These same liability concerns also severely restrict the MUs ability to use fire as a tool on their own (without VMP program help), and this is unlikely to change until state laws and regulations governing fire liability are reformed.

Stock Type Trials

W. M. Beaty & Associates, Inc. continually tests conifer seedling stock types and physiology as a method to reduce chemical vegetation management needs. Starting twenty years ago, W. M. Beaty & Associates, Inc. has installed several trials comparing small, medium, and large container

stock with various bare root stock types. The objective was to see what seedlings survived and grew the best for each conifer species, in order to occupy the site in the shortest amount of time, reducing the need for additional chemical treatments. Although trials in other regions have shown that larger coastal Douglas-fir seedlings (particularly plug-1) grew faster and stayed larger after planting, our results for our ponderosa pine, eastside Douglas-fir and true fir tests show a very shorter duration effect, with any differences attributable to initial stock size disappearing after only two years.

W. M. Beaty & Associates, Inc. has also conducted stock trials in combination with different chemical site preparation treatments for ponderosa pine. The studies looked at the interaction between stock type (containerized versus bare-root) and chemical choice. The results showed that treatments with sulfometuron (Oust), severely stunted root growth, height, and caliper for both stock types, and survival was no better than the no treatment control. Atrazine (Aatrex 9-0) treatments were safe on both stock types, but only controlled annual grasses and germinating broadleaves and did not control established brush or most perennial grasses. Products containing hexazinone (Velpar L and Pronone 10G) treatments were the most effective on herbaceous and brush competition. Both stock types were very tolerant to products containing hexazinone. Treatments with products containing hexazinone had the largest caliper and height as well as the best survival.

b. **(Fill in only if you represent a medium-scale MU)**

Please describe how you will support and/or be involved in a research program from research agencies/institutions (e.g. universities) or commercial enterprises in the requested derogation period, including devoted resources and expected timelines.

N/A

c. **(Fill in only if you represent a small-scale MU)**

Please describe the program to exchange information related to pesticides use with other forest managers, to contact research institutions and/or search in alternative databases that will be implemented in the requested derogation period.

N/A

d. **(Fill in only if you are applying for the renewal of a derogation)**

Please describe the programs that have been implemented to investigate, research, identify and test alternatives to the requested 'highly hazardous' pesticide, and the results.

N/A

4. Stakeholder Consultation

a. Please indicate the dates when the stakeholder consultation was conducted.

b. Please indicate which affected stakeholders (eg. Neighbouring, local communities, forest workers) have been consulted.

<u>Economic</u>

Collins Pine Company, Chester CA, Eric O'kelley, Forester, eokelley@collinsco.com

Collins Pine Company, Lakeview, OR, Travis Erickson, Lands Manager, TErickson@CollinsCo.com

Forest Landowners of California, Larry Camp, ldccac@sbcglobal.net

Fruit Growers Supply Company, Burney CA, John Eacker, Regional Manager, john.eacker@fruitgrowers.com

Hancock Forest Management – McCloud, James Wolter, Forester, jwolter@hnrg.com

Hearst Corporation, Lloyd Bradshaw, Chief Forester, lbradshaw@nctv.com

Jefferson Resources Company, Danielle Lindler, Owner, jrc@jeffersonresource.com

Pacific Gas & Electric Company, Don Pierce, Natural Resource Management, DEPj@pge.com

Roseburg Resources Company, Ken Scott, Regeneration Forester, kens@rfpco.com

Sierra Pacific Industries, Herb Baldwin, Area Manager, hbaldwin@spi-ind.com

Soper-Wheeler Company, Paul Violett, Chief Forester, pviolett@soperwheeler.com

c. Please indicate other stakeholders consulted (e.g. government agencies for environmental protection or public health, scientific experts, regional/local authorities and associations, representatives of hunters, farmers or non-governmental organizations).

Environmental

California Department of Fish and Wildlife, Region 1, Joe Croteau, Environmental Program Manager, Joe.Croteau@wildlife.ca.gov

California Department of Fish and Wildlife, Region 2, Harvest Vieira, Environmental Scientist, harvest.vieira@wildlife.ca.gov

California Department of Forestry and Fire Protection, Donald R. Owen, Ph.D., Entomologist, don.owen@fire.ca.gov

California Department of Forestry and Fire Protection, Shasta Trinity Unit, Benjamin Rowe, Manager, Latour Demonstration State Forest, benjamin.rowe@fire.ca.gov

California Department of Forestry and Fire Protection, Lassen, Modoc, & Plumas Unit, Ivan Houser, Unit Forester, Ivan.Houser@fire.ca.gov

California Department of Pesticide Regulation, California Environmental Protection Agency, Department of Pesticide Regulation, Brian Leahy, Director

California Forest Pest Council, Robert Rynearson, Chairman, bobr@wmbeaty.com

Central Valley Regional Water Quality Control Board, Angela Wilson, Program Manager, awilson@waterboards.ca.gov

Lassen County Department of Agriculture, Agricultural Commissioner, agcommissioner@co.lassen.ca.us

Modoc County Department of Agriculture, Joe Moreo, Agricultural Commissioner, susiephilpott@co.modoc.ca.us

Natural Resources Conservation Service, Robert.Bailey@ca.usda.gov

Plumas County Department of Agriculture, Tim Gibson, Agricultural and Standards Inspector, TimGibson@countyofplumas.com

Shasta County Department of Agriculture, Paul Kjos, Agricultural Commissioner, pkjos@co.shasta.ca.us

Siskiyou County Department of Agriculture, Jim Smith, Agricultural Commissioner, jsmith@siskiyou.ca.us

Social

California Farm Bureau, Paul Wenger, President, cfbf@cfbf.com

California Forestry Association, David Bischel, President, davidb@calforests.org

Fall River Resource Conservation District, Bill Buckman, President, fallriverrcd@citlink.net

Honey Lake Valley Resource Conservation District, info@honeylakevalleyrcd.us

Pacific Forest Trust, Laurie Wayburn, Co-founder, Co-CEO and President, lwayburn@pacificforest.org

The Fly Shop, Inc., Duane Milleman, Guide Service / Private Waters, duane@theflyshop.com

The Forest Guild, Zander Evans, Interim Executive Director, zander@forestguild.org

The Nature Conservancy, California, Fran Price and John Randall, calweb@tnc.org

U.C. Cooperative Extension Office, Redding CA, Ryan DeSantis, Forestry/Natural Resources Advisor, rdesantis@ucanr.edu

USDA Lassen National Forest, Greg Mayer, Timber Management Officer, gmayer@frontiernet.net

USDA Modoc National Forest, Ann Mileck, amileck@fs.fed.us

USDA Pacific Southwest Research Station, Jianwei Zhang, Research Scientist, jianweizhang@fs.fed.us

USDA Pacific Southwest Research Station, Matt Busse, Research Scientist, mattbusse@fs.fed.us

USDA, USFS, Pacific Southwest Research Station, Nancy Gillette, Ph.D., Research Entomologist Emerita, negillette@fs.fed.us

USDA, USFS, Forest Health Protection, NE California Shared Services Area, Danny Cluck, Entomologist, dcluck@fs.fed.us

Western Shasta Resource Conservation District, Leslie Bryan, Westside Watershed Coordinator/Climate Stewardship Coordinator, leslie@westernshastarcd.org

d. Please describe the information on hazards, intended use of the HHP and commitment to prevent, mitigate and/or repair damage to environmental values and human health that has been provided to stakeholders.

The derogation application includes specified measures to prevent, minimize, and mitigate impacts in Section 2, which was provided to stakeholders in its entirety.

e. Please describe the consultation mechanism (i.e. public notices in local newspapers or on local radio stations, letters sent to potentially affected persons, meetings, field observations etc.) used to inform, consult and receive significant feedback.

The FSC® U.S. consulted with potential stakeholders via email correspondence.

f. Please summarize the comments received and how stakeholder concerns were addressed. (Where necessary, the original stakeholder comments may be requested).

5. Certification Body Evaluation of the compliance with the requirements of the previous derogation approval (To be filled in by the certification body only in renewal applications)

a. Please confirm if during the previous derogation period the applicant has identified and located on maps the streams, rivers, lakes and other water zones, as well as buffer zones and other sensitive areas (e.g. groundwater zone providing water for public consumption, natural reserves, conservation zones and protection areas for rare and threatened species, or habitat with biodiversity refuge.

b. Please confirm if during the previous derogation period the applicant has effectively implemented control measures to prevent, minimize and mitigate negative social and environmental impacts associated with the use of the 'highly hazardous' pesticides.

c. Please confirm if during the previous derogation period workers dealing with HHP were provided with appropriate training on the use of the PPE and the application of the HHP.

d. Please confirm if during the previous derogation period workers dealing with HHP were provided with appropriate personal protective equipment (PPE) and the use of them was enforced.

e. Please confirm if the applicant has implemented all the conditions set by the Pesticides Committee as part of the derogation approval.

References

Busse, Rappaport and Powers (USDA Forest Service Research Station, Redding CA). Hexazinone Effects on Soil Biota and Processes: Preliminary Findings (presented to the 22nd Annual California Forest Vegetation Management Conference).

DiTomaso, J.M., D.B. Marcum, M.S. Rasmussen, E.A. Healy, and G.B.Kyser. 1997. Post-fire site preparation enhances recovery of native plant diversity. California Agriculture 51(1):6-11.

Fredrickson, E. 2013. Evaluation of Hexazinone Efficacy and Conifer Tolerance Based on Several Replicated Trials for the Forest Stewardship Council Research Group.

Fredrickson, E. 2010. Literature Review of Non-Chemical Vegetation Control Methods in Forestry. For: the FSC Landowners Group, W.M. Beaty & Assoc, Roseburg Resources Co, Collins Pine Co and Potlatch Corporation.

Ganapathy, C. 1996. Environmental Fate of Hexazinone. Environmental Monitoring & Pest Management Branch, Department of Pesticide Regulation, Sacramento, CA.

Lewis NB and Ferguson IS. 1993. Management of Radiata Pine. Inkata Press, Melbourne.

McDonald, P.M., G.O. Fiddler, and P.W. Meyer. 1996. Vegetation trends in a young conifer plantation after grazing, grubbing, and chemical release. Res. Paper PWS-RP-228-Web. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 17 p.

Radosevich S, Lappé M, and Addlestone B. 2000. Use of chemical pesticides in certified forests: clarification of FSC criteria 6.6, 6.7, and 10.7, Washington D.C. (FSC-USA).

Sierra Cascade Intensive Forest Management Research Cooperative. Series Report No. 15. Annual Report. 2014. htttp://wric.ucdavis.edu.sierracascade/.

Trevethan. 2002. Hexazinone. Pesticide Fact Sheet: Forestry Use. Agriculture Chemistry Research and Extension, Department of Environmental and Molecular Toxicology, Oregon State University, and National Institute of Environmental Health Services, Environmental Health Sciences Center, Community Outreach Program, Oregon State University.

"Oxyfluorfen RED Facts." Pesticide Registrations. US Environmental Protection Agency. Accessed 9/17/2015. < http://www.epa.gov/oppsrrd1/reregistration/REDs/factsheets/oxyfluorfen_red_fs.htm>

Attachments

Fredrickson, Edward. 2015. Review of W. M. Beaty & Associates Cost/Benefit Analysis of Pindar GT Compared to Alternative Chemical and Non-Chemical Methods. Thunder Road Resources Co, unpublished report.

Blackeslee, Beth, Luciano Merolla, and Patricia Lopez-Mancisidor. 2015. FSC Oxyfluorfen Derogation. Dow Chemical Company, unpublished report.

FSC Oxyfluorfen Derogation

The EPA carefully regulates pesticides to ensure that legal uses are protective of human health, especially the health of children, and the environment. It evaluates comprehensive toxicity and exposure data in order to determine the risks associated with pesticide use and achieves this using the National Research Council's four-step process for human health risk assessment. This paradigm is underpinned by the fact that the amount of a substance a person is exposed to is as important as how toxic the substance might be when determining human risk. A low level of exposure to a very toxic pesticide may be no more dangerous than a high level of exposure to a relatively low toxicity pesticide and in many cases the amount of pesticide people are likely to be exposed to is too small to pose a risk.

The Health Effects Division of the Office of Pesticide Programs performs an independent review of studies conducted in mice and rats to evaluate the carcinogenic potential of pesticides. The results of the independent review are peer-reviewed by the Cancer Assessment Review Committee. This committee recommends a cancer classification. The classification will determine how the Agency regulates the pesticide and will include methods for quantification of human risk.

When assessing possible cancer risk posed by a pesticide, the EPA considers how strongly carcinogenic the chemical is (its potency) and the potential for human exposure. In order to provide some measure of clarity and consistency descriptors are used as part of the hazard narrative to express the conclusion regarding the weight of evidence for carcinogenic hazard potential. The weight of evidence to characterize hazard is recorded and summarizes the results of the hazard assessment and provides a conclusion with regard to human carcinogenic potential. This record explains the kinds of evidence available and how they fit together in drawing conclusions, and it points out significant issues/strengths/limitations of the data and conclusions.

The standard carcinogenic hazard descriptor for oxyfluorfen is "**Likely *to Be Carcinogenic to Humans***." However, the narrative associated with the descriptor is as follows; *This classification was based on the occurrence of treatment-related hepatocellular tumors in male mice and the lack of an adequate carcinogenicity study in a second species (rat). Although there were no mutagenic concerns for oxyfluorfen, the data were inadequate to support a nonmutagenic mode of action for liver tumorigenesis.*

For any pesticide classified as a potential carcinogen, the risk would depend on the extent to which a person might be exposed (how much time and to what quantity of the pesticide). It is not part of a cut-off criterion, but forms another part of the weight of evidence in the risk assessment process. Descriptors such as the one highlighted above represent points along a continuum of evidence; consequently, there are gradations and borderline cases that are clarified by the full narrative. The standard descriptor may be applicable to a wide variety of data sets and weights of evidence and is presented only in the context of a weight of evidence narrative.

Although the term "likely" can have a probabilistic connotation in other contexts, its use as a weight of evidence descriptor does not correspond to a quantifiable probability of whether the chemical is carcinogenic. In the case of oxyfluorfen the descriptor used was due to a default position that the tumours observed in the mouse study may be relevant to humans in the

absence of conclusive mode of action data. The EPA also decided that the rat carcinogenicity study in which no tumours were observed was deemed unacceptable. It is worth pointing out that the rat carcinogenicity study is acceptable in Europe and has been used in the classification of oxyfluorfen in said geography. In assessing the cancer risk of oxyfluorfen a conservative approach has been adopted, which includes a linear low-dose quantitative approach being used for human risk categorisation.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. It should be made clear that when oxyflourfen is used in US forestry; (1) applications are not made to an edible crop, (2) mixers and handlers wear US EPA regulated Personal Protective Equipment (PPE), (3) workers abide by Re-entry intervals (REI), (4) buffers are used around water (they rarely spray where homes or crops are but they would be buffered also), and (5) applicators and Pest Control Advisors (those professionals that write the herbicide recommendations) are licensed by the state of CA.

Given the information provided above and the fact that the EPA has approved uses for this molecule we believe that oxyfluorfen is safe to use under certain exposure scenarios irrespective of the carcinogenic classification that it has been given by the EPA. The classification should not be used in isolation in order for decisions to be made as to whether oxyfluorfen should be approved for use by the Forest Stewardship Council.

Beth Blakeslee
Environmental Regulatory Sciences (ERS)
Dow AgroSciences

Luciano Merolla
Mammalian Toxicology and Human Health Risk Assessment
Dow AgroSciences

Patricia Lopez-Mancisidor (PhD)
Regulatory Ecotoxicologist
Dow AgroSciences

REVIEW OF W.M. BEATY & ASSOCIATES COST/BENEFIT ANALYSIS OF PINDAR GT COMPARED TO ALTERNATIVE CHEMICAL AND NON-CHEMICAL METHODS

NOVEMBER 2, 2015

BY: ED FREDRICKSON
INDEPENDANT PESTICIDE DEVELOPMENT SPECIALIST
PRESIDENT-THUNDER ROAD RESOURCES CO
21169 FALLING LEAF RD
REDDING, CA 96003
530-949-4734 CELL
530-549-3843 OFF

INTRODUCTION

This document is an independent review of the cost/benefit analysis conducted by W.M. Beaty & Associates (WMB) comparing Pindar GT to alternative chemical and non-chemical vegetation control methods.

Pindar GT is a new herbicide to forestry, but has been registered for use in tree crops and non-crop for several years. It contains two active ingredients, oxyfluorfen at 3.93 and penoxsulam at 0.083 pounds active ingredient per gallon. Oxyfluorfen is in the diphenylether family of herbicides and its mode of action is to inhibit the Protox enzyme needed for chlorophyll and heme biosynthesis, whereas penoxsulam is in the triazolopyrimidine family and inhibits the ALS enzyme needed for biosynthesis of three essential amino acids in plants valine, leucine and isoleucine.

Oxyfluorfen is tightly bound to soil particles and is practically non-mobile in most soil conditions. It also has a short half life of 30 to 40 days in soil. Penoxsulam is more mobile but rapidly broken down with half lives ranging from 20 to 58 days depending on soil type and climate. Both oxyfluorfen and penoxsulam have low toxicities to mammals, birds and bees, and penoxsulam has very low toxicity to fish. Oxyfluorfen is relatively toxic to fish but with its low soil mobility, any risks are easily mitigated. As a pre-emergent herbaceous treatment, applications of Pindar GT would be most likely applied only once during the course of a timber stands rotation, making the risks very minimal.

Extensive testing in California, Oregon and Idaho has shown Pindar GT to have unsurpassed conifer tolerance on species that are generally intolerant to hexazinone such as Douglas-fir, white fir, red fir, sugar pine, incense cedar and western larch. Ponderosa pine also has very high margins of safety regarding Pindar GT. Tolerance with Pindar GT is so high that it may be applied pre or post plant as well as pre or post conifer bud break without risk of damage. Applications may even include the addition of a surfactant without any negative effect.

Very effective vegetation control has been shown in the spring or fall with Pindar GT. It is primarily a pre-emergent herbicide when used alone, inhibiting both herbaceous vegetation and woody brush germination. Post-emergent activity is significantly enhanced with the addition of an adjuvant or low rates of other herbicides.

COST/BENEFIT ANALYSIS REVIEW

WMB thoroughly compared the cost and effectiveness of Pindar GT to other chemical and non-chemical methods of vegetation control, including a no-action scenario. Regarding their comparisons to other chemical applications, WMB chose to compare Pindar GT to applications involving either hexazinone or glyphosate. It should be noted that sulfometuron methyl and atrazine are also soil active products that have similar roles in forestry but on WMB's management areas are not used due to conifer tolerance issues with sulfometuron methyl and water quality concerns with atrazine. Therefore, their comparison to only hexazinone and glyphosate is adequate.

Regarding WMB's comparison to hexazinone and glyphosate, Pindar GT has many advantages over both herbicides. The main one being conifer tolerance. Douglas-fir, white fir and incense cedar are moderately to severely intolerant of hexazinone, even at low rates. Glyphosate applications are strictly limited to ground directed spray applications because no conifer species is tolerant to over the top glyphosate applications in the spring when newly planted release applications occur. No soil or foliar active herbicide has shown the conifer tolerance evident with Pindar GT to date.

Pindar GT also has several very attractive environmental attributes compared to hexazinone applications. It is relatively non-mobile in the soil and therefore will not leach through the soil profile. It also has a very short half life. Any risks to aquatic organisms are easily mitigated through the use of buffers because of these two attributes. Compared to typical hexazinone or glyphosate applications, fewer pounds of active ingredient are applied per acre with Pindar GT compared to typical application rates of either hexazinone or glyphosate. Pindar GT will most likely be applied only once over the course of a timber stands rotation, making any risks extremely minimal.

WMB's comparison to glyphosate is also correct in that the duration of control with glyphosate is short due to no soil residual activity, that repeat applications are necessary to achieve the same level of control as one application of Pindar GT. Control of competing vegetation early in the season with glyphosate is critical for newly planted seedling survival, so applications with glyphosate must be done early to capture the available soil moisture for the seedlings. However, by early summer, the summer annuals and woody brush seedlings germinate and the sites are quickly re-invaded with vegetation and seedlings are almost immediately under stress again. Survival in Mediterranean climates has shown to be severely impacted with as little as 25 percent vegetative cover (Oliver, 1984). Glyphosate treatments are generally not very effective, costly, and require more multiple applications in the long-term.

Cost is another comparison that WMB uses to justify the use of Pindar GT. Hexazinone is inherently an expensive chemical to produce and the price per pound reflects that. Three pints per acre of Pindar GT generally runs between the $60 to $65 per acre that WMB states in their analysis depending on what price gets negotiated with the distributor. General use rates of hexazinone range between three to four pounds product per acre and in general costs around $27 per pound for a range of $81 to $108 per acre. Labor rates would be the same as they state since they are getting applied in the same broadcast manner. The high cost of the glyphosate applications are due to the application method having to be a ground directed spray to protect the trees from any contact with the spray mix. WMB states the application cost to be $110 per acre. In reality this is probably on the low end as labor costs may go as high as $150 per acre depending on the amount of vegetation present. WMB also correctly states that multiple applications of this type will be necessary to achieve the desired level of vegetation control for successful establishment.

In Mediterranean and other climates mechanical or hand treatments alone are not a viable method of vegetation control (Newton & Dost 1984, Flint 1985, Knowe 1992, McDonald & Fiddler 1992, Fiddler & McDonald 1997) . Costs are extremely high, but more importantly the duration of control is incredibly short. Mechanical and hand treatments are most effectively used in an integrated program that includes herbicide use. Newton and Dost, 1984, also showed a significantly greater injury risk to workers with either mechanical or manual removal methods. There are other methods of manual control WMB did not focus on such as mulch mats, however, their installation and maintenance costs (sometimes exceeding $2000 per acre) along with mixed results do not make this a viable option either (McDonald & Fiddler 1992, McDonald et al. 1994). Overall, WMB was correct in their efficacy and cost assumptions regarding mechanical and hand treatments to control vegetation.

Other methods of a non-chemical nature could also have been addressed such as the non-synthetic and essential oil products to control vegetation such as vinegar, clove oil, cinnamon oil, corn gluten meal, etc. However, in almost all cases these methods have proven ineffective (Chase et al. 2004, Curran et al. 2005, Moran & Greenberg 2006, Chandran 2009, Webber & James 2009). Herbicidal symptoms using these methods are short lived and plant recovery occurs quickly. With some of the products such as the vinegar treatments, the active ingredient is acetic acid, which is toxic in itself and a severe eye irritant. Clove oils tended to be the most effective treatments, but only on very small newly germinated herbaceous broadleaved seedlings, and the rates required to effectively control the seedlings ranged in cost from $200 to $1000 per acre for the clove oil alone.

Biological controls such as insects and pathogenetic fungi and cultural methods could have been mentioned but do not provide a suitable alternative by themselves, but may have a fit as part of an integrated program. Biological controls tend to be too target specific and population levels are usually not adequate to achieve any desired level of control (Newton & Dost 1984).

WMB is correct in their assumptions for a no-action alternative. Survival and growth of conifer seedlings would be so negatively affected that sites would be dominated by woody brush and hardwoods with little to no conifer stocking (Powers & Reynolds 1999). This would also put their ownership under significant risk from fire for increased fuel loading. They also could not adequately meet state mandated stocking requirements under a do nothing approach.

CONCLUSION

Overall, I find WMB's cost/benefit analysis to be correct and adequate to justify a derogation for the use of Pindar GT on WMB's management area. The alternatives they did focus on were the most logical choices to compare to and their cost and efficacy assumptions were correct. Pindar GT use is justified due to lower use rates, increased conifer tolerance, low soil mobility, rapid breakdown, efficacy and a greater cost effectiveness.