Impacts of Glyphosate Application on Grizzly Bear Forage Production in the Coastal Western Hemlock Zone – Project 2.55

INTRODUCTION

This study was designed to determine the impact of glyphosate on grizzly bear forage at three levels — regional, watershed and site-specific; and to develop management recommendations for integrating grizzly bear habitat requirements and silviculture on floodplain and lower slope fan sites in mainland coastal British Columbia. A problem analysis (Biggs and Walmsey 1988) had shown "a complete lack of research on the impact of herbicides on the habitat and food resources of grizzly bear[s]."

Floodplains and lower slope fans in the Coastal Western Hemlock (CWH) Zone of mainland British Columbia are among the most productive conifer-growing sites in the world. The same area also supports some of the highest grizzly bear densities in Canada. Evidence collected throughout the coast indicates that floodplain and lower slope fan sites are heavily used by grizzly bears (e.g., Hamilton 1987). During their active season (Table 1), grizzly bears may feed in clearcuts on these sites and post-logging deciduous forests may also be important as bedding and feeding habitat (Hamilton 1987).

TABLE 1. Seasons of coastal grizzly bear activity (Weaver et al. 1986)

<table>
<thead>
<tr>
<th>Season</th>
<th>Start</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Early April</td>
<td>Den emergence to valley floor leaf flush to avalanche chute green-up</td>
</tr>
<tr>
<td>2</td>
<td>Late May</td>
<td>Avalanche chute green-up to berry availability (includes use of estuary)</td>
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<tr>
<td>3</td>
<td>Late June</td>
<td>Berry availability to salmon availability</td>
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<tr>
<td>4</td>
<td>Late August</td>
<td>Salmon availability to den entrance</td>
</tr>
<tr>
<td>5</td>
<td>Early November</td>
<td>Denning</td>
</tr>
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</table>

Past attempts to re-establish free-growing conifers on floodplain and lower slope fan sites have been mostly unsuccessful, generally because of competition from shrubs and deciduous trees. As a result, grizzly bear forage values lost when old-growth was logged were partially replaced by productive deciduous trees and shrub-dominated second growth. Now, however, the increased emphasis on intensive silviculture conflicts with the maintenance of forage values after logging. Herbicide treatment, site rehabilitation, and other vegetation management techniques contribute to a decline in forage supply. Therefore, depending on the proportion of the landscape covered by closed-canopy second-growth coniferous forests, the capacity of a watershed to sustain grizzly bears may be reduced.

METHODS

Five watersheds in the mainland CWH Zone of the Vancouver Forest Region were chosen as study sites. These watersheds had 1988 operational glyphosate treatments proposed for floodplain or lower slope fan sites. Pre-1988 treatments were also sampled. Treatment methods included hack-and-squirt and foliar application (aerial and backpack/powerhouse). Permanent 5 x 5 m "macroplots" were established in each treatment; 1-m² "microplots" were established at each inside corner of the macroplots. Plots were visited in 1988 and 1989, at which time data were collected for all fruit-bearing shrub species in each macroplot. Measurements included percent cover, vigour, distribution, phenology, and fruit abundance (Hamilton 1987). Percent cover, vigour, distribution, and phenology were also recorded for all vascular plants in each microplot.

Grizzly bear habitat was mapped in the Chuckwalla-Kilbella watershed to assess the impacts of glyphosate on habitat values at the watershed level. Habitat types were given a "bear value rating" (high, medium, low, or nil) for each of five seasons of bear use. Two ratings were assigned to glyphosate-treated habitat types: one that considered the impacts on bear forage; the other as though no treatment had occurred. Glyphosate impacts were projected for 3 years post-treatment only. The area of each habitat type was then determined, and the areas were totalled by bear value rating — first, with actual 1986–89 glyphosate treatments, and second, as if these had not occurred.

Information from the Pesticide Control Branch of the Ministry of Environment was summarized to assess impacts at the regional level and determine the level of glyphosate use in occupied grizzly bear habitat in the CWH. Additional information on glyphosate use was obtained from reports prepared by the Protection Branch, Ministry of Forests.

RESULTS AND DISCUSSION

Site-Specific

The shrub layer was affected significantly 1 year after hack-and-squirt treatments combined with foliar undersprays (46% decrease in percent cover) (Figure 1). However, on sites similarly treated in 1987, shrub cover and fruit abundance increased substantially between 1988 and 1999 (Figure 1). It is not known whether this recovery was equivalent to or greater than original productivity levels.

Changes in forage availability after hack-and-squirt treatments without foliar underspray are influenced by several factors including initial shade levels and species composition. Such treatments may actually enhance understory cover and productivity although any increases in fruit production may not be evident until 2–3 years after treatment as shrubs adapt to new light and moisture regimes.

Although there was some variation in the severity and distribution of impacts after the 1988 foliar treatments, results indicate a substantial loss of forage the 1st year after treatment (63% decrease in percent cover) (Figure 1). The shrub layer on sites with the highest impacts from 1987 foliar treatments recovered the most by 1989. However, unlike the 1987 hack-and-squirt treatments with underspray (which had high shrub cover in 1989), average cover in 1989 for the 1987 foliar treatments appeared to be one-third to one-half of what was typical for the site.

Watershed

Over a 4-year period, a 10% decline in the availability of high value berry-feeding habitat occurred in the Chuckwalla-Kibbelia watershed as a result of glyphosate use. Impacts are of particular concern when they occur on the floodplain and lower slope fans, because of the importance of these areas to grizzly bears. Fifty-nine percent of the area treated with glyphosate from 1984 to 1989 was less than 500 ft in elevation (45% of the land area below 500 ft has been logged). An increasing proportion of the low elevation habitats will reach the unproductive, intermediate seral stages as succession proceeds and more plantations become free-to-grow. Depending on the extent of these plantations, their age distribution, and the productivity and diversity of the old-growth and non-forested habitats across the landscape, long-term forage deficits may result.

Regional

Twenty percent of the total area proposed for forestry-related glyphosate use (90,252 ha) in the CWH under permits with start dates from 1985 to 1988 was in occupied grizzly bear habitat. An average of 1826 ha was treated annually with glyphosate in occupied grizzly bear habitat in the CWH between 1986 and 1988 (Table 2).

CONCLUSION

In addition to causing a short-term loss of forage, glyphosate use accelerates succession. Several studies have shown that closed-canopy conifer plantations have limited understory production (e.g., Alaback 1984). Under current Ministry of Forestry silviculture regulations, all logged sites must be restocked at prescribed standards and managed until seedlings reach the free-to-grow stage. Therefore, in areas where the majority of logging has occurred in the last 30 years, we predict there will be a grizzly bear forage deficit.

MANAGEMENT RECOMMENDATIONS

Our recommendations for the integrated management of grizzly bear habitat requirements and silviculture on floodplain and lower slope fan sites are:

1. to improve integration of silviculture, timber harvest, and wildlife habitat planning;
2. to improve timber resource, ecological, and wildlife mapping and inventories;

TABLE 2. Forestry-related glyphosate use in the CWH Zone 1986–88, summarized by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Total area treated (ha)</th>
<th>Area treated in occupied grizzly bear habitat (ha)</th>
<th>Percent of total area treated that is in occupied grizzly bear habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>5 138</td>
<td>1 564</td>
<td>30</td>
</tr>
<tr>
<td>1987</td>
<td>8 890</td>
<td>2 402</td>
<td>27</td>
</tr>
<tr>
<td>1988</td>
<td>9 570</td>
<td>1 511</td>
<td>16</td>
</tr>
<tr>
<td>Totals</td>
<td>23 598</td>
<td>5 477</td>
<td>23</td>
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3. to use the Biogeoclimatic Ecosystem Classification to structure integrated management prescriptions;
4. to assess proposed glyphosate treatments in the context of available grizzly bear habitat in the watershed;
5. to relax regional stocking standards on some floodplain sites (e.g., by managing for “gaps” in the canopy);
6. to avoid treatment of bear forage species not competing directly with crop trees by using selective ground spray rather than aerial and other broadcast methods; and
7. to consider alternative silvicultural systems and extended rotations.

REFERENCES


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