Executive Summary

Oregon Department of Forestry
Aerial Pesticide Application Project
Final Report
March 2000

Introduction

Forest pesticides, which include herbicides, fungicides, insecticides, and rodenticides, are commonly used to aid in the re-establishment, growth, and survival of forest tree species throughout Oregon. In 1997 the Oregon Board of Forestry revised forest practice rules governing application of pesticides and other chemicals (OAR 629-620). The rule revision process committed the Oregon Department of Forestry to monitor the effectiveness of the rules and report those findings to the Board of Forestry (OAR 620-620-700). In particular, the goal of this study was to test the effectiveness of the forest practice rules in protecting fish-bearing (Type F) and domestic use (Type D) streams from unacceptable drift contamination during aerial applications of forest pesticides.

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The focus of this monitoring project was on a subset of the Division 620 rules: Chemical and Other Petroleum Product Rules. The purpose of the Division 620 rules is to "ensure that chemicals used on forestland do not occur in the soil, air or waters of the state in quantities that would be injurious to water quality or to the overall maintenance of terrestrial or aquatic life."

Study Design

This project was designed to answer the following monitoring questions:

Are forest practice rules protecting water quality from drift contamination during aerial applications of pesticides?

Are forest practice rules protecting riparian vegetation during aerial applications of herbicides?

<u>Water Quality Sampling Design</u>
A total of 26 operations were sampled. Nineteen sites were sampled in the Fall of 1997 and seven sites in the Spring of 1999 (Figure 1). Sixteen sites were located in the Coast Range georegion,

eight in the Interior georegion, and two in the Western Cascades georegion. Twelve small, nine medium, and five large streams were sampled from these georegions. Twenty-one were Type F, three were Type D, and two were Type N (neither fish-bearing or domestic water source) streams. The Type N streams (both small) had overstory riparian buffers similar to those found along Type F streams, a practice not required for small Type N streams. Stream wetted widths averaged nine feet with average velocity and stream flow of one foot per second and one cubic foot per second, respectively. The average stream length through the harvest unit was approximately 2000 feet.

- ***Water quality was sampled from streams on 26 volunteered operations in western Oregon.***
- ***Vegetation surveys were conducted on 24 riparian management areas from 14 randomly selected operations***

The program focused on herbicide and fungicide applications. There were no insecticide operations conducted during the sampling period so that practice could not be monitored. Six samples were collected at each spray operation: one before the operation (control), and one each at 15 minutes, 2 hours, 4 hours, 8 hours, and 24 hours after the operation.

The Oregon Department of Agriculture laboratory analyzed the water quality samples individually. Samples from 21 sites were tested at a method detection limit (mdl) of 1 part per billion (ppb). This means that any chemical present at levels less than 1 ppb would not have been detected. Samples from the remaining 5 sites were tested at mdls that ranged from 0.04 to 0.5 ppb. The detection limits used in analyzing all of the water quality samples (1 ppb and lower) are well below the concentrations currently considered injurious to human health and aquatic biota.

Water samples were tested individually by the ODA laboratory. Very low (1 ppb and less) detection limits were used in analyzing the water quality samples.

Riparian Vegetation Surveys

During herbicide applications, the riparian vegetation identified by the water protection rules must be protected. "Protection" means no direct application and no damage resulting in the loss of function of the riparian area. Protection of understory and overstory vegetation from aerial herbicide applications was surveyed on 24 RMAs from 14 randomly selected harvest operations. Herbicide application occurred six to eighteen months prior to the field evaluation.

Evenly spaced transects were established every 100 to 200 feet depending on the length of the RMA. Transects ran perpendicular to the stream. Along each transect the surveyed understory and overstory vegetation for impacts from herbicides (e.g. deformed or curled leaves, spotting, or dead vegetation).

Evaluation Methods

Protection of Water Quality

Since the forest practice rules allow for minute, but measurable, concentrations of applicable chemicals to reach waters of the state, rule effectiveness depends on determining if such

concentrations are considered injurious to water quality or terrestrial or aquatic life. Therefore, the forest practices staff, with input from Dr. Nancy Kerkvliet (Oregon State University) and Dr. Robert Pratt (Portland State University), developed Surface Water Quality Criteria for Forest Chemical Operations. These criteria, expressed as the 24-hour average concentration, were developed in 1996 from current toxicological studies as a basis for evaluating pesticide and fertilizer monitoring results. The water quality results of this monitoring study were compared against these values to evaluate whether identified drift contamination levels were a cause for concern for aquatic biota and human health.

Water quality results were compared against the surface water quality criteria developed by Dr. Nancy Kerkvliet (OSU) and Dr. Robert Platt (PSU) to determine if the observed levels would be injurious to water quality, human health and aquatic biota.

The surface water quality criteria are based on extended (chronic) herbicide and fertilizer exposure, even though it is assumed that drift contamination from a forest operation should only result in short term (acute) exposure. Therefore, it was assumed that these criteria represent concentrations at which it is highly unlikely that any long-term adverse impacts would occur for humans, fish, or aquatic invertebrates (Kerkvliet, et. al 1996). Even so, it must also be emphasized that these numbers are not intended to represent permissible pollution levels (Norris and Dost 1992). A more appropriate interpretation is to view the criteria as "thresholds of concern" that should trigger more intensive monitoring if often exceeded when BMPs are followed.

Protection of Riparian Vegetation

Effectiveness of the rules in protecting riparian vegetation was determined based on visible damage or destruction of overstory and understory riparian vegetation that resulted from aerial herbicide applications. The percent of the riparian area damaged was measured and reported.

Summary and Conclusions

Monitoring Question #1

Are forest practice rules protecting water quality from drift contamination during aerial application of pesticides?

Based on current understanding of the toxicity of commonly used forest pesticides with regard to human health and aquatic biota, the authors conclude that forest practice rules are effective at protecting water quality during aerial herbicide and fungicide applications on Type F and D streams. These results pertain to contamination from drift on Type F and D streams. The Type N streams sampled here had vegetation and spray-boundary offset buffers similar to those of Type F streams. Issues concerning other mechanisms of contamination were not addressed with this study. Furthermore, the effectiveness of water quality protection on streams without overstory riparian buffers or offset spray boundaries (typical practice on Type N streams) was not evaluated.

The authors conclude that forest practice rules are effective at protecting water quality during aerial herbicide and fungicide applications on Type F and D streams.

No pesticide contamination levels at or above 1 ppb were found in any of the post-spray samples analyzed.

No pesticide contamination levels at, or above 1 ppb were found in any of the post-spray samples analyzed. Seven of the 25 post-spray samples (from 2 sites) that were tested at levels lower than 1 ppb (mdl 0.5 to 0.04 ppb) were found to contain trace levels of the applied pesticide. Contamination levels ranged from 0.1 to 0.9 ppb. The contaminants included hexazinone from site 22 and 2 4-D ester from site 25. The forest practice rules allow for some level of contamination as long as it is not harmful to aquatic or terrestrial life, human health, or water quality.

Current literature and ODF monitoring criteria indicate that thresholds of concern for human health and aquatic biota start at levels much higher than 1 ppb.

Current literature and ODF monitoring criteria indicate that thresholds of concern for human health and aquatic biota start at levels much higher than 1 ppb. The surface water quality criteria for hexazinone (found in five samples from site 22) are 2500 for human health, 3200 for trout health, and 52,000 ppb based on daphnia mortality. The surface water quality criteria for 2 4-D ester (found in two samples from site 25) are 300 ppb for human health, 7 ppb for bluegill health, and 100 ppb based on daphnia mortality.

Monitoring Question #2

Are forest practice rules protecting riparian vegetation during aerial application of pesticides?

Forest practice rules are effective at protecting understory and overstory riparian vegetation on Type F and D streams during aerial application of herbicides. There was no damage to riparian vegetation protected by the FPA water quality rules that occurred as a result of herbicide applications on 24 RMAs along Type F streams.

Forest practice rules are effective at protecting understory and overstory riparian vegetation on Type F and D streams during aerial application of herbicides.

Recommendations

Future Monitoring

The results of this study indicate that chemical application monitoring is a low priority. Continued water sampling will occur as needed to respond to public complaints and to facilitate enforcement action.

If chemical monitoring is prioritized in the future, the focus should consider a number of topics that were not addressed by this study. They include non-biological insecticides, delayed effects that may occur days after the application as a result of precipitation runoff, water quality protection of small Type N streams, surfactants, "inert" ingredients, and fertilizers.

The results of this study indicate that chemical application monitoring is a low priority.

Policy

These results indicate that the rules are effective at protecting water quality on Type F and D streams. If the current scientific knowledge of hazard levels for human and aquatic biota do not change, no changes are recommended to the forest practice rules.

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The department, in partnership with the research community, should continue to refine the surface water quality criteria to address new pesticides (e.g. clopyralid) and to incorporate new information derived from toxicological studies.

The aerial pesticide monitoring study and executive summary reports were prepared by forest practices monitoring program staff: Liz Dent and Joshua Robben.

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