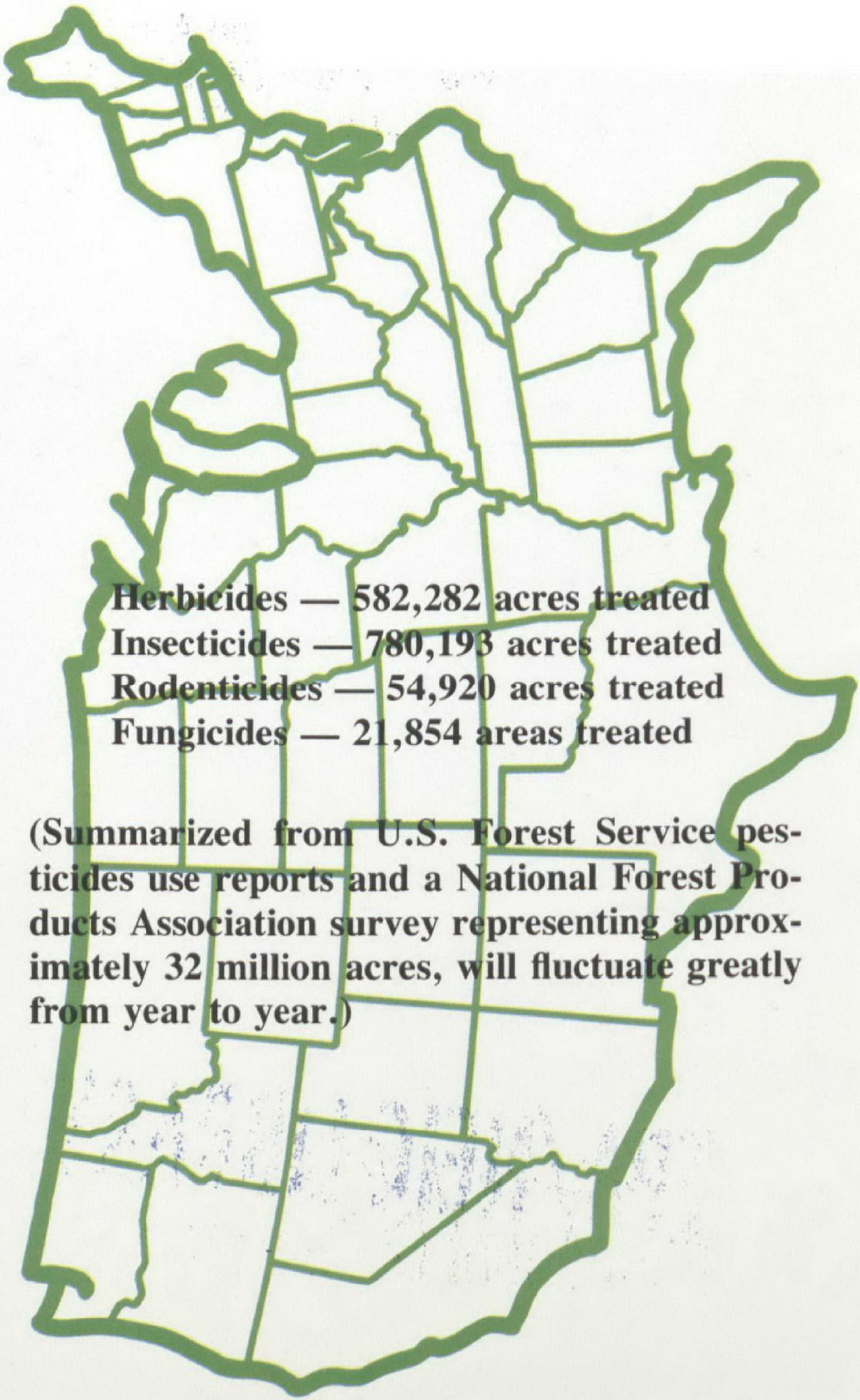
FOREST CHEMICALS AND WATER QUALITY

REPORTED SILVICULTURAL PESTICIDE USE IN CONTINENTAL UNITED STATES, 1972



Herbicides — 582,282 acres treated
Insecticides — 780,193 acres treated
Rodenticides — 54,920 acres treated
Fungicides — 21,854 areas treated

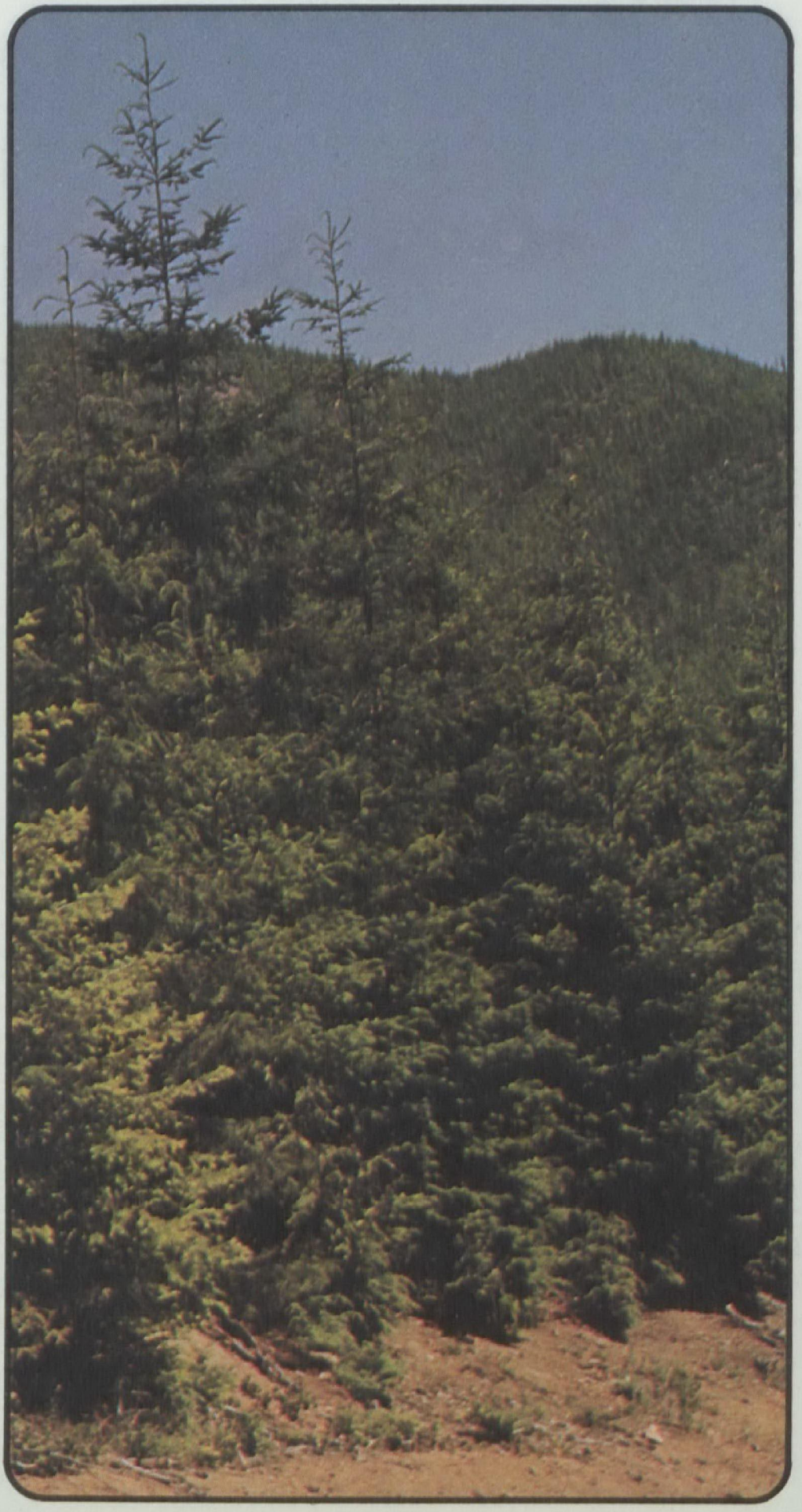
(Summarized from U.S. Forest Service pesticides use reports and a National Forest Products Association survey representing approximately 32 million acres, will fluctuate greatly from year to year.)

INTRODUCTION

There are approximately 0.5 billion acres of commercial forest lands in the United States. Chemical application to the forest land for enhanced production has fluctuated widely from year to year; however, as many as 2 million acres may receive one or more forms of chemical treatment in any given year.

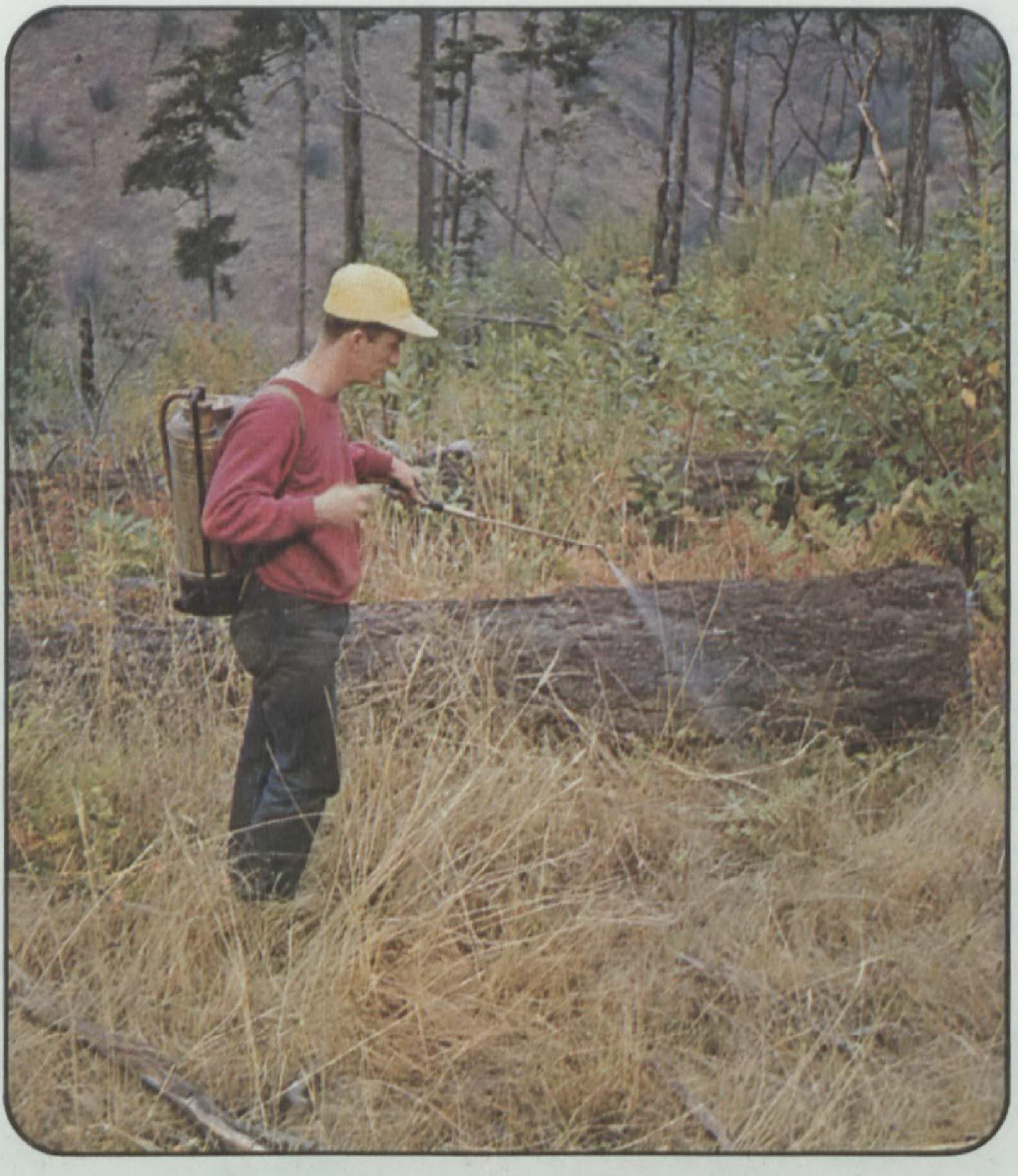
Three general groups of chemicals are used, all of which might result in significant water pollution if application procedures are not carefully controlled. The categories are: fertilizers (for increased fiber production), herbicides (for species selectivity), and insecticides and rodenticides (for pest control).

EPA Region X has recently published a detailed report, "Silvicultural Chemicals and Protection of Water Quality." The report presents a general description of chemical use in silviculture, provides criteria for limiting concentrations of chemicals in water, identifies chemical behavior and establishes pollution control guidelines. Ordering information for it and related publications is given in the back of this brochure. This brochure is intended to touch on best management practices in forest chemical application. Procedures are presented that will better assure meeting the mandates for both environmental protection and high commodity production in America's forests.



APPLICATION METHODS

Aerial application by airplane or helicopter is by far the dominant method of chemical application.



Ground application of all classes of forest chemicals has traditionally involved small amounts of chemical at such distances from open water that possible detrimental impacts on streams are less than those of aerial application.

ENVIRONMENTAL CONCERNS

Toxic Chemicals

Many of the forest chemicals have toxic properties even at low concentrations. The miminum

dose necessary to produce a measurable effect (threshold dosage) in an organism will vary considerably from chemical to chemical. The toxic hazard of a chemical is dependent not only on dosage but also on (1) level of exposure, (2) duration of exposure, (3) route of contact, and (4) absolute toxicity of the compound. The concentration of a toxicant has a direct effect on aquatic organisms only in relation to the amount absorbed and the period of retention.

Nutrient Enriching Chemicals

A toxic impact from fertilizers would generally require extremely large application rates. The

primary concern for improper use of these chemicals is excess nutrient enrichment of surface waters due to either runoff or direct application to streams and lakes, resulting in heavy aquatic weed growths or stimulation of other aquatic organism growth that could lead to oxygen depletion, fish kills, and related problems.

NATURAL INFLUENCES ON IMPACTS

Generally, the nature of forest chemicals and accepted application procedures preclude excessive transport of the chemicals within a watershed. However, there are several factors related to climate and physical characteristics at the point of application that may influence the extent of impact. These include:

Nature and distribution of precipitation —
Torrential rain soon after application of water soluble chemicals will generally result in polluted runoff. Low intensity, intermittent rain several weeks after application will have little pollution effect.

Length and steepness of slopes —
This is generally of limited concern in forested areas because of ground cover effect on retention of runoff; however, steeper slopes will increase potential impacts where cover is light or increased surface runoff occurs.

Nature and distribution of ground and surface water —
Forest waters will often show higher levels of pollution in nearby flat areas where water tables approach the surface and small streams or swamps are numerous. Contamination can occur because of the difficulty in avoiding aerial application to water.

Nature of soils —
Pesticides that persist long enough to be washed from vegetation and through the forest floor material may be (depending on the type of pesticide) adsorbed onto the surfaces of the smaller soil particles, where a large variety of micro-organisms are capable of decomposing many of them. As long as groundwaters are not close to the surface, high soil porosity can improve the results of this process. However, water may move through very highly porous soils so rapidly that there is little opportunity for adsorption or microbial degradation.

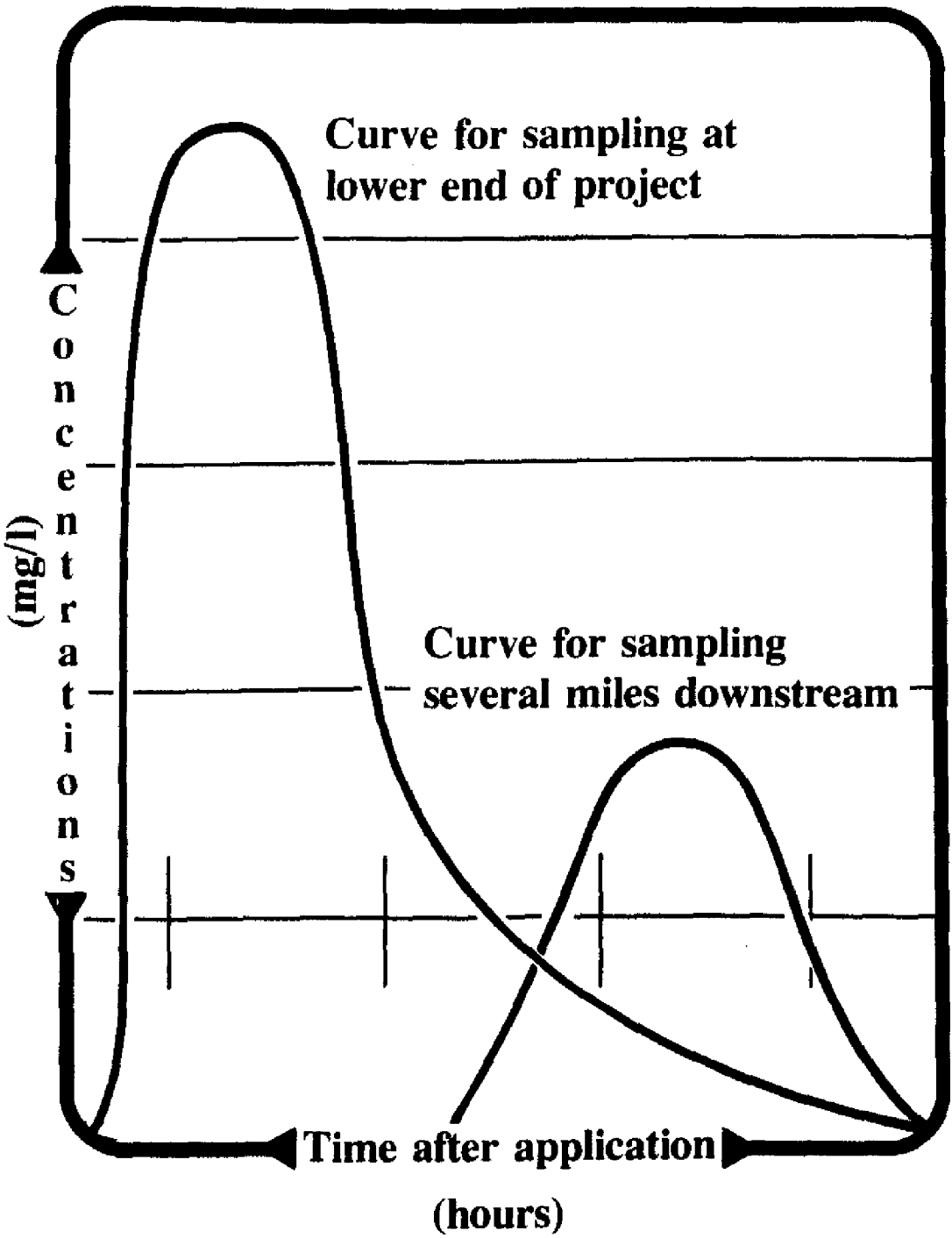
Other natural influences —
Extent of streamside cover vegetation, water depth at point of contamination, stream bottom characteristics, stream velocity, degree of aeration in the stream, suspended sediments in the stream, water temperature, availability of dilution water below the point of contamination, sensitivity of the aquatic community to the chemical being applied — these and more influences can determine the relative impact of a chemical application.

SEVERAL FACTORS THAT CAN AFFECT THE DEGREE OF CHEMICAL IMPACT

Increased Impact	Decreased Impact
Steep slopes	Infrequent application
Disturbed soils	Continuous ground cover
Application upstream from water users	High water dilution rates
Frozen soil during spring runoff	Low percentage of area treated
Thin soils	Porous soils
	Minimum surface runoff

The graph that follows shows pesticide concentration in a stream after 10% of a watershed was

sprayed. It points out how quickly the concentration can decrease given certain stream conditions and selected application techniques.



APPLICATION CONSIDERATIONS

Chemical and Environmental Characteristics

- Insecticides require greater safety measures than herbicides since acute insecticide toxicity tends to cause direct and immediate injury to aquatic and other non-target organisms.
- Chronically toxic materials (e.g. the persistent insecticides) require greater safety measures also to insure against long-term effects.
- Small streams (less than 10 c.f.s.) cleanse more rapidly and will tolerate a given peak level of contamination more readily without major harm than will a larger stream.
- Because large streams cleanse more slowly and more biological communities are exposed, the larger the stream the greater the needed safety measures.

Operational Considerations

Some state forest practices acts require the isolation of treatment areas from open water. The effectiveness of a buffer strip in minimizing pollution is dependent on application droplet size, basic swath width, and degree of precision in control of the aircraft. It is necessary to:

- Maintain control over the proximity of the application to the stream.
- Maintain control over the choice of chemical, hence the probability for an application rate to cause damage.
- Maintain control of the dispersion from application equipment.

Technical Considerations

An important control factor is to minimize fine droplets that may be widely dispersed in a 1 to 10 mph wind during chemical application. This can be accomplished in several ways:

- Reducing boom pressure.
- Increasing orifice size.
- Orienting nozzle into air stream.
- Using specialized boom and nozzle designs.
- Minimizing straight oil in spray mix.
- Using spray adjuvants to thicken spray mix.

Management Considerations

- **Substitute less harmful practices when operating in streamside buffer strips.**
- **Restrict general use of organochlorine insecticides.**
- **Train and license chemical applicators.**
- **Eliminate picloram and dicamba chemical residues in water used for irrigation.**
- **Monitor silviculture applications to be certain both that recommended doses and application procedures are being followed and that these are effectively maintaining water quality.**

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For further information the following reports are available:

1. **"Silvicultural Chemicals and Protection of Water Quality" EPA 910/9-77-036, June 1977, through NTIS, PB 271923/AS, ($8.00) Springfield, Virginia 22161.**

2. **"Forest Harvest, Residue Treatment, Reforestation and Protection of Water Quality" EPA 910/90-76-020, April 1976, through NTIS, PB 253393/AS, ($9.25) Springfield, Virginia 22161.**

3. **"Forest Harvesting and Water Quality" EPA 625/5-76-013, available free of charge from Technology Transfer, U.S. EPA, Cincinnati, Ohio 45268. (18 page brochure)**

4. **"Logging Roads and Protection of Water Quality" EPA 910/9-75-007, March 1975, through NTIS, PB 243703/AS, ($9.75) Springfield, Virginia 22161.**

5. **"Logging Roads and Water Quality" EPA 625/5-76-011, available free of charge from Technology Transfer, U.S. EPA, Cincinnati, Ohio 45268. (18 page brochure)**

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