ments are slow acting and highly specific for the target species. However, in some situations it is possible that these agents may prohibit animals from using a pasture during relatively short periods.

## Prescribed Burning

The burning of rangeland may temporarily reduce grass and forb production, thus reducing available forage for livestock. However, in most cases, policy requires that livestock not be allowed on a burned area for two growing seasons after a prescribed fire so that forage has an opportunity to recover. The burning of rangeland generally results in greater perennial grass production and grazing capacity, as well as increased forage availability from the removal of physical obstructions to plants posed by dense stands of sagebrush or other brush species. Using prescribed burning in concert with herbicide treatments would effect the greatest positive response in situations involving brush land.

## Chemical Methods

Chemical treatments are generally applied in a form or at such low rates that they do not affect livestock. Most significant treatments would be applied when livestock are not in the treated pasture, but spot treatments could be applied any time, regardless of the presence of livestock. Animals consuming forage treated with certain herbicides (picloram, 2,4-D, and dicamba) cannot be slaughtered for food within the time specified on the herbicide label. Dairy animals should not be allowed to graze on areas treated with certain herbicides (picloram, 2,4-D, and dicamba) for the time specified on the label. The potential for livestock exposure to herbicides can be reduced by not allowing grazing within the sprayed areas for one grazing season.

Based on the risk analysis in Appendix E-8, the estimated doses for livestock would be well below the EPA risk criterion of 1/5 $LD_{50}$ for all of the program herbicides. Therefore, the risk of direct toxic effects to these animals is negligible, even assuming exposure immediately after herbicide treatment.

Using herbicides is the most efficient and effective way to control some competing vegetation and noxious weeds. However, some aerially applied herbicides also may eliminate some shrubs and trees that livestock need for shelter.

# WILD HORSES AND BURROS

Approximately 36,000 wild horses and 3,300 burros roam the sagebrush and desert shrub regions of the program area. Because most of these animals are on public lands in Arizona, Colorado, New Mexico, Nevada, Montana, Oregon, Utah, and Wyoming, BLM must consider the effects on wild horses and burros when proposing land management strategies. As a result of BLM's herd management efforts, herd populations have increased at an annual rate, which is currently 16 percent overall, since 1971 (BLM 1985). Unfortunately, the increased numbers of wild horses and burros, in combination with other resource demand (for example, livestock grazing and outdoor recreation), are exerting greater ecological pressure on their habitats, threatening the balance of these fragile lands (BLM 1985). Therefore, the effects, both positive and negative, on these wild animals as a result of vegetation treatment methods will essentially be the result of habitat alteration in the sagebrush and desert shrub regions.

## Manual Methods

Impacts of manual treatment methods on wild horses and burros would, in most cases, be the same as for livestock. Vegetation conversions using manual treatment methods in the habitat areas of wild horses and burros result in an increased diversity and production of grasses, forbs, and shrubs, which should be beneficial for herd populations.

## Mechanical Methods

Mechanical vegetation treatment methods may temporarily reduce forage available to wild horses and burros. However, long-term effects would prove beneficial. Mechanical treatments may temporarily displace wild horse herds.

## Biological Methods

Biological treatment methods should not significantly affect herd populations in either sagebrush or desert shrub analysis regions. Grazing, as a biological control method, may compete in a minor way with wild horses and burros, but this would be short term and highly localized. Biological treatments using insects and pathogens have little potential for affecting wild horses and burros because these treatments are host-specific and slow-acting.

## Prescribed Burning

Prescribed burning would temporarily reduce available forage for wild horses and burros, but ultimately it could result in increased plant production in treated areas. Using prescribed burning with chemical control could effectively control the targeted plant species and allow palatable forage grasses to regenerate rapidly.

### Chemical Methods

Wild horses and burros could be indirectly affected by changes in forage supply and herbicide exposure. Restricting grazing in sprayed areas for one grazing season could reduce the potential for this effect. Based on the risk analysis in Appendix E-8, using the representative species of beef cow and pronghorn respectively, the estimated doses for wild horses and burros would be well below the EPA risk criterion of 1/5 $LD_{50}$ for all of the program herbicides. Therefore, the risk of direct toxic effects to these animals is negligible, even assuming exposure immediately after herbicide treatment.

## SPECIAL STATUS PLANT AND ANIMAL SPECIES

Unidentified, unknown populations of special status plant and animal species in or near a treated site would be susceptible to any impacts discussed under Impacts to Vegetation and Impacts to Fish and Wildlife. Special status plants and animals may also benefit from vegetation treatments designed to enhance habitat; for example, prescribed burning or the removal of competing exotics.

As discussed in Chapter 2, all BLM actions will be evaluated for potential effects on State and federally listed threatened or endangered species. If the evaluation indicates a "no effect" situation, the action may proceed. If the evaluation indicates a "may affect" situation (may affect includes both beneficial and adverse impacts) on a federally listed species and the adverse impacts cannot be eliminated, Section 7 consultation with the U.S. Fish and Wildlife Service must be conducted. BLM does not have the authority to make a "no affect" finding if a "may affect" situation exists. For federally proposed species, a Section 7 conference will be conducted. There are no legal requirements for Federal candidate species other than BLM policy for multiple-use management and to eliminate the need for listing. BLM will consult with appropriate State agencies for adverse impacts to State-listed species.

## WILDERNESS AND SPECIAL AREAS

All vegetation treatments in Wilderness Study Areas (WSAs) and designated wilderness areas would be conducted to avoid impairing the wilderness characteristics of the area. Actions in WSAs are guided by the Interim Management Policy (IMP) until Congress makes a final wilderness decision. The IMP Handbook on page 47 states, "In 'grandfathered' grazing operations, if vegetative manipulation had been done on the allotment before October 21, 1976, and its impacts were noticeable to the average visitor on that date, the improvement may be maintained by applying the same treatment again on the land previously treated." Because most treated areas would have been deleted from the WSAs because of impacts on naturalness, few of these types of situations should occur.

Vegetation treatments in designated wilderness must follow the guidance contained in BLM's Wilderness Management Manual (BLM 1983). The guidance states:

Plant control must be approved only for:

(a) Native plants when needed to maintain livestock grazing operations where practiced prior to the designation of wilderness.

(b) Noxious farm weeds by grubbing or with chemicals when they threaten lands outside wilderness or are spreading within the wilderness, provided the control can be affected [sic] without serious impacts on wilderness values.

### Manual Methods

Manual treatments would be the least obtrusive method for use in wilderness areas; they are also the most expensive and least practical. Manual treatments can be very selective and would minimize damage to nontarget vegetation. This treatment would be best suited for small areas invaded by noxious weeds.

### Mechanical Methods

Mechanical treatment of vegetation would, in most cases, be incompatible with wilderness (or WSA) management. In very limited, site-specific cases, mechanical means may be appropriate if no other method is feasible. Also, areas mechanically treated in the past may need to be treated again, although most areas affected by mechanical treatment have been deleted from the wilderness process. Mechanical treatments also could be detrimental to other special areas, affecting their scenic value, at least in the short term. Positive effects in the longer term could include greater vegetation diversity, increased wildlife habitat, and better research and education opportunities.

## Biological Methods

Biological methods of vegetation treatment that may be considered for BLM use include grazing animals, insects, and pathogens. Because of their special status, wilderness and special areas have strict guidelines for vegetative treatment. Biological control by grazing animals in WSAs would only be practiced as specified in the Interim Management Policy. Vegetation management in designated wilderness areas must follow guidance contained in BLM's Wilderness Management Manual (1983). Insects and pathogens are good candidates for serving as biological agents for noxious weed control in wilderness areas, because they are host-specific and help restore the natural vegetative diversity of the treated area.

## Prescribed Burning

Prescribed burning is the most "natural" of the proposed vegetation treatment methods; however, the BLM manual states that prescribed burning may not be used solely as vegetation treatment in wilderness areas. Prescribed burning may be used to maintain fire-dependent natural ecosystems and to reduce the risk of wildfires. Prescribed burning could be beneficial in some areas, such as ponderosa pine forests or chaparral shrublands, where fire exclusion has affected the ecosystem's natural balance.

## Chemical Methods

Chemical methods may be used to remove noxious weeds, as long as they are used without adversely affecting wilderness values. Determining whether to conduct aerial spraying on wilderness and WSAs would have to be done on a site-specific basis. Chemical treatment on other special status lands may be used to eliminate the adverse visual effects of other treatment methods, such as chaining and blading.

# HUMAN HEALTH AND SAFETY

Manual methods of vegetation treatment should not affect members of the public because they would not handle any of the equipment involved. Workers may receive minor injuries from using hand tools. Workers using power tools also face some risk of major injury. Although mechanical methods should not affect the public, they would be at slight risk of injury from flying debris if they were near a mowing operation on a highway right-of-way project. Workers would be at risk from the same types of injuries that agricultural or construction workers face when they use tractors and other heavy equipment. Neither workers nor members of the public should be affected by any biological vegetation treatment methods.

Sensitive members of the public and some workers may experience minor ill effects, including eye and lung irritation from the smoke of prescribed fires. Workers may suffer burns from igniting or managing prescribed fires, although normal safety precautions should minimize this possibility. Escaped fires may place workers or members of the public at risk, but, again, safety precautions should minimize the possibility of escapes and should limit any risk to human health if wildfires occur.

Herbicide use results in few risks to members of the public, although they may be affected under worst case conditions or if they are exposed as a result of an accidental spraying or spill. There are risks to workers from herbicides, particularly in applications to oil and gas sites or rights-of-way, because of the high application rates used.

## Manual Methods

The public is not at risk from manual methods of vegetation treatment; only workers are likely to be affected. Manual methods use hand labor to remove competing vegetation, unwanted plants, and noxious weeds or to create conditions favorable for a desirable plant's growth. Techniques include cutting brush and vegetation with brush saws or chain saws, pulling weeds by hand, scalping the soil, and mulching the vegetation into the soil cover. Manual methods are one of the most expensive treatments and consequently are used on less than 10 percent of the total annual acreage treated.

Although most treatments would be conducted with hand-held implements, approximately 3 percent of the manual activities would involve hand pulling. Hand pulling exposes workers to the hazards of physical contact with irritant weeds, such as leafy splurge (Euphorbia esula), common tansy (Tanacetum vulgare), and poison ivy (Rhus radicans), that cause blisters, inflammation, and dermatitis. Sensitive individuals may react to the pollen of ragweed (Ambrosia sp.), and the close contact of hand pulling could cause significant discomfort.

Some manual treatment programs take place in remote wildlife habitat areas. Workers who happen to surprise or frighten animals are at risk from animal bites or attacks. Workers also risk exposure to biting and sucking insects, such as ticks and mosquitos. Certain tick species carry various diseases, including Rocky Mountain spotted fever and Lyme Disease. The high potential for encountering poisonous snakes during manual treatments presents another human health risk. Moreover, many treatment areas are remote, and the time necessary to obtain medical attention might complicate some cases of snakebite poisoning.

Workers using manual treatments need physical stamina and muscular strength. When temperatures are high, workers may experience increased fatigue, heat exhaustion, or heat stroke. Falls or other accidents may occur. Continual work in rugged terrain may cause or exacerbate existing chronic health problems, such as ligament damage or arthritis. In extreme cases, exertion from manual methods in rugged terrain may bring on a heart attack or stroke in susceptible workers.

Other potential hazards related to manual operations include injuries from handtools, such as axes, brushhooks, machetes, and mattocks, and hand-held power tools, such as chain saws and brush saws. Workers may cut themselves with tools, be hit by falling brush, or fall onto the sharp ends of cut stumps or brush. Injuries could range from minor cuts, sprains, bruises, or abrasions to severe injuries, such as major arterial bleeding or compound bone fractures. Unusually severe injuries, especially in remote regions, may be fatal. Although the total acreage treated with manual methods under Alternatives 1, 2, 3, and 4 varies by less than 5 percent, risks would increase as the total area treated by these methods is enlarged.

## Mechanical Methods

Mechanical vegetation treatment methods should not affect the public. Members of the public would be at slight risk of injury from flying debris if they were near a mowing operation on a highway right-of-way project. Workers would be at risk from the same types of injuries that agricultural or construction workers face when they use tractors and other heavy equipment. High noise levels associated with heavy equipment operations may cause operators to experience partial hearing impairment. Providing hearing protection for workers and notifying the public of field operations should be sufficient to avoid hearing loss. Machinery operators (tractor operators) could be injured by losing control of equipment on steep terrain or by coming into contact with falling trees, flying debris and rocks, and brush. Operators may be severely injured by overturning tractors. Proper treatment design and planning can minimize these risks.

## Biological Methods

Biological vegetation treatment methods include the selected grazing of cattle, goats, and sheep and selected introduction of parasitic insects for controlling noxious weeds. Selective livestock grazing is the most common biological treatment, accounting for 94 percent of the acreage treated using this method. Effective biological treatment requires the correct combinations of grazing animals, growth season, system of grazing, and stocking rates to achieve a grazing-induced reduction of less desirable or competing vegetation.

The biological treatment program acreage remains constant under Alternatives 1, 2, 3, and 4. Under Alternative 5, there is a slight decrease in the total acreage to be treated by this method. The combination of livestock numbers and duration of grazing may result in relatively high volumes of fecal matter deposited on biological treatment sites. This factor and the tendency for animals to congregate near live water sources create a potential for fecal contamination of surface waters. Members of the public who drink water downstream of these biologically treated sites may be exposed to fecally contaminated water. However, these risks are minimized by using stock tanks (alternate water sources), constructing range fences, and moving and dispersing grazing stock within treatment areas.

Insects are used for vegetation treatment on approximately 6 percent of the land identified for biological treatment. Pathogens are used for vegetation treatment on less than 0.5 percent of the acreage in the biological program. Both of these treatments involve using parasitic organisms to suppress populations of a specific targeted species of unwanted plants, competing plants, or noxious weeds. Insect and pathogen programs are carefully studied to ensure that they will not harm other nontarget or desirable vegetation species.

These biological methods are unlikely to cause human health effects. Evidence is insufficient to conclude that there is a potential for fecally derived, waterborne disease as a result of livestock grazing. The insects and pathogens proposed for use are target-specific. As more insects and pathogens become available as biological control agents, more will be released on BLM-administered lands.

## Prescribed Burning

This section presents a summary of the risks to members of the public and workers from the use of prescribed burning as a vegetation treatment method. A detailed analysis is found in Appendix D.

## Risks From Fire

If a burn escapes and causes a wildfire, members of the public in adjacent areas may be endangered.

Prescribed burning presents various hazards to ground crews, who could possibly receive injuries ranging from minor burns to severe burns that may result in permanent tissue damage. However, standard safety procedures, protective gear, and training are integrated into every prescribed fire plan and are expected to reduce or eliminate most hazards. If a burn escapes and causes a wildfire, the potential is higher for severe worker injuries, including fatalities.

## Risks From Smoke

A quantitative assessment was made of the risks to members of the public and workers from exposure to the combustion products of vegetation that may result from a prescribed burn. The hazard presented by the various combustion products was evaluated, exposures were estimated, and risks were assessed.

### Hazard Evaluation

Substances that may be found in wood smoke include particulate matter, carbon dioxide, nitrogen oxides, aldehydes, and ketones. The proportion of each varies widely, depending on factors such as moisture content in the vegetation and the temperature of the fire.

Particulate matter is a result of incomplete fuel combustion. Fine particulate matter, with a particle diameter of less than 2.5 microns, has a greater ability than do larger particles to avoid the body's defense mechanisms and reach the lungs. Carbon dioxide, nitrogen oxides, and other gaseous components of smoke generally decompose or diffuse into the atmosphere relatively quickly. However, some may attach to particulate matter and remain more concentrated and protected from decomposition. For example, aldehydes, which inhibit the removal of foreign material from the respiratory tract, may be absorbed onto the surface of particles. Polynuclear aromatic hydrocarbons, or PAHs, are of significant toxicological concern in evaluating health effects from wood smoke. The PAHs in wood smoke include at least five carcinogenic chemicals—benzo(a)pyrene, benzo(c)phenanthrene, perylene, benzo(g,h-,i)perylene, and the benzofluoranthenes.

### Exposure Estimation

Exposures to the carcinogenic and possibly carcinogenic PAHs in wood smoke from burning vegetation were estimated using methods developed by Dost (1986). Various atmospheric exposure levels were estimated that might be experienced by members of the public and workers, providing a range of doses from typical to worst case. A detailed explanation of the methodology is presented in Appendix D.

### Risk Analysis

Risks were calculated by multiplying the atmospheric concentrations of the combustion products by the total exposure time and the cancer potency of each chemical. Based on these calculations, estimated cancer risks are not expected to exceed the criteria of 1 in 1 million for any member of the public or worker, even in extreme cases, as a result of the carcinogenic PAHs in the smoke from burning vegetation. The cancer risk probabilities are presented in Appendix D.

Smoke from prescribed fires will impact air quality. Sensitive members of the public may experience eye, throat, or lung irritation from these exposures. Possible effects on workers as a result of smoke exposure may include eye irritation, coughing, and shortness of breath.

## Risks From Herbicides Used in a Brown-and-Burn Operation

Vegetation may be treated with herbicides several weeks before beginning a prescribed burn, with the goal of drying the vegetation to accomplish a more efficient burn. The herbicides that may be used in this method of treatment are 2,4-D, glyphosate, hexazinone, picloram, and triclopyr.

In this assessment of risk from volatilization of herbicide residues, the atmospheric levels of the herbicides were compared to threshold limit values (TLVs), which indicate an acceptable daily exposure level for workers to airborne chemicals over the course of their careers. Appendix D includes detailed information on the estimation of the atmospheric herbicide levels that may result from a brown-and-burn operation and a comparison of those levels to TLVs.

All estimated exposure levels are significantly less than the levels determined to be safe exposure levels. The risks were calculated using a smoke density that is likely to occur onsite and therefore represent risks to workers. Members of the public would be exposed to much lower atmospheric concentrations than these and would have a margin of safety that is even greater than that calculated for workers. Based on this method of risk estimation, neither workers nor the public are expected to be at risk from the herbicide residues volatilized in a brown-and-burn operation.

### Impacts by Program Areas

Prescribed fire will only be used as a vegetation treatment method on rangeland and public domain forests in the BLM program. Therefore, there will be no effects on human health from the use of this method on oil and gas sites, rights-of-way, or recreational and cultural sites.

Effects on human health from the use of prescribed fire on rangeland and in forests vary by the type of land, based on the amount of fuel available for burning and its moisture content. Drier fuel produces more smoke. A grassland with several thousand pounds per acre of fine fuels, all of which will essentially be consumed, may produce far more smoke than a forest underburn, where there is just enough litter to carry the fire. The risk of short-term health effects from smoke in a grass fire could be high to those in the immediate vicinity, because essentially all of the fuel is consumed in the flaming front of the fire; however, safety equipment and standard operating procedures mandated by BLM minimize the potential for these effects.

## Chemical Methods

Potential human health effects from using the 19 proposed herbicides—amitrole, atrazine, bromacil, chlorsulfuron, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, imazapyr, mefluidide, metsulfuron methyl, picloram, simazine, sulfometuron methyl, tebuthiuron, and triclopyr (Table 1-2)—the inert ingredient kerosene, and the herbicide carrier diesel oil were evaluated in a risk assessment (Appendix E). In essence, the risk assessment quantified general systemic and reproductive human health risks for a given herbicide by dividing the dose found to produce no ill effects in laboratory animal studies by the exposure a person might get from applying the herbicide or from being near an application site. Human cancer risk was calculated for those herbicides that caused tumor growth in laboratory animal studies by multiplying a person's estimated lifetime dose of the herbicide by a cancer probability value (cancer potency) calculated from the animal tumor data. The risk assessment included a qualitative analysis of the risk of heritable mutations and synergistic effects.

### Risk Assessment Structure

The risk assessment consisted of three steps—a hazard analysis, an exposure analysis, and a risk analysis.

The hazard presented by a chemical pesticide is its characteristic toxicity or poisonous quality that may cause human health effects. Those effects may be brief and reversible, such as nasal irritation or nausea in humans who receive small amounts, or much more severe, such as permanent organ damage or, in the extreme, death from larger amounts. All chemicals are injurious to health at some level of intake, even commonly consumed items such as aspirin, table salt, and sugar. The more toxic chemicals produce severe effects in much lower amounts than the less toxic chemicals.

Exposure is the amount of pesticide in a person's immediate surroundings (in the air, on the skin, in the food eaten, or in drinking water). The amount that enters the body—that one ingests, inhales, or has penetrated the skin during a specified time period—is the dose. A single dose is usually expressed in milligrams of chemical per kilogram of a person's body weight (mg/kg). Doses that occur over time are expressed per unit of time as milligrams per kilogram per day (mg/kg/day).

Risk from a chemical pesticide is the probability or expectation that if a person is exposed to the chemical under a specified set of circumstances (for example, if one eats berries growing near a site that has just been sprayed), that person may receive a dose that causes him or her to experience the kinds of toxic effects seen in laboratory toxicity studies on that chemical. Human health risk in the BLM vegetation treatment program is the possibility that humans will experience toxic effects from exposure to one of the proposed herbicides.

### Hazard Analysis

Evaluations of potential human health effects caused by pesticide exposure are generally based on results of toxicity tests in laboratory animals. The hazard analysis section (Appendix E, Section E3) describes the human health effects associated with each of the BLM herbicides. These laboratory animal data were supplemented by data on actual human exposure when available.

The routes of administration of test material for laboratory animal toxicity testing are selected based on the most probable route of human exposure. These routes of exposure include oral (by consumption of feed mixed with test material), dermal (application of the test material to the skin), and inhalation (exposure through breathing vapors or aerosol fumes). Levels of exposure (or doses) are expressed as milligrams of the chemical per kilogram of body weight of the test animal.

The reference dose (or acceptable daily intake) is an estimate (with uncertainty spanning perhaps an order of magnitude) of daily exposure of the human population (including sensitive subgroups) that is not likely to have an appreciable risk of harmful effects during a lifetime (EPA 1988). The reference dose, established by EPA, is selected using the lowest no-observed-effect level (NOEL) from the most relevant test species. An uncertainty factor of 100 is usually applied (10 to account for variation within the test animal species and 10 for extrapolation from animals to humans). The reference dose value is relevant in this discussion to the toxicity of the vegetation treatment herbicides because it provides a useful point of reference by which to gauge potential exposures of workers and the public used in this analysis.

Toxicological tests that were reviewed are in six categories.

#### Acute Toxicity

Acute toxicity studies are conducted to determine the $LD_{50}$ (the median lethal dose)—the single dose that kills 50 percent of the test animals. Acute toxicity tests also are used to estimate dosage levels for longer term studies. Acute toxicity studies are usually conducted over a 1- to 14-day period, depending on the purpose of the study.

#### Subchronic Toxicity

Subchronic studies establish the dose level at which no effects are observed in the test animals. This level is termed the NOEL. This type of toxicity study generally lasts 3 weeks to 3 months.

#### Chronic Toxicity

Chronic toxicity studies are longer (1 to 2 years) studies conducted to establish a NOEL. Chronic studies are useful in determining the long-term effects of a chemical, particularly its carcinogenic effects.

#### Reproductive/Developmental Toxicity

Reproductive studies are conducted to determine whether a chemical may diminish reproductive success, shown by effects on the fertility (production of germ cells), fetotoxicity (direct toxicity on the developing fetus), maternal toxicity, and survival and weight of offspring. Developmental studies (also called teratology studies) determine the potential of a chemical to cause malformation in an embryo or developing fetus between the time of conception and birth.

#### Oncogenicity/Carcinogenicity Studies

Oncogenicity studies examine the potential for a chemical to cause malignant (cancerous) or benign (noncancerous) tumors when consumed over the test animal's lifetime. Data on tumor formation are used to determine a cancer potency value. This value is defined as the increase in likelihood of getting cancer from a unit increase (1 mg/kg/day) in the dose of a chemical and is expressed as the probability per mg/kg/day.

#### Mutagenicity Assays

Mutagenicity assays are used to determine the ability of a chemical to cause physical changes (mutations) in an organism's basic genetic material.

Figure 3-3 summarizes the acute oral $LD_{50}$ values in rats for each chemical. Figure 3-4 summarizes NOELs for general systemic effects, such as decreases in body weight and food consumption, gross or microscopic abnormalities in tissues, or changes in hematology and blood chemistry. Figure 3-5 presents NOELs for reproductive or developmental effects. Sources for the data in Figures 3-3, 3-4, and 3-5 are found in Section E3 of Appendix E.

## Exposure Analysis

The human health risk assessment analyzed potential health effects to anyone who might be exposed to the proposed herbicides or carriers as a result of BLM rangeland, forest land, oil and gas site, right-of-way, or recreational and cultural site vegetation treatments. The risk assessment estimated human exposures for the herbicides proposed to be used for each category of treatment at the application rates listed in Table 1-2. The detailed methodology (Appendix E, Section E4) used to estimate human exposures to the proposed BLM herbicides is outlined here.

Two groups of people were considered at risk from each type of treatment—the public (who could be exposed if herbicide spray drift got on their skin, if they brushed up against sprayed vegetation, if they ate food items such as berries growing in or near sprayed areas or fish containing herbicide residues, or if they consumed water containing residues) and workers (including aerial, ground vehicle, backpack, and ground hand applicators). Exposure scenarios to estimate worker and public exposures were created for each of the five categories of treatment: rangeland, forests, rights-of-way, oil and gas sites, and recreation areas.

To represent the range of possible exposures from the BLM vegetation treatment program, three levels of exposure were estimated—routine-realistic, routine-worst case, and accidental.

Routine-realistic exposure scenarios used assumptions about typical herbicide applications, including herbicides used and application rates (Table 1-2), average site size, and normal distance to exposure points to estimate worker and public doses that might occur as a result of routine herbicide applications.

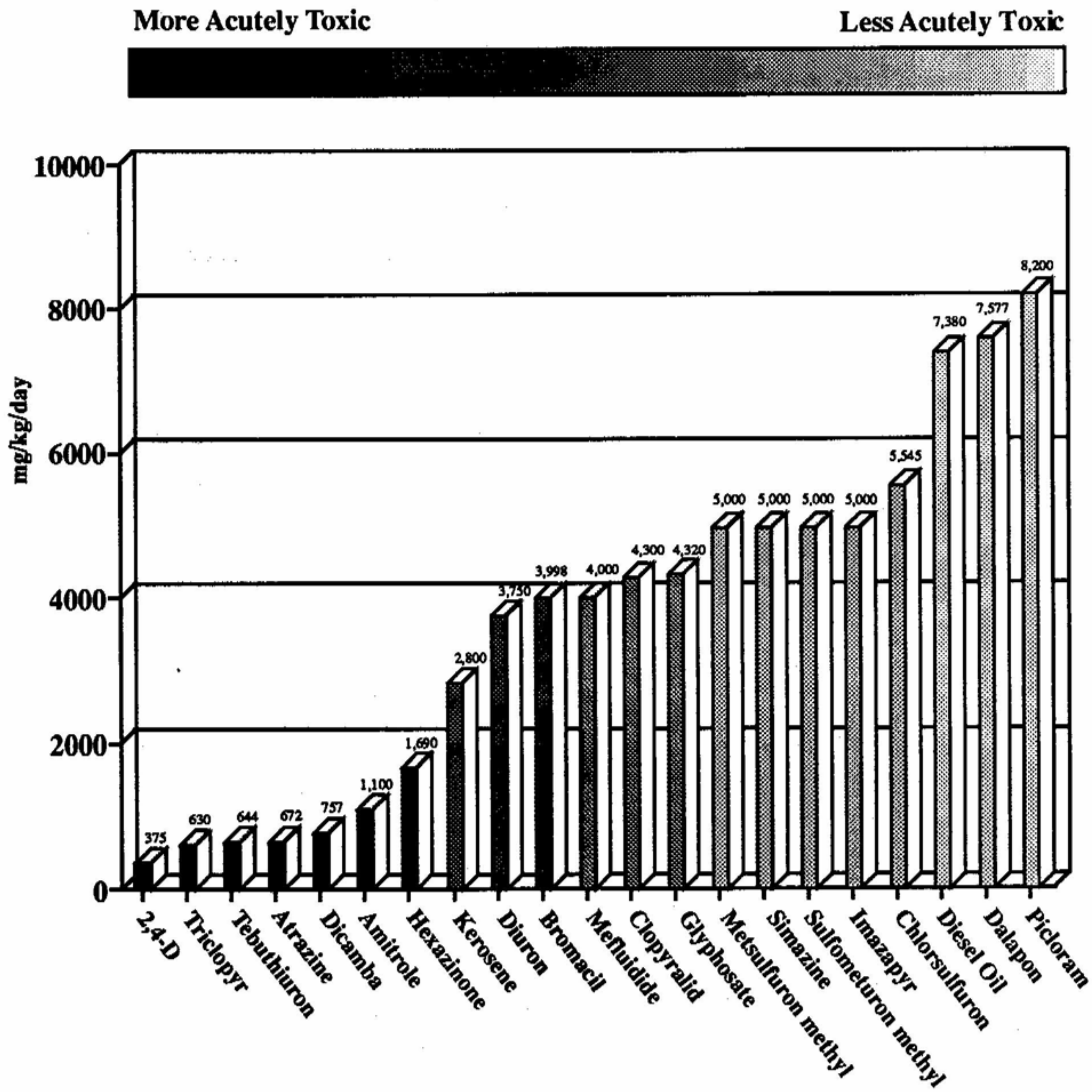



Figure 3-3
**Oral $LD_{50}$s in Rats**
**mg/kg/day**

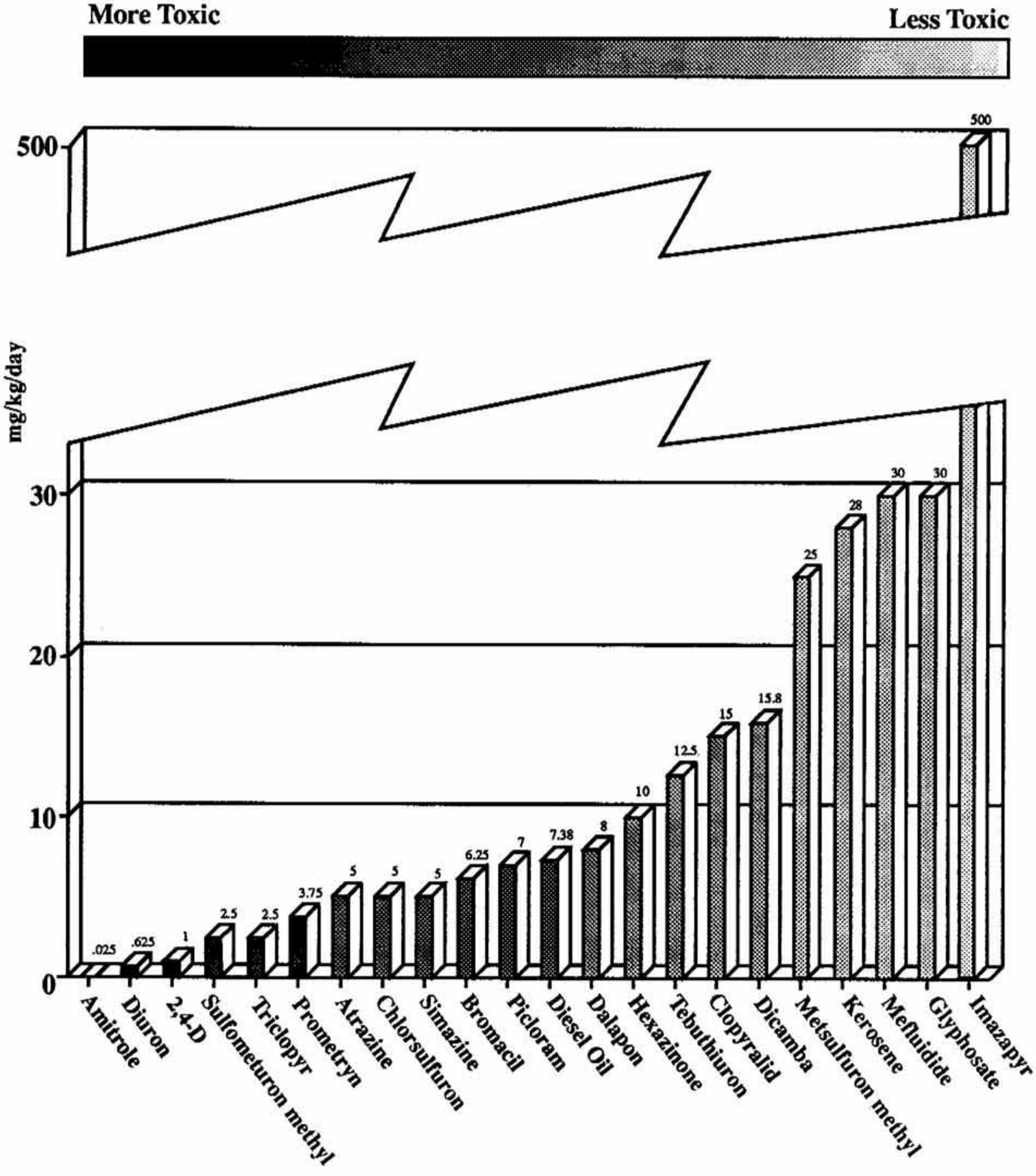



Figure 3-4
**Systemic NOELS**
**mg/kg/day**

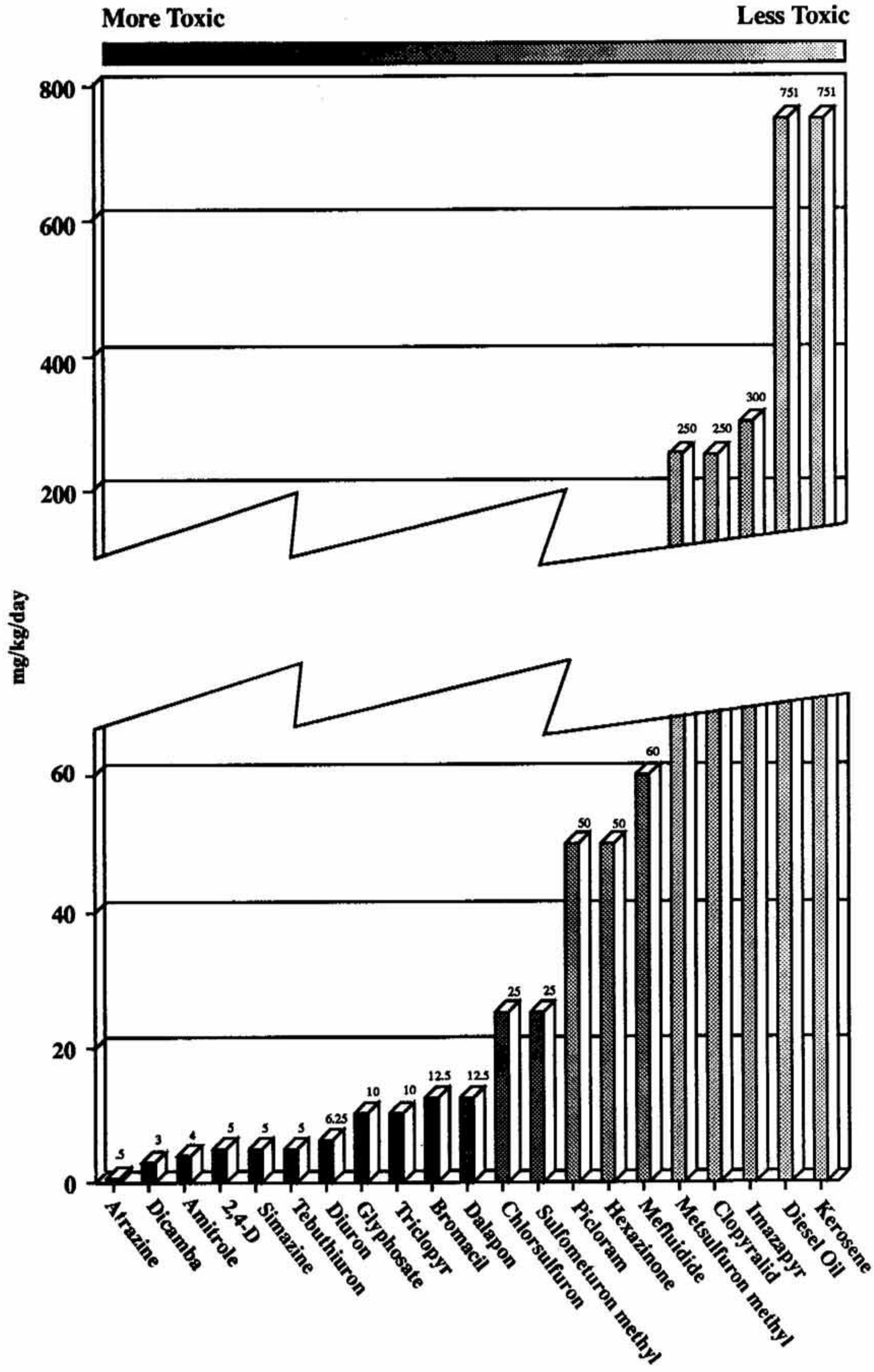



Figure 3-5
**Reproductive NOELS**
**mg/kg/day**

Routine-worst case scenarios were based on extreme values of the routine-realistic application characteristics, including largest site size and closest distance to exposure points to estimate the higher doses that might occur in less than 5 percent of all treatments. Routine-worst case assumptions were incorporated in the analysis to obtain the maximum exposures that may occur, except in the case of an accident.

Because the potential for error exists in all human activity, accidental exposure levels were estimated for a number of events that, in fact, may occur only rarely or never in the course of implementing BLM's proposed vegetation treatment program.

### Exposure Estimates for the Public

Members of the public could be exposed to the herbicides through dermal, inhalation, and dietary routes. Mathematical modeling (detailed in Appendix E, Section E4), based on field studies of herbicide residues, was used to estimate residue deposition on skin, in water, and on vegetation resulting from spray drift. Dermal and inhalation exposures to the public were estimated using routine-realistic and routine-worst case assumptions about the distance they are exposed downwind of a treated site. Dietary exposure to the public was estimated using three possible diet items, which included eating 0.4 kg (0.9 lb) of berries with drift residue, drinking 2 liters (about 2 quarts) of pond water that has received drift, and eating 0.4 kg (0.9 lb) of fish from a pond that has received spray drift.

In addition to estimating public exposures from each exposure route, multiple exposures were estimated assuming an individual could be exposed in several ways as a result of a single-spray operation. These multiple exposures, representing the worst case for cumulative public exposure from one application, included the following:

- Hiker—having dermal exposure from spray drift; contacting vegetation receiving spray drift, specific for a hiker; or drinking 2 liters (slightly more than 2 quarts) of water from a pond receiving spray drift.
- Berrypicker—touching vegetation with drift residues, specific for a berrypicker; drinking 2 liters (slightly more than 2 quarts) of water from a pond receiving spray drift; or eating 0.4 kg (about 14 ounces) of berries that have received spray drift.
- Angler—having dermal exposure from spray drift; touching vegetation with drift residues, specific for a hiker; drinking 2 liters (slightly more than 2 quarts) of water from a pond receiving spray drift; or eating 0.4 kg (about 14 ounces) of fish that were taken from a pond receiving spray drift.
- Nearby resident—having dermal exposure from spray drift; or contacting vegetation receiving spray drift, specific for a hiker.

### Lifetime Exposure Estimates for Public Cancer Risk

The cancer risk analysis for the public was based on four exposures per year for 5 years over a 70-year lifetime. Nineteen of the exposures were assumed to be at the routine-realistic level; one was assumed to be at the worst case level. This is in line with the estimated 5-percent probability of a person receiving a worst case exposure.

### Worker Exposure Estimates

Workers may be exposed dermally or by inhalation during routine operations, such as mixing and loading herbicides into application equipment or applying herbicides to sites. Actual field worker exposure monitoring studies were used to estimate doses to workers.

Four different types of workers (aerial applicators, backpack applicators, ground vehicle applicators, and ground hand applicators) were used to estimate doses to workers in the routine-realistic and routine-worst case scenarios. For all worker scenarios, routine-realistic exposures were calculated assuming average adjusted exposure rates based on field study data (detailed in Appendix E, Section E4) and application rates and frequencies estimated for the BLM vegetation treatment program.

### Lifetime Exposure Estimates for Worker Cancer Risk

Carcinogenic risk for workers was calculated based on 10 years of employment with 6, 9, 10, and 14 exposures per year for aerial, ground vehicle, backpack, and ground hand applicators respectively. Workers are assumed to receive 9 years of realistic exposures and 1 year of worst case exposures.

### Exposure Estimates From Accidents

Accidental doses to the people were estimated using the following scenarios:

- Consumption of 2 liters (slightly more than 2 quarts) of water from a reservoir that has received an accidental jettison of 80 gallons from an aircraft.
- Consumption of 2 liters (slightly more than 2 quarts) of water that has received a spill of 2,000 gallons of herbicide mix from a batch truck.
- Consumption of 0.4 kg (about 14 ounces) berries that have been directly sprayed.

- Dermal and inhalation exposure from a direct spray.
- Consumption of 2 liters (slightly more than 2 quarts) of water that has been directly sprayed.
- Consumption of 0.4 kg (about 14 ounces) of fish from a pond that has been directly sprayed.
- Immediate reentry—dermal exposure of a hiker or a berrypicker from contacting vegetation at a site that has just been sprayed.

#### Uncertainty in the Risk Analysis

There is uncertainty in relating dose levels used in laboratory animal studies to doses that may cause health effects in humans. To allow for the uncertainty in extrapolating from NOELs in laboratory animals to safe levels for humans, uncertainty factors of 10 were used to account for interspecies differences (animals to humans) and 10 to account for intraspecies differences (variations of sensitivity within the human population). This 10 times 10 or 100-fold safety factor was used in this analysis to evaluate acceptable risk levels. The margin of safety (MOS) between the estimated exposure and the NOEL is based on a comparison with the dose level that produced no effects in laboratory animals. Because most laboratory animal NOELs were established from daily exposures of up to 2 years, this comparison tends to overestimate risks to humans.

### Human Health Risk Analysis

The risk from a chemical pesticide is the probability or expectation that if a person is exposed to the chemical under a specified set of circumstances (for example, if he or she eats berries growing near a site that has just been sprayed), he or she may receive a dose that causes him or her to experience the kinds of toxic effects seen in laboratory toxicity studies on that chemical. Human health risk in the BLM vegetation treatment program is the possibility that humans will experience toxic effects from exposure to one of the proposed herbicides.

This section describes the potential human health effects of using the 19 proposed BLM herbicides and carriers in BLM's vegetation treatment program. This risk analysis quantifies general systemic and reproductive human health risks for a given herbicide by dividing the dose found to produce no ill effects in laboratory animal studies by the exposure a person might get from applying the herbicide or from being near an application site. Human cancer risk has been calculated for those herbicides that have caused tumor growth in laboratory animal studies by multiplying a person's estimated lifetime dose of the herbicide by a cancer probability value (cancer potency) calculated from the animal tumor data. The risk analysis includes a qualitative analysis of the risk of heritable mutations, synergistic effects, and cumulative effects.

The risk analysis compared the scenario-based estimates of doses to workers and the public with the toxicity levels detailed in the hazard analysis. These comparisons were used to determine the risk to humans under the specified circumstances of exposure.

For threshold effects, the doses were compared to NOELs determined in the most sensitive animal test species. An MOS, which is the animal NOEL divided by the estimated human dose, was computed to relate the doses and effects seen in animals to estimated doses and possible effects in humans. For example, an animal NOEL of 20 mg/kg divided by an estimated human dose of 0.2 mg/kg gives an MOS of 100, which is comparable to the 100-fold safety factor described in the Hazard Analysis section as being generally recognized as safe for humans. The larger the margin of safety (the smaller the estimated human dose compared to the animal NOEL), the lower the risk to human health. Where MOSs are greater than 100, the risk can be considered low to negligible for the chemical in question. MOSs less than 100 indicate a risk of toxic effects and should be the focus of mitigation.

When an estimated dose exceeded a NOEL, the dose was divided by the NOEL and the MOS preceded with a negative sign. The result was not an MOS, but simply a negative ratio. A negative ratio does not necessarily lead to the conclusion that there will be human toxic effects because NOELs used in this risk analysis are levels at which no adverse effects were observed in long-term animal studies. Negative MOSs, however, identify the most important exposures to mitigate. Estimated doses are not likely to occur often or on a long-term basis. This applies particularly to doses that are not likely to occur more than once, such as those to the public.

Systemic effects were evaluated based on the lowest systemic NOEL found in a chronic or subchronic feeding study of dogs, rats, or mice. Reproductive effects were evaluated based on the lowest maternal toxic, fetotoxic, or teratogenic NOEL found in a two- or three-generation reproductive study or in a teratology study.

An analysis of cancer risk was conducted for the pesticides suspected to be possible human carcinogens by multiplying estimates of lifetime dose by cancer potency estimates derived from laboratory animal study data to obtain a probability that a tumor will occur as a result of the specified exposure. Cancer risk from the herbicides for the public has been calculated for 20 exposures (19 realistic, 1 worst case) in a lifetime. Cancer risk to workers from the pesticides has been calculated assuming 10 years of employment, with 9 years of realistic and 1 year of worst case exposures.

Mutagenic risks for these herbicides were evaluated on a qualitative rather than a quantitative basis, with a statement of the probable risk based on the available evidence of mutagenicity and carcinogenicity in laboratory studies.

### Overview of Risk Assessment

There are no risks to members of the public from the use of hand application methods in any of the programs, even assuming worst case conditions. There are no significant risks to members of the public from the application of any herbicide by any method used by BLM on public recreation and cultural sites, even in the worst case scenario. Routine-realistic applications of amitrole to rangeland, public domain forest land, or rights-of-way by aerial or ground mechanical methods may lead to a significant risk to members of the public of experiencing systemic effects, as well as increasing the risk of cancer beyond the criterion of a 1 in 1 million probability. For routine-realistic rangeland treatments, this risk is only present as a result of eating fish from a body of water that has received amitrole spray drift or for the multiple exposures of an angler. However, the conservative assumptions made during the risk assessment may have overstated exposures and therefore risks, especially considering the remote location of most treatment sites.

Workers applying the herbicides on a regular basis face some risks, even assuming typical working conditions. These risks increase with the number of acres treated in a day and the toxicity of the herbicides used in each program area.

In general, mixer-loaders face higher risks from several herbicides in aerial applications than do pilots or fuel truck operators. However, certain herbicides present risks to each of these aerial application team members in all programs in which aerial spraying is used. With the exception of fuel truck operators, even typical exposures present some degree of risk.

Backpack applicators are not at risk from typical exposures that may be encountered during rangeland or public recreation and cultural site applications, but a risk is present when treating public domain forests, oil and gas sites, or rights-of-way.

Except for workers treating public recreation and cultural sites, the applicators, mixer-loaders, and applicator/mixer-loaders in ground mechanical operations face some degree of risk, even in typical scenarios. Risks for mixer-loaders are generally higher than those of applicators or of applicator/mixer-loaders, who divide their time between the two tasks.

Workers using hand application methods are faced with some risks, even in the realistic case. Use of atrazine, 2,4-D, triclopyr, or tebuthiuron most commonly leads to risks in excess of the criteria employed in this risk assessment.

Accidents present significant risks to any person who may receive the indicated exposures. The probability of any of these events occurring is small, however, because of normal safety precautions during applications, the remoteness of treatment units, the use of protective clothing by workers, and standard operating procedures required by BLM. Combined with this fact, the possibility of adverse health effects, such as those that may be predicted from accidental exposures, is remote.

The following discussions present the results of the risk analysis for the herbicides and carriers proposed for use on BLM-managed lands in the 13 Western States. The estimated exposures on which the risk estimates are based were calculated using the herbicide application information and methods described in Appendix E, Section E4. The MOSs and cancer risk values are based on the methods described briefly in this chapter and in detail in Appendix E, Section E5. The risks that exceed the risk criteria (MOS less than 100 or cancer risk greater than 1 in 1 million) are summarized in Tables 3-7 through 3-21 for each program for members of the public and workers. In the following sections, risks are discussed only for those scenarios in which the risks exceed these criteria.

### Risks From Rangeland Herbicide Treatments

Those applications that present a significant risk from herbicide use on rangeland under the BLM program are summarized in Table 3-7 for members of the public and Table 3-8 for workers. The herbicides used on rangeland are amitrole, atrazine, clopyralid, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, imazapyr, picloram, tebuthiuron, and triclopyr, as well as the carriers diesel oil and kerosene.

In terms of herbicide application, other agencies or private individuals in the vicinity of BLM-treated sites may be using other treatments of vegetation with many of the same chemicals as BLM proposes to use. Also, other pesticides may be used in agriculture, forestry, or industrial applications that might create an overall pesticide burden in an area where BLM plans to treat. While the herbicides used in the BLM treatment program are not expected to have an impact on water quality, streams that may receive some herbicide drift or runoff from the BLM areas also may be receiving drift or runoff of these other chemicals, and this cumulative pesticide burden may place the aquatic ecosystems at risk. Because of the remoteness of most BLM program treatment sites, this type of occurrence should be relatively rare.

**Table 3-7**

**High Risks to Members of the Public From Herbicide Use on Rangeland**

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | — | — | — |
| Drinking Water | — | — | AM | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | AM | — | AM, 4D | — | — |
| Hiker | — | — | AM | — | — |
| Berrypicker | — | — | AM | — | — |
| Angler | AM | — | AM, 4D | — | AM |
| Nearby Resident | — | — | — | — | — |
| **Backpack Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | — | — | — |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | — | — | — | — | — |
| Angler | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |
| **Ground Mechanical Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | AM | — | AM | — | AM |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | AM | — | AM | — | AM |
| Angler | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |

AM = Amitrole; 4D = 2,4-D

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

Another cumulative impact would be to workers who apply herbicides, both aerially and by ground methods. Some workers who apply herbicides in the BLM treatment program may apply or otherwise come into contact with the same herbicides or other chemicals used in agricultural, forestry, and industrial programs. This would result in workers being cumulatively exposed to a greater amount of an herbicide on an annual or lifetime basis or a wider variety of pesticides than any other individuals. For chemicals that pose a cancer risk to workers, the risks would depend on total lifetime exposure, which would include both BLM treatments and the other applications. In terms of possible synergistic effects, the wider the variety of chemicals handled, the greater the possibility of synergistic effects.

**Risks to Members of the Public.** In routine-realistic cases, members of the public may be at risk of systemic effects or have an increased cancer risk from some exposures that may result from the use of amitrole to treat rangeland vegetation.

***Aerial Applications.*** Routine-realistic aerial applications of the BLM herbicides present few risks to members of the public. The MOS is less than 100 for systemic effects from eating fish from a body of water that has received amitrole spray drift and for the cumulative exposure that an angler may receive from amitrole exposure.

Routine-worst case aerial applications present a risk of systemic effects from drinking water that has received amitrole spray drift; from eating fish from a body of water that has been contaminated with drift from nearby amitrole or 2,4-D applications; from cumulative exposure to amitrole by a hiker, berrypicker, or angler; and from cumulative exposure to 2,4-D by an angler.

No routine aerial applications of the herbicides on rangeland present a significant risk of adverse reproductive or teratogenic effects to members of the public. An angler's cumulative exposure to amitrole results in a risk of cancer that slightly exceeds the cancer probability risk criterion of 1 in 1 million.

***Backpack Applications.*** Backpack applications of herbicides on rangeland do not present any significant risks to members of the public. There are no significant risks of reproductive or teratogenic effects to members of the public from backpack applications of the BLM herbicides on rangeland. No cancer risk estimate exceeds 1 in 1 million for a member of the public in this scenario.

***Ground Mechanical Applications.*** Routine-realistic and routine-worst case ground mechanical applications of amitrole present a risk of systemic effects from vegetation contact by a berrypicker and from the cumulative exposure of a berrypicker. No significant adverse reproductive effects were predicted for members of the public from ground mechanical applications on rangeland. Vegetation contact by a berrypicker may result in a significant cancer risk from amitrole, as may the cumulative exposure received by a berrypicker.

***Hand Applications.*** BLM does not use these methods on rangeland.

**Risks to Workers.** In routine-realistic cases, some workers may be at risk of systemic effects from amitrole, atrazine, 2,4-D, dalapon, dicamba, tebuthiuron, triclopyr, or diesel oil; reproductive effects from atrazine, 2,4-D, dalapon, dicamba, glyphosate, tebuthiuron, or triclopyr; and increased carcinogenic risk from amitrole, atrazine, or 2,4-D.

***Aerial Applications.*** Imazapyr and picloram risk estimates for workers in aerial applications result in MOSs greater than 100 in both the routine-realistic case and routine-worst case for all aerial application worker categories. Imazapyr is not considered carcinogenic in this risk assessment. Although picloram may be a potential carcinogen, cancer risk estimates are less than 1-in-1 million for all workers in aerial rangeland herbicide applications.

Routine-realistic aerial applications of herbicides to BLM-managed rangeland may result in significant risks of systemic effects to pilots from amitrole, 2,4-D, or triclopyr and to mixer-loaders from amitrole, atrazine, 2,4-D, dalapon, dicamba, tebuthiuron, triclopyr, or diesel oil. No high systemic risks for fuel truck operators are expected as a result of routine-realistic aerial applications. In the routine-worst case, there are significant risks to pilots from amitrole, atrazine, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, tebuthiuron, triclopyr, diesel oil, or kerosene; to mixer-loaders from amitrole, atrazine, clopyralid, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, tebuthiuron, triclopyr, diesel oil, or kerosene; or to fuel truck operators from 2,4-D.

In the routine-realistic case, significant reproductive risks are present for pilots from the use of atrazine, 2,4-D, dicamba, or tebuthiuron and for mixer-loaders from atrazine, 2,4-D, dalapon, dicamba, glyphosate, or tebuthiuron. There are no high reproductive risks to fuel truck operators under realistic conditions. In the routine-worst case, there are significant adverse reproductive risks to pilots and mixer-loaders from atrazine, 2,4-D, dalapon, dicamba, glyphosate, tebuthiuron, or triclopyr and to fuel truck operators from atrazine or dicamba.

Cancer risks exceed 1 in 1 million for pilots and mixer-loaders from amitrole, atrazine, or 2,4-D. No estimated cancer risks for fuel truck operators in rangeland aerial herbicide applications exceed 1 in 1 million.

***Backpack Applications.*** Backpack applicators are not expected to face any significant systemic, reproductive, or cancer risks from the use of clopyralid, hexazinone, imazapyr, picloram, tebuthiuron, or kerosene on rangeland.

Routine-realistic backpack applications of herbicides to BLM-managed rangeland are not expected to result in significant systemic risks to applicators. However, in the routine-worst case scenario, there are high systemic risks from amitrole, atrazine, 2,4-D, dalapon, triclopyr, and diesel oil.

There are no significant reproductive risks to backpack applicators applying herbicides to rangeland in the realistic case. In the worst case, there are notable risks from atrazine, 2,4-D, dalapon, dicamba, and glyphosate.

Cancer risk estimates are significant for backpack applicators using atrazine or 2,4-D on rangeland.

***Ground Mechanical Applications.*** No excess systemic, reproductive, or cancer risks to workers from rangeland herbicide application by ground mechanical methods are expected to result from the use of clopyralid, hexazinone, imazapyr, picloram, or kerosene.

For workers using ground mechanical equipment to apply herbicides to rangeland, there are significant systemic risks in the routine-realistic case for applicators and applicator/mixer-loaders from 2,4-D and for mixer-loaders from amitrole, or 2,4-D. In the worst case, there are high risks to applicators and applicator/mixer-loaders from amitrole, atrazine, 2,4-D, dalapon, dicamba, glyphosate, tebuthiuron, triclopyr, or diesel oil and to mixer-loaders from amitrole, atrazine, 2,4-D, dalapon, dicamba, tebuthiuron, triclopyr, or diesel oil.

In the realistic case, there are significant reproductive risks from atrazine to applicators, mixer-loaders, and applicator/mixer-loaders. In the worst case, high reproductive risks are expected for applicators and applicator/mixer-loaders from atrazine, 2,4-D, dalapon, dicamba, glyphosate, tebuthiuron, or triclopyr and for mixer-loaders from atrazine, 2,4-D, dalapon, dicamba, glyphosate, or tebuthiuron.

There are significant cancer risks from ground mechanical rangeland herbicide application for applicators, mixer-loaders, and applicator/mixer-loaders from atrazine and 2,4-D.

***Hand Applications.*** Hand application of herbicides is not used on BLM-managed rangeland.

**Risks From Public Domain Forest Land Herbicide Treatments**

Scenarios in which the MOSs are less than 100 or cancer risk probabilities are greater than 1 in 1 million are summarized in Table 3-9 for members of the public and Table 3-10 for workers. The herbicides used on public domain forest lands are amitrole, atrazine, chlorsulfuron, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, imazapyr, picloram, simazine, tebuthiuron, and triclopyr, as well as the carriers diesel oil and kerosene

**Risks to Members of the Public.** In the routine-realistic case, members of the public may be at risk of systemic effects and have an increased carcinogenic risk from the use of amitrole on forests.

***Aerial Applications.*** Routine-realistic aerial application of BLM herbicides to public domain forest land may present a significant risk of adverse systemic effects to members of the public from eating fish from a body of water that has received amitrole spray drift and from the multiple exposures to amitrole that an angler may receive. Worst case aerial applications pose elevated systemic risks to those drinking water contaminated by amitrole spray drift, to those eating fish from a body of water contaminated by spray drift from amitrole or 2,4-D, to hikers with multiple exposures to amitrole, and to berrypickers' or anglers' multiple exposures to amitrole, atrazine, or 2,4-D.

Members of the public are not expected to have any significant reproductive risks from the routine-realistic aerial application of the BLM herbicides to public domain forest land. However, in the routine-worst case, there is a significant risk to berrypickers who may be exposed through several routes to atrazine.

Single routes of exposure are unlikely to result in a significant cancer risk to members of the public from aerial applications. The multiple exposures received by an angler may lead to a significant cancer risk from amitrole.

***Backpack Applications.*** Estimated systemic MOSs for members of the public for routine exposures in this scenario are all greater than 100. There are no significant reproductive risks to members of the public from routine exposures in this scenario. There are no significant cancer risks to members of the public from backpack applications of herbicides on BLM-managed public domain forest land.

***Ground Mechanical Applications.*** In the routine-realistic case, members of the public may have a risk of adverse systemic effects from the use of ground mechanical herbicide application of amitrole. In the routine-worst case, there is a significant risk of systemic effects from vegetation contact by a berrypicker and the multiple exposures that a berrypicker may receive from amitrole, and 2,4-D.

In the routine-realistic case, there are no significant reproductive risks from the ground mechanical herbicide application to members of the public. In the routine-worst case, there is a significant risk of reproductive effects from atrazine from the vegetation contact that a berrypicker may have and the multiple exposures of a berrypicker.

A significant risk of cancer exists from amitrole from the vegetation contact and the multiple exposures that a berrypicker may have.

## Table 3-8

## High Risks to Workers From Herbicide Use on Rangeland

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Pilot | AM, 4D, TC | AT, 4D, DC, TB | AM, AT, 4D, DP, DC, GP, HX, TB, TC, DE, KE | AT, 4D, DP, DC, GP, TB, TC | AM, AT, 4D |
| Mixer/loader | AM, AT, 4D, DP, DC, TB, TC, DE | AT, 4D, DP, DC, GP, TB | AM, AT, CP, 4D, DP, DC, GP, HX, TB, TC, DE, KE | AT, 4D, DP, DC, GP, TB, TC | AM, AT, 4D |
| Fuel Truck Operator | — | — | 4D | AT, DC | — |
| Backpack Applications | | | | | |
| Applicator | — | — | AM, AT, 4D, DP, TC, DE | AT, 4D, DP, DC, GP | AT, 4D |
| **Ground Mechanical Operations** | | | | | |
| Applicator | 4D | AT | AM, AT, 4D, DP, DC, GP, TB, TC, DE | AT, 4D, DP, DC, GP, TB, TC | AT, 4D |
| Mixer/loader | AM, 4D | AT | AM, AT, 4D, DP, DC, TB, TC, DE | AT, 4D, DP, DC, GP, TB | AT, 4D |
| Applicator/mixer/loader | 4D | AT | AM, AT, 4D, DP, DC, GP, TB, TC, DE | AT, 4D, DP, DC, GP, TB, TC | AT, 4D |

AM = Amitrole; AT = Atrazine; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; GP = Glyphosate; HX = Hexazinone; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-9

## High Risks to Members of the Public From Herbicide Use on Public-Domain Forest Land

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | — | — | — |
| Drinking Water | — | — | AM | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | AM | — | AM, 4D | — | — |
| Hiker | — | — | AM | — | — |
| Berrypicker | — | — | AM, 4D | AT | — |
| Angler | AM | — | AM, 4D | — | AM |
| Nearby Resident | — | — | — | — | — |

Table 3-9 (Continued)

High Risks to Members of the Public From Herbicide Use on Public-Domain Forest Land

| | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| Exposure Scenario | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Backpack Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | — | — | — |
| Drinking Water | — | — | AM | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | AM, 4D | — | — |
| Hiker | — | — | AM | — | — |
| Berrypicker | — | — | AM | AT | — |
| Angler | — | — | AM, 4D | AT | — |
| Nearby Resident | — | — | — | — | — |
| **Ground Mechanical Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | AM | — | AM, 4D | AT | AM |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | AM | — | AM, 4D | AT | AM |
| Angler | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |

AM = Amitrole; AT = Atrazine; 4D = 2,4-D

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

***Hand Applications.*** No significant risks of systemic effects, reproductive effects, or cancer are expected for members of the public as a result of hand applications of herbicides to BLM-managed public domain forest land.

**Risks to Workers.** Routine-realistic exposures of some workers may result in notable systemic risks from atrazine, 2,4-D, or triclopyr; reproductive risks from atrazine or tebuthiuron; and carcinogenic risks from amitrole, atrazine, 2,4-D, or simazine.

***Aerial Applications.*** MOSs are greater than 100 and cancer risks less than 1 in 1 million for workers aerially applying chlorsulfuron, imazapyr, picloram, or kerosene to BLM-managed public domain forest land.

In the routine-realistic case, there are significant risks of adverse systemic effects to pilots from 2,4-D and to mixer-loaders from 2,4-D, or triclopyr. MOSs are all above 100 for fuel truck operators in the realistic case. In the routine-worst case, there are significant systemic risks to pilots from amitrole, atrazine, 2,4-D, dalapon, dicamba, hexazinone, simazine, tebuthiuron, triclopyr, or diesel oil; to mixer-loaders from amitrole, atrazine, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, simazine, tebuthiuron, triclopyr, or diesel oil; and to fuel truck operators from 2,4-D.

In the routine-realistic case, aerial herbicide application to public domain forest land may result in significant reproductive risks from atrazine to pilots and mixer-loaders. Fuel truck operators' MOSs are all above 100 under realistic conditions. In the routine-worst case, there are significant reproductive risks to pilots and mixer-loaders from atrazine, 2,4-D, dalapon, dicamba, glyphosate, simazine, tebuthiuron, or triclopyr and to fuel truck operators from atrazine.

In this scenario, cancer risks exceed 1 in 1 million for pilots from atrazine, 2,4-D, and simazine, and for mixer-loaders from amitrole, atrazine, 2,4-D, and simazine. Cancer risks for fuel truck operators are all less than 1 in 1 million.

***Backpack Applications.*** No significant systemic, reproductive, or cancer risks are predicted for backpack applicators applying herbicides in BLM-managed public domain forest land from chlorsulfuron, imazapyr, picloram, or kerosene.

In the routine-realistic case, backpack applicators have a notable systemic risk from atrazine. In the routine-worst case, there are significant systemic risks from amitrole, atrazine, 2,4-D, dalapon, hexazinone, simazine, triclopyr, and diesel oil.

Reproductive risk is present for applicators in the realistic case from atrazine. In the worst case, high reproductive risks are posed by atrazine, 2,4-D, dalapon, dicamba, glyphosate, simazine, tebuthiuron, and triclopyr.

Significant cancer risks are present for applicators from atrazine, 2,4-D, and simazine.

***Ground Mechanical Applications.*** Workers using ground mechanical equipment to treat BLM-managed public domain forest lands are not expected to have any significant systemic, reproductive, or cancer risks from the use of chlorsulfuron, imazapyr, picloram, or kerosene.

The use of ground mechanical equipment to apply herbicides on public domain forest land results in systemic risks to mixer-loaders and applicator/mixer-loaders from 2,4-D in the routine-realistic case. Using worst case assumptions, significant systemic risks are posed for applicators from amitrole, atrazine, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, simazine, tebuthiuron, triclopyr, and diesel oil and for mixer-loaders and applicator/mixer-loaders from amitrole, atrazine, 2,4-D, dalapon, hexazinone, simazine, tebuthiuron, triclopyr, and diesel oil. In the routine-realistic case, atrazine poses significant reproductive risks for applicators, mixer-loaders, and applicator/mixer-loaders. In the worst case, there are significant reproductive risks for applicators, mixer-loaders, and applicator/mixer-loaders from atrazine, 2,4-D, dalapon, dicamba, glyphosate, simazine, tebuthiuron, and triclopyr.

For ground mechanical treatment of public domain forest lands, worker cancer risks exceed 1 in 1 million for applicators, mixer-loaders, and applicator/mixer-loaders from atrazine, 2,4-D, and simazine.

***Hand Applications.*** The hand applicator on BLM-managed public domain forest land is not expected to face any significant systemic, reproductive, or cancer risks from the use of hexazinone, imazapyr, picloram, or kerosene.

In the routine-realistic case, workers using hand equipment to treat public domain forest land with herbicides may have notable systemic risks from the use of 2,4-D, or triclopyr. In the routine-worst case, systemic risks are high to hand applicators from amitrole, atrazine, chlorsulfuron, 2,4-D, dalapon, simazine, tebuthiuron, triclopyr, or diesel oil.

Routine-realistic reproductive MOSs are less than 100 for hand applicators using atrazine or tebuthiuron. In the worst case, there are high reproductive risks from atrazine, 2,4-D, dalapon, dicamba, glyphosate, simazine, tebuthiuron, and triclopyr.

Cancer risks exceed 1 in 1 million for the hand applicator on public domain forest land from atrazine, 2,4-D, and simazine.

#### Risks From Oil and Gas Site Herbicide Treatments

Significant risks from herbicide applications on BLM-managed oil and gas sites are presented in Table 3-11 for members of the public and Table 3-12 for workers. The herbicides used on oil and gas sites are amitrole, atrazine, bromacil, chlorsulfuron, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, imazapyr, mefluidide, metsulfuron methyl, picloram, simazine, sulfometuron methyl, tebuthiuron, and triclopyr, and the carriers diesel oil and kerosene.

**Risks to Members of the Public.** In the routine-realistic case, no significant systemic, reproductive, or carcinogenic risks are expected for members of the public as a result of herbicide application to oil and gas sites.

***Aerial Applications.*** Routine-realistic aerial applications of herbicides on oil and gas sites are not expected to result in any significant risks of systemic effects to members of the public. Routine-worst case applications may lead to significant risks from diuron as a result of dermal exposure to spray drift, the multiple exposures of a hiker, or the multiple exposures of a nearby resident.

Routine-realistic aerial application to oil and gas sites is not expected to result in any significant reproductive risks to members of the public. However, in the routine-worst case, atrazine presents significant

## Table 3-10

## High Risks to Workers From Herbicide Use on Public-Domain Forest Land

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Pilot | 4D | AT | AM, AT, 4D, DP, DC, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, 4D, SI |
| Mixer-loader | 4D, TC | AT | AM, AT, 4D, DP, DC, GP, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AM, AT, 4D, SI |
| Fuel Truck Operator | — | — | 4D | AT | — |
| **Backpack Applications** | | | | | |
| Applicator | — | AT | AM, AT, 4D, DP HX, SI, TC, DE | AT, 4D, DP, DC GP, SI, TB, TC | AT, 4D, SI |
| **Ground Mechanical Operations** | | | | | |
| Applicator | 4D | AT | AM, AT, 4D, DP, DC, GP, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, 4D, SI |
| Mixer-loader | 4D | AT | AM, AT, 4D, DP, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, 4D, SI |
| Applicator/mixer-loader | 4D | AT | AM, AT, 4D, DP, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, 4D, SI |
| **Hand Applications** | | | | | |
| Applicator | 4D, TC | AT, TB | AM, AT, CS, 4D, DP SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, 4D, SI |

AM = Amitrole; AT = Atrazine; CS = Chlorsulfuron; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; GP = Glyphosate; HX = Hexazinone; SI = Simazine; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-11

## High Risks to Members of the Public From Herbicide Use on Oil and Gas Sites

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Spray Drift, Dermal | — | — | DU | AT | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Hiker | — | — | DU | AT | — |
| Nearby Resident | — | — | DU | AT | — |
| **Backpack Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |

**Table 3-11 (Continued)**

**High Risks to Members of the Public From Herbicide Use on Oil and Gas Sites**

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Ground Mechanical Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |

AT = Atrazine; DU = Diuron.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

reproductive risks from dermal exposure to spray drift and the multiple exposures that may be received by a hiker or a nearby resident.

Estimated cancer risk probabilities for members of the public as a result of aerial applications of herbicides on BLM-managed oil and gas sites do not exceed 1 in 1 million.

***Backpack Applications.*** Routine-realistic backpack applications of herbicides on BLM-managed oil and gas sites are not expected to result in any adverse systemic effects for members of the public. No significant reproductive effects for members of the public are expected from routine-realistic backpack applications on oil and gas sites. Cancer risks estimated for members of the public as a result of oil and gas site backpack herbicide application do not exceed 1 in 1 million.

***Ground Mechanical Applications.*** There are no expected significant systemic or reproductive risks to members of the public from ground mechanical herbicide application on BLM-managed oil and gas sites. No cancer risks in this scenario exceed 1 in 1 million.

***Hand Applications.*** There are no expected significant systemic, reproductive, or cancer risks to members of the public from the hand application of herbicides to oil and gas sites.

**Risks to Workers.** In routine-realistic cases on oil and gas sites, workers may be at risk of systemic effects from applying amitrole, atrazine, bromacil, 2,4-D, dalapon, diuron, mefluidide, metsulfuron methyl, sulfometuron methyl, simazine, or triclopyr; reproductive risks from atrazine, dalapon, diuron, simazine, or tebuthiuron; and carcinogenic effects from amitrole, atrazine, bromacil, 2,4-D, or simazine.

***Aerial Applications.*** Herbicides used in oil and gas site aerial applications for which no worker is estimated to have an MOS less than 100 or cancer risk greater than 1 in 1 million are chlorsulfuron, imazapyr, mefluidide, metsulfuron methyl, picloram, and kerosene.

Routine-realistic aerial application of herbicides to oil and gas sites may cause significant systemic risks to pilots from amitrole, atrazine, diuron, and simazine and to mixer-loaders from amitrole, atrazine, bromacil, 2,4-D, dalapon, diuron, simazine, and triclopyr. There are no significant adverse systemic risks to fuel truck operators in the realistic case. In the routine-worst case, there are significant systemic risks to pilots from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, hexazinone, simazine, tebuthiuron, triclopyr, and diesel oil; to mixer-loaders from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, hexazinone, simazine, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil; and to fuel truck operators from atrazine, and diuron.

Under the routine-realistic case, significant reproductive risks exist for pilots from atrazine, diuron, and simazine and for mixer-loaders from atrazine, dalapon, diuron, simazine, and tebuthiuron. There are no high reproductive risks for fuel truck operators in the realistic case. In the routine-worst case, there are significant risks to pilots from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr; to mixer-loaders from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, simazine, tebuthiuron, and triclopyr; and to fuel truck operators from atrazine and simazine.

For workers involved in aerial herbicide applications on oil and gas sites, cancer risks are significant for pilots from amitrole, atrazine, 2,4-D, and simazine; for mixer-loaders from amitrole, atrazine, bromacil, 2,4-D, and simazine; and for fuel truck operators from atrazine and simazine.

***Backpack Applications.*** No significant systemic, reproductive, or cancer risks are expected for backpack applicators on oil and gas sites who are applying chlorsulfuron, imazapyr, metsulfuron methyl, picloram, or kerosene.

In the routine-realistic case, backpack applicators on oil and gas sites have significant systemic risks from diuron. In the worst case, they have high systemic risks from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, hexazinone, mefluidide, simazine, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil.

Backpack applicators have high reproductive risks from atrazine in the realistic case. In the worst case, reproductive risks are significant from atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr.

Cancer risks to backpack applicators on oil and gas sites exceed 1 in 1 million for amitrole, atrazine, 2,4-D, and simazine.

***Ground Mechanical Applications.*** No significant systemic, reproductive, or cancer risks are expected for workers using ground mechanical equipment on oil and gas sites to apply chlorsulfuron, imazapyr, metsulfuron methyl, picloram, or kerosene.

Routine-realistic exposures to workers in oil and gas site ground mechanical applications present significant risks of systemic effects to applicators from diuron; to mixer-loaders from atrazine, 2,4-D, and diuron; and to applicator/mixer-loaders from atrazine and diuron. Worst case exposures result in high systemic risks to applicators from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, hexazinone, mefluidide, simazine, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil; to mixer-loaders from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, diuron, hexazinone, simazine, tebuthiuron, and triclopyr; and to applicator/mixer-loaders from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, diuron, hexazinone, simazine, tebuthiuron, triclopyr, and diesel oil.

Routine-realistic applications present high reproductive risks for applicators from atrazine and for mixer-loaders and applicator/mixer-loaders from atrazine. Worst case applications result in reproductive MOSs less than 100 for applicators from atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, simazine, tebuthiuron, and triclopyr and for mixer-loaders and applicator/mixer-loaders from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr.

Cancer risks exceed 1 in 1 million for oil and gas site ground mechanical operations for applicators from amitrole, atrazine, 2,4-D, and simazine and for mixer-loaders and applicator/mixer-loaders from amitrole, atrazine, and simazine.

***Hand Applications.*** Systemic, reproductive, and cancer risk estimates for workers in oil and gas site hand applications do not exceed the risk criteria as a result of applying clopyralid, hexazinone, imazapyr, picloram, and kerosene.

Hand herbicide application on oil and gas sites may result in high systemic risk to applicators from the use of 2,4-D, diuron, mefluidide, sulfometuron methyl, or triclopyr in the routine-realistic case. In the worst case, hand applicators have a significant systemic risk from amitrole, atrazine, bromacil, chlorsulfuron, 2,4-D, dalapon, diuron, mefluidide, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil.

Routine-realistic reproductive MOSs are less than 100 for atrazine and tebuthiuron. In the worst case, there are notable reproductive risks from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr.

Cancer risks to the hand applicator treating oil and gas sites are high from atrazine, 2,4-D, and simazine.

**Risks From Right-of-Way Herbicide Treatments**

MOSs that are less than 100 and cancer risks that are greater than 1 in 1 million as a result of herbicide applications on rights-of-way are presented in Table 3-13 for members of the public and Table 3-14 for workers. Herbicides used on rights-of-way are amitrole, atrazine, bromacil, chlorsulfuron, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, imazapyr, mefluidide, metsulfuron methyl, picloram, simazine, sulfometuron methyl, tebuthiuron, and triclopyr; the carriers diesel oil and kerosene also are used.

**Risks to Members of the Public.** In the routine-realistic case, members of the public may be at risk of systemic effects and carcinogenicity from amitrole.

***Aerial Applications.*** For routine-realistic aerial applications on BLM-managed rights-of-way, risks of systemic effects for members of the public are significant for eating fish from a body of water contaminated with amitrole spray drift and for the multiple exposures that an angler may receive from amitrole. In the routine-worst case, there are high risks from dermal exposure to spray drift from diuron; the veg-

## Table 3-12

## High Risks to Workers From Herbicide Use on Oil and Gas Sites

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Pilot | AM, AT, DU, SI | AT, DU, SI | AM, AT, BR, CP, 4D, DP, DC, DU, HX, SI, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AM, AT, 4D, SI |
| Mixer-loader | AM, AT, BR, 4D, DP, SI, TC | AT, DP, DU, SI, TB | AM, AT, BR, CP, 4D, DP, DC, DU, HX, SI, SM, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AM, AT, BR, 4D, SI |
| Fuel Truck Operator | — | — | AT, DU, SI | AT, SI | AT, SI |
| **Backpack Applications** | | | | | |
| Applicator | DU | AT | AM, AT, BR, CP, 4D DP, DC, DU, HX, MF, SM, TB, TC, DE | AT, BR, CP, 4D, DP, DC, DU, GP,TB, TC | AM, AT, 4D, SI |
| **Ground Mechanical Operations** | | | | | |
| Applicator | DU | AT | AM, AT, BR, CP, 4D, DP, DC, DU, HX, MF, SI, SM, TB, TC, DE | AT, BR, CP, 4D, DC, DP, DU, GP, HX, SI, TB, TC | AM, AT, 4D, SI |
| Mixer-loader | AT, 4D, DU | AT | AM, AT, BR, CP, 4D, DP, DU, HX, SI, TB, TC | AT, BR, 4D, DP, DC, DU, SI, TB, TC | AM, AT, SI |
| Applicator/mixer-loader | AT, DU | AT | AM, AT, BR, CP, 4D, DP, DU, HX, SI, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AM, AT, SI |
| **Hand Applications** | | | | | |
| Applicator | 4D, DU, MF, SM, TC | AT, TB | AM, AT, BR, CS, 4D, DP, DU, MF, SI, SM, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AT, 4D, SI |

AM = Amitrole; AT = Atrazine; BR = Bromacil; CS = Chlorsulfuron; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; DU = Diuron; GP = Glyphosate; HX = Hexazinone; MF = Mefluidide; SI = Simazine; SM = Sulfometuron methyl; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-13

## High Risks to Members of the Public From Herbicide Use on Rights-of-Way

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Spray Drift, Dermal | — | — | DU | AT | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | DU | AT | — |
| Drinking Water | — | — | AM, DU | AT | — |
| Eating Berries | — | — | AM | — | — |
| Eating Fish | AM | — | AM, DU | AT | AM |
| Hiker | — | — | AM, DU | AT | — |
| Berrypicker | — | — | AM, AT, DU | AT | — |
| Angler | AM | — | AM, AT, 4D, DU | AT, DU, SI | AM |
| Nearby Resident | — | — | DU | AT | — |

**Table 3-13 (Continued)**

**High Risks to Members of the Public From Herbicide Use on Rights-of-Way**

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Backpack Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | DU | AT | — |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | — | — | DU | AT | — |
| Angler | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |
| **Ground Mechanical Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | AM | — | AM, AT, DU | AT | AM |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | AM | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | AM | — | AM, AT, DU | AT | AM |
| Angler | — | — | AM | — | — |
| Nearby Resident | — | — | — | — | — |

AM = Amitrole; AT = Atrazine; 4D = 2,4-D; DU = Diuron; SI = Simazine.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Note. High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

etation contact of a berrypicker from diuron; drinking water that has received spray drift from amitrole, and diuron; the eating of berries contaminated with drift from amitrole; the eating of fish from a body of water contaminated with spray drift from amitrole, and diuron; the multiple exposures a hiker may receive from amitrole, and diuron; the multiple exposures a berrypicker may receive from amitrole, atrazine, and diuron; the multiple exposures an angler may receive from amitrole, atrazine, 2,4-D, and diuron; and the multiple exposures a nearby resident may receive from diuron.

Reproductive risk estimates result in MOSs greater than 100 for all herbicides in the routine-realistic case. In the routine-worst case, significant risks are expected for dermal exposure to spray drift from atrazine; vegetation contact by a berrypicker from atrazine; drinking water that has been contaminated with spray drift from atrazine; the eating of fish from a body of water that has received spray drift from atrazine; the multiple exposures a hiker or nearby resident may have to atrazine; the multiple exposures a berrypicker may have to atrazine; and the multiple exposures an angler may have to atrazine, and diuron.

Cancer risks are significant for eating fish from a body of water that has been contaminated with amitrole spray drift and the multiple exposures that an angler may receive from amitrole.

***Backpack Applications.*** Risks of systemic effects to members of the public from backpack applications on rights-of-way all have MOSs greater than 100 in the routine-realistic case. In the routine-worst case, there are significant systemic risks from diuron for a berrypicker from vegetation contact and the multiple exposures of a berrypicker.

There are no significant reproductive risks to members of the public from routine-realistic backpack applications on rights-of-way. For routine-worst case applications, there is expected to be a significant risk from atrazine for vegetation contact for a berrypicker and the multiple exposures of a berrypicker.

No cancer risk estimate for members of the public exceeds 1 in 1 million for backpack herbicide applications on rights-of-way.

***Ground Mechanical Applications.*** The routine-realistic dose estimated for vegetation contact by a berrypicker results in a significant risk of systemic effects from amitrole, as do the multiple exposures received by a berrypicker. In the routine-worst case, there is a significant risk of systemic effects from vegetation contact by a berrypicker from amitrole, atrazine, and diuron; the eating of fish from a body of water that has been contaminated with amitrole spray drift; multiple exposures to a berrypicker from amitrole, atrazine, and diuron; and the multiple exposures an angler may have from amitrole.

Routine-realistic exposures are not expected to result in any adverse reproductive effects to members of the public from ground mechanical herbicide applications. However, in the routine-worst case, there are significant reproductive risks from vegetation contact by a berrypicker and the multiple exposures of a berrypicker from atrazine.

Cancer risks exceed 1 in 1 million for vegetation contact by a berrypicker and the multiple exposures of a berrypicker from amitrole.

**Risks to Workers.** In the routine-realistic case, workers on rights-of-way may be at risk of systemic effects from applying amitrole, atrazine, bromacil, 2,4-D, dalapon, diuron, mefluidide, metsulfuron methyl, sulfometuron methyl, simazine, or triclopyr; reproductive effects from atrazine, dalapon, diuron, simazine, or tebuthiuron; and increased cancer risk from amitrole, atrazine, bromacil, 2,4-D, or simazine.

***Aerial Applications.*** MOSs are greater than 100 and cancer risks less than 1 in 1 million for all rights-of-way aerial workers applying chlorsulfuron, imazapyr, metsulfuron methyl, and picloram.

Routine-realistic aerial applications to rights-of-way result in significant systemic risks to pilots from amitrole, atrazine, diuron, and simazine, and to mixer-loaders from amitrole, atrazine, bromacil, 2,4-D, dalapon, diuron, simazine, and triclopyr. There are no high systemic risks in the realistic case to fuel truck operators. In the routine-worst case, there are notable systemic risks to pilots from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, mefluidide, simazine, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil; to mixer-loaders from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, mefluidide, simazine, sulfometuron methyl, tebuthiuron, triclopyr, diesel oil, and kerosene; and to fuel truck operators from amitrole, atrazine, dalapon, diuron, and triclopyr.

Reproductive risks in the realistic case are significant for pilots from atrazine, diuron, and simazine and for mixer-loaders from atrazine, dalapon, diuron, simazine, and tebuthiuron. There are no significant reproductive risks to fuel truck operators in the realistic case. In the worst case, there are high reproductive risks to pilots and mixer-loaders from atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, simazine, tebuthiuron, and triclopyr and to fuel truck operators from atrazine, diuron, and tebuthiuron.

There are significant cancer risks for pilots and mixer-loaders from amitrole, atrazine, bromacil, 2,4-D, and simazine and for fuel truck operators from atrazine and simazine.

***Backpack Applications.*** Risk estimates for backpack applicators on rights-of-way do not exceed the systemic, reproductive, or cancer risk criteria as a result of the use of chlorsulfuron, imazapyr, mefluidide, metsulfuron methyl, picloram, or kerosene.

Backpack applicators receiving routine-realistic exposures on rights-of-way are expected to have significant systemic risks from diuron. In the worst case, high risks result from the use of amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, diuron, hexazinone, simazine, sulfometuron methyl, triclopyr, and diesel oil.

Excess reproductive risks to backpack applicators on rights-of-way may result from atrazine under realistic conditions. In the worst case, there may be high reproductive risks from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr.

There are significant cancer risks to backpack applicators treating rights-of-way with atrazine, 2,4-D, and simazine.

***Ground Mechanical Applications.*** MOSs are all greater than 100 and cancer risks less than 1 in 1 million for ground mechanical workers on rights-of-way for applications of chlorsulfuron, imazapyr, metsulfuron methyl, picloram, and kerosene.

Routine-realistic ground mechanical applications of herbicides on rights-of-way may lead to significant systemic risks to applicators from diuron and to mixer-loaders and applicator/mixer-loaders from 2,4-D, and diuron. Worst case applications may cause high systemic risks to applicators from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, hexazinone, mefluidide, simazine, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil; to mixer-loaders from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, diuron, hexazinone, simazine, tebuthiuron, and triclopyr; and to applicator/mixer-loaders from amitrole, atrazine, bromacil, clopyralid, 2,4-D, dalapon, diuron, hexazinone, simazine, tebuthiuron, triclopyr, and diesel oil.

In the routine-realistic case, significant reproductive risks are posed for applicators from atrazine and for mixer-loaders and applicator/mixer-loaders from atrazine. In the worst case, there are notable reproductive risks for applicators from atrazine, bromacil, clopyralid, 2,4-D, dalapon, dicamba, diuron, glyphosate, hexazinone, simazine, tebuthiuron, and triclopyr and for mixer-loaders and applicator/mixer-loaders from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr.

Significant cancer risks are present for applicators and applicator/mixer-loaders from amitrole, atrazine, 2,4-D, and simazine and for mixer-loaders from atrazine and simazine.

***Hand Applications.*** There are no excessive systemic, reproductive, or cancer risks to hand applicators from the use of clopyralid, hexazinone, imazapyr, picloram, or kerosene on rights-of-way.

Workers applying herbicides by hand equipment on rights-of-way are at systemic risk from 2,4-D, diuron, mefluidide, sulfometuron methyl, and triclopyr in the routine-realistic case. Under worst case assumptions, applicators are at high systemic risk from amitrole, atrazine, bromacil, chlorsulfuron, 2,4-D, dalapon, diuron, mefluidide, simazine, sulfometuron methyl, tebuthiuron, triclopyr, and diesel oil.

Realistic exposures may result in excess reproductive risks from atrazine and tebuthiuron. Worst case exposures may lead to significant reproductive risks from atrazine, bromacil, 2,4-D, dalapon, dicamba, diuron, glyphosate, simazine, tebuthiuron, and triclopyr.

Cancer risks to hand applicators on rights-of-way exceed 1 in 1 million for atrazine, 2,4-D, and simazine.

### Risks From Public Recreation and Cultural Site Herbicide Treatments

Risks from herbicide applications on public recreation and cultural sites are summarized in Table 3-15 for members of the public and Table 3-16 for workers. The herbicides used on public recreation and cultural sites are atrazine, chlorsulfuron, 2,4-D, dalapon, dicamba, glyphosate, hexazinone, imazapyr, picloram, simazine, tebuthiuron, triclopyr; the carriers diesel oil and kerosene also are used.

**Table 3-14**

**High Risks to Workers From Herbicide Use on Rights-of-Way**

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Aerial Applications** | | | | | |
| Pilot | AM, AT, DU, SI | AT, DU, SI | AM, AT, BR, CP, 4D, DP, DC, DU, GP, HX, MF, SI, SM, TB, TC, DE | AT, BR, CP, 4D, DP, DC, DU, GP, HX, SI, TB, TC | AM, AT, BR, 4D, SI |
| Mixer-loader | AM, AT, BR, 4D, DP, DU, SI, TC | AT, DP, DU, SI, TB | All except CS, IP, MM, PC | AT, BR, CP, 4D, DP, DC, DU, GP, HX, SI, TB, TC | AM, AT, BR, 4D, SI |
| Fuel Truck Operator | — | — | AM, AT, DP, DU, TC | AT, DU, TB | AT, SI |
| **Backpack Applications** | | | | | |
| Applicator | DU | AT | AM, AT, BR, CP, 4D, DP, DU, HX, SI, SM, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AT, 4D, SI |
| **Ground Mechanical Operations** | | | | | |
| Applicator | DU | AT | AM, AT, BR, CP, 4D, DP, DC, DU, HX, MF, SI, SM, TB, TC, DE | AT, BR, CP, 4D, DP, DC, DU, GP, HX, SI, TB, TC | AM, AT, 4D, SI |
| Mixer-loader | 4D, DU | AT | AM, AT, BR, CP, 4D, DP, DU, HX, SI, TB, TC | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AT, SI |
| Applicator/mixer-loader | 4D, DU | AT | AM, AT, BR, CP, 4D, DP, DU, HX, SI, TB, TC, DE | AT, BR, 4D, DP DC, DU, GP, SI, TB, TC | AM, AT, 4D, SI |

## Table 3-14 (Continued)

## High Risks to Workers From Herbicide Use on Rights-of-Way

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Hand Applications** | | | | | |
| Applicator | 4D, DU, MF, MM, SM, TC | AT, TB | AM, AT, BR, CS, 4D, DP, DU, MF, MM, SM, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SM, TB, TC | AT, 4D, SI |

AM = Amitrole; AT = Atrazine; BR = Bromacil; CS = Chlorsulfuron; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; DU = Diuron; GP = Glyphosate; HX = Hexazinone; IP = Imazapyr; MF = Mefluidide; MM = Metsulfuron methyl; PC = Picloram; SI = Simazine; SM Sulfometuron methyl; TB Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-15

## High Risks to Members of the Public From Herbicide Use on Recreation and Cultural Sites

| Exposure Scenario | Typical Exposures | | Worst-case Exposures | | |
|---|---|---|---|---|---|
| | Systemic | Reproductive | Systemic | Reproductive | Cancer |
| **Backpack Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | — | — | — |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | — | — | — | — | — |
| Angler | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |
| **Ground Mechanical Applications** | | | | | |
| Spray Drift, Dermal | — | — | — | — | — |
| Vegetation Contact, Hiker | — | — | — | — | — |
| Vegetation Contact, Picker | — | — | — | — | — |
| Drinking Water | — | — | — | — | — |
| Eating Berries | — | — | — | — | — |
| Eating Fish | — | — | — | — | — |
| Hiker | — | — | — | — | — |
| Berrypicker | — | — | — | — | — |
| Angler | — | — | — | — | — |
| Nearby Resident | — | — | — | — | — |

Note. High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

**Risks to Members of the Public.** No significant systemic, reproductive, or carcinogenic risks are expected for members of the public as a result of herbicide applications to public recreation and cultural sites in the routine-realistic case.

***Aerial Applications.*** BLM does not use aerial applications on public recreation and cultural sites.

***Backpack Applications.*** There are no expected significant systemic, reproductive, or cancer risks to members of the public from backpack application of herbicides on BLM-managed public recreation and cultural sites.

***Ground Mechanical Applications.*** There are no expected significant systemic, reproductive, or cancer risks to members of the public from ground mechanical application of herbicides on BLM-managed public recreation and cultural sites.

***Hand Applications.*** There are no expected significant systemic, reproductive, or cancer risks to members of the public from hand application of herbicides on BLM-managed public recreation and cultural sites.

**Risks to Workers.** Some workers may be at risk of systemic effects from the use of atrazine, 2,4-D, or triclopyr; of reproductive effects from the use of atrazine or tebuthiuron; and of increased carcinogenic effects from the use of atrazine, 2,4-D, or simazine.

***Aerial Applications.*** Aerial applications are not used on BLM-managed public recreation and cultural sites.

***Backpack Applications.*** There are no significant risks to backpack applicators on BLM-managed public recreation and cultural sites from the use of chlorsulfuron, imazapyr, picloram, tebuthiuron, and kerosene.

Systemic MOSs are greater than 100 for all herbicides in the routine-realistic case. Under worst case assumptions, there are significant systemic risks from atrazine, 2,4-D, dalapon, hexazinone, simazine, triclopyr, and diesel oil.

Reproductive MOSs are greater than 100 for all herbicides in the routine-realistic case. Under worst case assumptions, there are significant reproductive risks from atrazine, 2,4-D, dalapon, dicamba, glyphosate, and simazine.

Cancer risks for backpack applicators exceed 1 in 1 million for atrazine and simazine.

***Ground Mechanical Applications.*** The use of ground mechanical applications on BLM-managed public recreation and cultural sites is not expected to result in significant systemic, reproductive, or cancer risks to workers from the use of chlorsulfuron, hexazinone, imazapyr, picloram, diesel oil, or kerosene.

Systemic MOSs are greater than 100 for all herbicides in the routine-realistic case. Under worst case assumptions, there are significant risks of systemic effects for applicators from 2,4-D, dalapon, simazine, and triclopyr; to mixer-loaders from 2,4-D; and to applicator/mixer-loaders from 2,4-D, and simazine.

Reproductive MOSs are greater than 100 for all herbicides in the routine-realistic case. Under worst case assumptions, there are significant risks of systemic effects for applicators from atrazine, dicamba, glyphosate, simazine, and tebuthiuron; to mixer-loaders from atrazine and dicamba; and to applicator/mixer-loaders from atrazine, dicamba, simazine, and tebuthiuron.

Cancer risks exceed 1 in 1 million for applicators and applicator/mixer-loaders from atrazine and simazine and for mixer-loaders from atrazine.

***Hand Applications.*** MOSs are greater than 100 and cancer risks less than 1 in 1 million for hand application workers on public recreation and cultural sites from the use of hexazinone, imazapyr, picloram, and kerosene.

Routine-realistic hand equipment applications may lead to significant systemic risks for applicators from 2,4-D, and triclopyr. Worst case applications are estimated to result in systemic risks from atrazine, chlorsulfuron, 2,4-D, dalapon, simazine, tebuthiuron, triclopyr, and diesel oil.

Routine-realistic reproductive risks for hand applicators are significant from atrazine and tebuthiuron. In the worst case, high risks result from atrazine, 2,4-D, dalapon, dicamba, glyphosate, simazine, tebuthiuron, and triclopyr.

Excess cancer risks are predicted to result from the use of atrazine, 2,4-D, and simazine.

**Risks From Accidents**

Several accident scenarios were evaluated to estimate the risks that may result from a spill of herbicide concentrate or mixture, the drinking of water or the eating of fish from a body of water that was directly sprayed, immediate reentry to a treated area, the eating of berries that were directly sprayed, or the drinking of water from a body of water contaminated by a helicopter jettison or batch truck accident. In most cases, MOSs and cancer risks are significant. Risks are summarized in Tables 3-17 to 3-21 for the five program areas. Standard operating procedures and safety precautions will minimize the potential for accidents such as these to occur.

### Risk of Heritable Mutations

Three of the herbicides examined in this EIS—atrazine, diuron, and simazine—have demonstrated a potential to cause mutagenic changes in various laboratory test systems. It is possible that these herbicides may cause heritable mutations in mammals. Diesel oil and kerosene also may present a risk of mutagenic effects, because they contain PAHs and other constituents that are known or suspected mutagens.

Bromacil, 2,4-D, glyphosate, and picloram have not clearly demonstrated any mutagenic potential. However, they are considered to be potential carcinogens in this risk assessment. Because there is a possible correlation between mutagenicity and carcinogenicity, these herbicides may cause genetic damage if the mechanism of their carcinogenicity is related to genetic damage.

The rest of the herbicides have not sufficiently demonstrated any mutagenic or carcinogenic potential. Therefore, they are considered to present a negligible risk of heritable mutations.

### Risk of Synergistic Effects

The likelihood seems minimal that synergistic effects will occur in any of BLM's vegetation treatments with herbicides. Exposure to more than one herbicide would be limited to those instances where a mixture is used. Those mixtures that would be used in the program are tested and approved by EPA. There is a possibility that long-term effects could occur from the use of these mixtures and that the EPA testing was not sufficient to detect these effects. The probability of long-term synergistic effects from herbicide mixtures, their kind and magnitude, are not predictable based on the current state of scientific knowledge and testing. Based on experience with herbicide mixture use to date, however, it would seem that the probability of long-term synergistic effects would be very low.

### Effects of Inert Ingredients

Most pesticide formulations contain inert ingredients, in addition to the active ingredient. These inert ingredients act as solvents or carriers, help maintain the stability of the formulation, or increase the effectiveness of the active ingredient after application. An inert ingredient is not necessarily chemically unreactive; it is simply not an active ingredient in the formulation. EPA's Office of Pesticides and Toxic Substances (EPA 1989) has identified about 1,200 inert ingredients used in pesticides, and they have categorized these chemicals based on their ability to cause chronic human effects as follows:

- List 1—Inerts of Toxicological Concern: Fifty-seven chemicals shown to be carcinogens, developmental toxicants, neurotoxins, or exhibiting potential ecological hazards that merit higher priority for regulatory action.
- List 2—Inerts With a High Priority for Testing: Sixty-nine chemicals with data suggesting, but not confirming, possible chronic health effects or having chemical structures similar to chemicals on List 1.
- List 3—Inerts of Unknown Toxicity: All chemicals for which there is no basis for inclusion on Lists 1, 2, or 4.
- List 4—Minimum Risk Inerts: Two hundred seventy-seven chemicals generally regarded as safe.

Generally, the identity of the inerts present in a given formulation is the proprietary information of the manufacturer. For this reason, any potential risks associated with the presence of inert ingredients in the BLM herbicide formulations are unable to be assessed, with the exception of kerosene, which may be present in formulations of 2,4-D and triclopyr esters. This is regarded as a data gap in this EIS. Because there may be hazards associated with inert ingredients in pesticides, BLM generally will use no formulations in the proposed vegetation treatment program that contain inert ingredients on Lists 1 or 2, to reduce the possibility of hazards to human health or ecological resources. The exceptions are Esteron 99 and Garlon 4. These may be used in a limited degree.

## Table 3-16

### High Risks to Workers From Herbicide Use on Recreation and Cultural Sites

| Exposure Scenario | Typical Exposures: Systemic | Typical Exposures: Reproductive | Worst-case Exposures: Systemic | Worst-case Exposures: Reproductive | Worst-case Exposures: Cancer |
|---|---|---|---|---|---|
| **Backpack Applications** | | | | | |
| Applicator | — | — | AT, 4D, DP, HX, SI, TC, DE | AT, 4D, DP, DC, GP, SI | AT, SI |
| **Ground Mechanical Operations** | | | | | |
| Applicator | — | — | 4D, DP, SI, TC | AT, DC, GP, SI, TB | AT, SI |
| Mixer-loader | — | — | 4D | AT, DC | AT |
| Applicator/mixer-loader | — | — | 4D, SI | AT, DC, SI, TB | AT, SI |
| **Hand Applications** | | | | | |
| Applicator | 4D, TC | AT, TB | AT, CS, 4D, DP, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, 4D, SI |

AT = Atrazine; CS = Chlorsulfuron; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; GP = Glyphosate; HX = Hexazinone; SI = Simazine; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-17

### High Risks From Accidents From Herbicide Use on Rangeland

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Skin Spill, Concentrate | AM, AT, CP, 4D, DC, GP, HX, IP, PC, TC, DE, KE | AM, AT, CP, 4D, DC, GP, HX, IP, PC, TC, DE, KE | AM, AT, 4D |
| Skin Spill, Mixture | AM, AT, CP, 4D, DP, DC, GP, HX, IP, PC, TB, TC, DE, KE | AM, AT, CP, 4D, DP, DC, GP, HX, IP, PC, TB, TC, DE, KE | AM, AT, 4D |
| Direct Spray, Person | AM, AT, 4D, DP, DC, TB, TC | AT, 4D, DC, GP, TB, DE | — |
| Drinking Directly Sprayed Water | AM, 4D | — | — |
| Eating Fish From Directly Sprayed Water | AM, 4D, TC | 4D, DC | AM |
| Immediate Reentry, Hiker | — | — | — |
| Immediate Reentry, Picker | AM, AT, 4D, DP, DC GP, TB, TC, DE | AT, 4D, DP, DC, GP, TB, TC | — |

## Table 3-17 (Continued)

## High Risks From Accidents From Herbicide Use on Rangeland

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Eating Directly Sprayed Berries | AM, AT, 4D | AT, 4D, DC, TB | AM |
| Drinking Water Contaminated by a Jettison of Mixture | AM, AT, 4D, DP, DC, PC, TB, TC, DE | AM, AT, 4D, DP, DC, GP, TB | AM |
| Drinking Water Contaminated by a Truck Spill | AM, AT, CP, 4D, DP, DC, GP, HX, PC, TB, TC, DE, KE | AM, AT, 4D, DP, DC, GP, HX, PC, TB, TC | AM, AT, 4D |

AM = Amitrole; AT = Atrazine; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; GP = Glyphosate; HX = Hexazinone; IP = Imazapyr; PC = Picloram; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-18

## High Risks From Accidents From Herbicide Use on Public-Domain Forest Land

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Skin Spill, Concentrate | AM, AT, CS, 4D, DC, GP, HX, IP, PC, SI, TC, DE, KE | AM, AT, CS, 4D, DC, GP, HX, IP, PC, SI, TC, DE, KE | AM, AT, 4D, SI |
| Skin Spill, Mixture | AM, AT, CS, 4D, DP, DC, GP, HX, IP, PC, SI, TB, TC, DE, KE | AM, AT, CS, 4D, DP, DC, GP, HX, IP, PC, SI, TB, TC, DE, KE | AM, AT, 4D, SI |
| Direct Spray, Person | AM, AT, 4D, DP, DE HX, SI, TB, TC | AT, 4D, DP, DC, GP, SI, TB, TC | AT |
| Drinking Directly Sprayed Water | AM, AT, 4D | AT | — |
| Eating Fish From Directly Sprayed Water | AM, AT, 4D, SI, TC | AT, 4D, DC, SI | AM |
| Immediate Reentry, Hiker | — | — | — |
| Immediate Reentry, Picker | AM, AT, 4D, DP, DC, GP, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | AT, SI |
| Eating Directly Sprayed Berries | AM, AT, 4D, SI, TC | AT, 4D, DC, SI, TB | AM |
| Drinking Water Contaminated by a Jettison of Mixture | AM, AT, 4D, DP, DC, HX, PC, SI, TB, TC, DE | AM, AT, 4D, DP, DC, GP, SI, TB, TC | AM, AT |
| Drinking Water Contaminated by a Truck Spill | AM, AT, CS, 4D, DP, DC, GP, HX, PC, SI, TB, TC, DE, KE | AM, AT, 4D, DP, DC, GP, HX, PC, SI, TB, TC | AM, AT, 4D, SI |

AM = Amitrole; AT = Atrazine; CS = Chlorsulfuron; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; GP = Glyphosate; HX = Hexazinone; IP = Imazapyr; PC = Picloram; SI = Simazine; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

**Table 3-19**

**High Risks From Accidents From Herbicide Use on Oil and Gas Sites**

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Skin Spill, Concentrate | All except DP, TB | All, except DP, TB | AM, AT, BR, 4D, SI |
| Skin Spill, Mixture | All | All | AM, AT, BR, 4D, SI |
| Direct Spray, Person | AM, AT, BR, CP, 4D, DP, DC, DU, HX, SI, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AT, SI |
| Drinking Directly Sprayed Water | — | — | — |
| Eating Fish From Directly Sprayed Water | — | — | — |
| Immediate Reentry, Hiker | AT, DU | AT | — |
| Immediate Reentry, Picker | — | — | — |
| Eating Directly Sprayed Berries | — | — | — |
| Drinking Water Contaminated by a Jettison of Mixture | — | — | — |
| Drinking Water Contaminated by a Truck Spill | All except imazapyr | AM, AT, BR, CP, 4D, DP, DC, DU, GP, HX, PC, SI, SM, TB, TC | AM, AT, BR, 4D, SI |

AM = Amitrole; AT = Atrazine; BR = Bromacil; CS = Chlorsulfuron; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; DU = Diuron; GP = Glyphosate; HX = Hexazinone; IP = Imazapyr; MF = Mefluidide; MM = Metsulfuron methyl; PC = Picloram; SI = Simazine; SM = Sulfometuron methyl; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

**Table 3-20**

**High Risks From Accidents From Herbicide Use on Rights-of-Way**

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Skin Spill, Concentrate | All except DP, TB | All except DP, TB | AM, AT, BR, 4D, SI |
| Skin Spill, Mixture | All | All | AM, AT, BR, 4D, SI |
| Direct Spray, Person | AM, AT, BR, CP, 4D, DP, DC, DU, HX, SI, TB, TC, DE | AT, BR, 4D, DP, DC, DU, GP, SI, TB, TC | AT, SI |
| Drinking Directly Sprayed Water | AM, AT, 4D, DP, DU, SI, TC | AT, DU, SI, TB | AM, AT |
| Eating Fish From Directly Sprayed Water | AM, AT, BR, CP, 4D, DP, DU, HX, SI, TC | AM, AT, BR, 4D, DP, DC, DU, SI, TB, TC | AM, AT, SI |
| Immediate Reentry, Hiker | AT, DU | AT | — |
| Immediate Reentry, Picker | AM, AT, BR, CP, 4D, DP, DC, DU, GP, HX, MF, SI, SM, TB, TC, DE | AT, BR, CP, 4D, DP, DC, DU, GP, HX, SI, TB, TC | AT, SI |
| Eating Directly Sprayed Berries | AM, AT, BR, CP, 4D, DP, DU, HX, SI, TB, TC | AM, AT, BR, 4D, DP, DC, DU, SI, TB, TC | AM, AT, SI |

## Table 3-20 (Continued)

## High Risks From Accidents From Herbicide Use on Rights-of-Way

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Drinking Water Contaminated by a Jettison of Mixture | AM, AT, BR, CP, 4D, DP, DC, DU, HX, PC, SI, SM, TB, TC, DE | AM, AT, BR, 4D, DP, DC, DU, GP, HX, SI, TB, TC | AM, AT, SI |
| Drinking Water Contaminated by a Truck Spill | All except IP | AM, AT, BR, CP, 4D, DP, DC, DU, GP, HX, PC, SI, SM, TB, TC | AM, AT, BR, 4D, SI |

AM = Amitrole; AT = Atrazine; BR = Bromacil; CS = Chlorsulfuron; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; DU = Diuron; GP = Glyphosate; HX = Hexazinone; IP = Imazapyr; MF = Mefluidide; MM = Metsulfuron methyl; PC = Picloram; SI = Simazine; SM = Sulfometuron methyl; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

## Table 3-21

## High Risks From Accidents From Herbicide Use on Recreation and Cultural Sites

| Exposure Scenario | Systemic | Reproductive | Cancer |
|---|---|---|---|
| Skin Spill, Concentrate | All except DP, TB | All except DP, TB | AT, 4D, SI |
| Skin Spill, Mixture | All | All | AT, 4D, SI |
| Immediate Reentry, Hiker | — | — | — |
| Immediate Reentry, Picker | AT, 4D, DP, DC, GP, HX, SI, TB, TC, DE | AT, 4D, DP, DC, GP, SI, TB, TC | SI |
| Eating Directly Sprayed Berries | AT, 4D, SI | AT, DC, SI, TB | — |
| Drinking Water Contaminated by a Truck Spill | All except IP | AT, 4D, DP, DC, GP, HX, PC, SI, TB, TC | AT, 4D, SI |

AM = Amitrole; AT = Atrazine; BR = Bromacil; CS = Chlorsulfuron; CP = Clopyralid; 4D = 2,4-D; DP = Dalapon; DC = Dicamba; DU = Diuron; GP = Glyphosate; HX = Hexazinone; IP = Imazapyr; MF = Mefluidide; MM = Metsulfuron methyl; PC = Picloram; SI = Simazine; SM = Sulfometuron methyl; TB = Tebuthiuron; TC = Triclopyr; DE = Diesel; KE = Kerosene.

Amitrole - BLM has reexamined the risk assessment and examined additional data. BLM has determined that amitrole is no longer considered for proposed use in this document. Amitrole will be deleted in the Record of Decision.

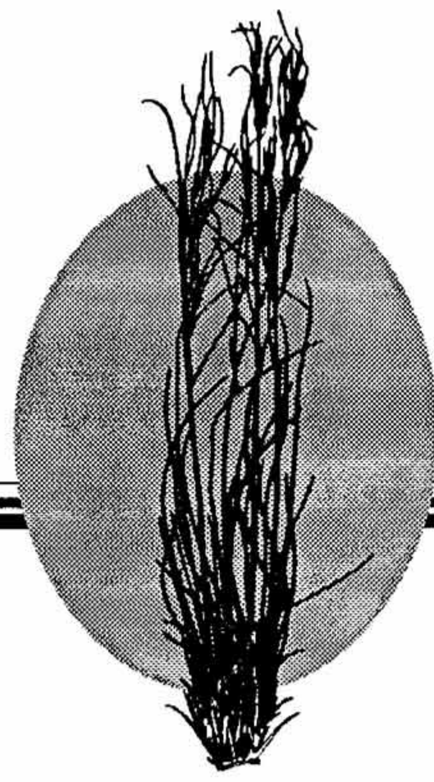
Dalapon - Since drafting this document, producers are no longer manufacturing formulations registered for proposed use. Therefore, dalapon is no longer considered for use.

Note: High risks are defined as those exposures that may result in a margin of safety less than 100 or a cancer risk greater than 1-in-1 million.

Chapter 3

# Section 2

# Impacts by Alternatives



# SECTION 2

# IMPACTS BY ALTERNATIVE

## VEGETATION

The overall effect of all alternatives would be changes in vegetation composition, structure, or productivity in the areas treated. In some instances, certain species would be suppressed or removed as a result of treatment. Other species would increase, while others would remain essentially unchanged. In some instances, vegetation would be rejuvenated or resized. Species and structural diversity of a given site may be enhanced or reduced, depending on treatment objectives and kind of site. The results of treatment would include enhanced structure and diversity of wildlife habitat, increased productivity of herbaceous vegetation and browse, enhanced productivity of commercially valuable trees, suppression of noxious weeds, reduced fire and safety hazards, and maintenance of a community in a particular successional stage that best meets land use objectives for the site.

Herbicides would provide greater control of resprouting vegetation than other treatments, particularly when applied before burning. Manual methods would be used primarily to suppress target vegetation that does not resprout and in sensitive areas, such as riparian areas, where extreme control over application is necessary. Mechanical treatments would temporarily remove competing vegetation from sites and would often be reseeded following treatment, but would aid germination of grasses and hardwoods in forest situations.

Management after treatment is as important as treatment selection to ensure that treatment objectives are met in the long term. Post-treatment management is addressed in local land-use plans and activity plans, such as area of critical environmental concern plans, habitat management plans, allotment management plans, watershed plans, and coordinated resource management plans.

Under all alternatives, decisions pertaining to treatment locations and acreages are affected by and consider BLM past actions, actions of other agencies, and natural events such as wildfire occurrence, in order to avoid adverse cumulative impacts. A proposed treatment might be postponed or abandoned altogether if a wildfire occurred in or near the treatment area, making treatment either unnecessary or potentially impacting too much of the local area at one time. Treatments may be implemented in conjunction with other agencies to achieve common objectives across different land jurisdictions, or coordinated to avoid adverse cumulative effects of independent actions of different agencies. Coordination between BLM and other agencies for vegetation treatments and other agency actions is generally guided by various written agreements between local offices. Coordination requirements and cumulative effects are part of the site-specific environmental analysis documentation for every proposed treatment.

Riparian areas, including xeroriparian dry washes, will be avoided under all alternatives and site-specific treatments except where saltcedar control has been proposed. Standard operating procedures and mitigation are designed to minimize or eliminate impacts to riparian vegetation and are addressed in the site-specific environmental analysis for the proposed project. Therefore, except where specific treatments are designed to control or manage vegetation within riparian areas, there will be no significant adverse impacts to riparian zones in any analysis region under any alternative. For these reasons, riparian vegetation will not be discussed in detail.

The few treatments proposed within riparian areas are either for controlling noxious weeds or nonnative problem species such as saltcedar. All treatments are for small acreages and generally consist of manual applications of control measures to individuals, such as chainsawing saltcedar and painting the stump with herbicide. The techniques required to achieve effective control minimize the opportunity for undesired impacts.

The proposed acreage for biological treatments under all alternatives primarily targets introduced species that have been designated as noxious weeds. Biological treatments may occur in any analysis region in any portion of the EIS area. The use of biological treatments depends on the nature of the target species, dispersal of the weed, and availability of appropriate biological control agents. The objective of biological control methods is to bring weeds to an economic control level, not to eradicate them. Generally, a complex of agents is necessary to do this, and control is attained only over a period of several to many years. BLM is working with other Federal agencies and universities to identify and test potential biological agents for use on noxious weed species. Before an agent may be released, extensive testing must be done to ensure that potential agents are host-specific and will not be detrimental to economically important or endangered or threatened species, and that they do not carry parasites and diseases. In addition, interaction between potential agents is examined, and the environments in which they operate most effectively are determined before release.

The sagebrush and plains grasslands analysis regions together contain nearly three-fourths of the acres proposed for treatment under each alternative, while the remaining analysis regions each constitute 10 percent or less of proposed treatment acreage. The greatest acreages of vegetation treatment are proposed under Alternative 1 (Table 1-1). Alternative 1 is the only alternative that allows a choice of the treatment method or program chemical that would be best suited to meet site-specific treatment objectives. Acreages proposed for treatment under Alternatives 2 and 4 are similar, but their impacts to vegetation would be quite different. Chemically treated acreage under Alternative 4 would be more than three times the chemically treated acreage under Alternative 2. Acreage treated by prescribed fire would be greatest under Alternative 3. Many noxious weeds would remain uncontrolled under Alternative 3. Alternative 5 proposes less acreage for treatment than any of the alternatives, as well as fewer acres of chemical treatment than any alternative except Alternative 3.

## Alternative 1: Proposed Action

Under Alternative 1, all available treatment methods—manual, mechanical, biological, prescribed burning, and chemical—could be used. The sequence of treatments would be selected to take maximum advantage of the characteristics of the treatments, target species, and environmental considerations—to get desired results. The treatment selection would be determined by evaluating treatment objectives along with information on the physiological response of species in the target community to different treatment methods, the composition and productivity of vegetation in the target area, environmental considerations (proximity of human habitations and water bodies, endangered species, National Parks, and so on), and physical site characteristics (such as soil type, rockiness, and slope).

The proposed treatment area of 371,640 average annual acres per year comprises 0.23% (about one-quarter of one percent) of the total BLM lands within the EIS area (Table 2-1). Over the past 10 years, wildfires have burned an average of 529,610 BLM acres per year in the EIS area (BLM 1990). This is about 0.34% (about one-third of one percent) of the EIS area. Together, the average annual disturbance would amount to about 901,250 acres, or about 0.6% (six-tenths of one percent) of BLM lands within the EIS area. The extent of vegetative disturbance is not additive over the life of the EIS. Repeated wildfires occur in these same areas planned for treatment. When this occurs, acreage is reduced accordingly. The largest degree of cumulative impact under the Proposed Action is that vegetation will be managed and maintained under guidelines determined by local land use plans. Undesirable cumulative effects are possible but unlikely because of the scope and design of the Proposed Action. Areas to be treated are small in relation to the total EIS area and treatments will not be repeated during the life of the EIS.

Under Alternative 1, herbicides would be used to treat the largest number of acres, followed by prescribed burning, mechanical, biological, and manual methods. For all the vegetation analysis regions under this alternative, noxious weeds would be treated primarily by chemical and biological methods. Oil and gas production facilities, recreation areas, and rights-of-way would be treated by chemical and mechanical methods, with manual and biological methods used when appropriate. Rangeland areas would be treated predominantly by chemicals, prescribed burning, biological and some mechanical treatment.

### Sagebrush

More than one-half of the acreage proposed for treatment under Alternative 1 would be in this analysis region. The primary treatment methods would be prescribed fire and chemicals. Prescribed fire would favor herbaceous vegetation over woody species in the short term, and treated areas would reflect this. Herbicides would be used on rangeland dominated by introduced annual grasses, such as cheatgrass and medusahead, followed by revegetation with perennial species. Chemicals also would be used to suppress shrubs in favor of herbaceous vegetation on some areas. The relative proportion of shrubs to herbaceous species left in treated areas would vary, depending on site management objectives. Chemical treatments that target woody species also may initially damage the herbaceous component, particularly forbs, but productivity would recover in the short term. Vegetation cover would initially be reduced following treatments but recover in the short term. Long-term impacts include a reduction in the extent of acreage dominated by annual grasses, increase in acres of perennial vegetation, and more sites with a shrub mosaic or predominantly herbaceous composition rather than closed stands dominated by shrubs.

### Desert Shrub

Little treatment is proposed in this analysis region under Alternative 1. Small acreages of saltcedar would be controlled and converted to native, multi-species riparian vegetation. Short-term negative losses of cover would occur, but reestablishing native vegetation would result in significant long-term benefits, particularly to the habitats of small birds, mammals, reptiles, and amphibians. Other treatments would be done with chemicals or by mechanical, manual, or biological methods to control noxious weeds and to reduce fire or other safety hazards on rights-of-way, recreation areas, and oil and gas production facilities.

## Southwestern Shrubsteppe

This analysis region ranks just below pinyon-juniper in the number of acres proposed for treatment under Alternative 1. The primary treatment methods would be prescribed fire and chemicals. Prescribed fire favors herbaceous vegetation and sprouting woody species. Chemical treatments would most often suppress the sprouting woody species when they are in closed stands without sufficient fine fuel to carry a fire. Prescribed fire would control very young plants and maintain communities already dominated by herbaceous species, or it would follow a chemical treatment to burn standing dead woody material that inhibits movement and access to forage by animals. Chemical treatments that target woody species also might initially damage the herbaceous component, particularly broadleaf species, but productivity would recover in the short term.

Small acreages of saltcedar would be controlled and converted to native, multispecies riparian vegetation. Short-term negative losses of cover would occur, but reestablishing native vegetation would result in significant long-term benefits, particularly to the habitats of small birds, mammals, reptiles, and amphibians. The most significant impact of Alternative 1 in this analysis region would be to increase the proportion of herbaceous vegetation relative to woody vegetation. Grasses would be favored slightly over forbs in most chemically treated areas. Treatment would initially reduce total vegetative cover on the treated site, but it would recover in the short term. Long-term effects include increased acreage with a shrub mosaic or predominantly herbaceous composition rather than stands dominated by shrubs.

## Chaparral-Mountain Shrub

Treatments proposed in this analysis region do not constitute a significant portion of the treatment program under Alternative 1. Prescribed fire, chemicals, and mechanical treatment would be used most often in interior chaparral communities. Prescribed fire alone would open and rejuvenate decadent stands of shrubs, increase the diversity and productivity of the herbaceous component, and reduce fuel loading and continuity. Chemical and mechanical treatments, in conjunction with fire, would be done if conversion from shrub-dominated to herbaceous communities was desired in local areas. Increased water yield also might result if the community is converted to grassland. Prescribed fire would be the most commonly used treatment method proposed in mountain shrub communities to resize and rejuvenate stands of Gambel oak and mountain mahogany for wildlife. The vegetation cover would initially be reduced after treatment but would recover in the short term. Long-term impacts would include the maintenance of a more open and vigorous shrub component and increased productivity of herbaceous species on some sites.

## Pinyon-Juniper

This analysis region comprises slightly less than 10 percent of the acreage proposed for treatment under Alternative 1. Treatment methods would most frequently be mechanical and prescribed fire. Both of these methods favor herbaceous species over woody species. The long-term impact of Alternative 1 in this analysis region would be to increase the abundance and diversity of herbaceous vegetation and understory shrubs and to decrease tree cover. The relative proportion of trees to other species left in treated areas would vary, depending on site management objectives.

## Plains Grassland

Approximately 20 percent of the acreage proposed for treatment under Alternative 1 is in this analysis region. Prescribed fire and chemical treatments would be used most often. The major impact would be an increase in herbaceous species, primarily grasses, and a decrease in the density and abundance of woody species. The vegetation cover would be reduced initially after treatment but recover in the short term. Long-term impacts would be maintenance of mostly open grassland communities.

## Mountain/Plateau Grasslands

Treatments in this analysis region do not constitute a significant portion of the treatment program under Alternative 1. Proposed treatments would consist mainly of chemicals or prescribed fire to control noxious weeds or other herbaceous species or to suppress woody species. Some treatments might be started to control vegetation on rights-of-ways, oil and gas facilities, and recreation areas by chemical, mechanical, biological, or manual methods.

### Coniferous/Deciduous Forests

This analysis region comprises the least acreage proposed for treatment under Alternative 1, mostly because BLM administers so little forested land. Forests would be managed primarily by combinations of chemical, mechanical, and prescribed fire methods. Most of the treatment acreage proposed for this analysis region is in important timber-producing areas. Significant impacts of Alternative 1 in this analysis region would include reduced fuel loads and reduced understory competition for timber species. Some treatments might be initiated to control vegetation on rights-of-ways, oil and gas facilities, and recreation areas by chemical, mechanical, biological, or manual methods.

## Alternative 2: No Aerial Application of Herbicides

Under Alternative 2, aerial applications of herbicides (Figure 3-6) would not be permitted. The control of some target species in many areas would not be as effective as that under Alternative 1, and retreatment or maintenance treatments would have to be done more frequently. Exact combinations of manual, mechanical, bilogical, prescribed fire, and ground herbicide treatments (Figure 3-7) would be determined as was done for Alternative 1. Under Alternative 2, prescribed fire would be used on the greatest number of acres, followed by mechanical, bilological, chemical, and manual treatments (Table 1-1).

The 322,868 acre average annual treatment level proposed under Alternative 2 represents 0.20% of the total BLM lands within the EIS area (Table 2-1). Including wildfire occurrence as stated for the Proposed Action, average annual disturbance would be about 0.54% of BLM lands within the EIS area for this alternative. The extent of vegetative disturbance is not additive over the life of the EIS. Repeated wildfires occur in these same areas planned for treatment. When this occurs, acreage is reduced accordingly. Cumulative effects of Alternative 2 would be that vegetation management objectives of local land use plans would not be met within prescribed timeframes because managers would have fewer treatment methods available.

Under Alternative 2 for all the vegetation analysis regions, noxious weeds would be treated primarily by biological and chemical methods. Oil and gas

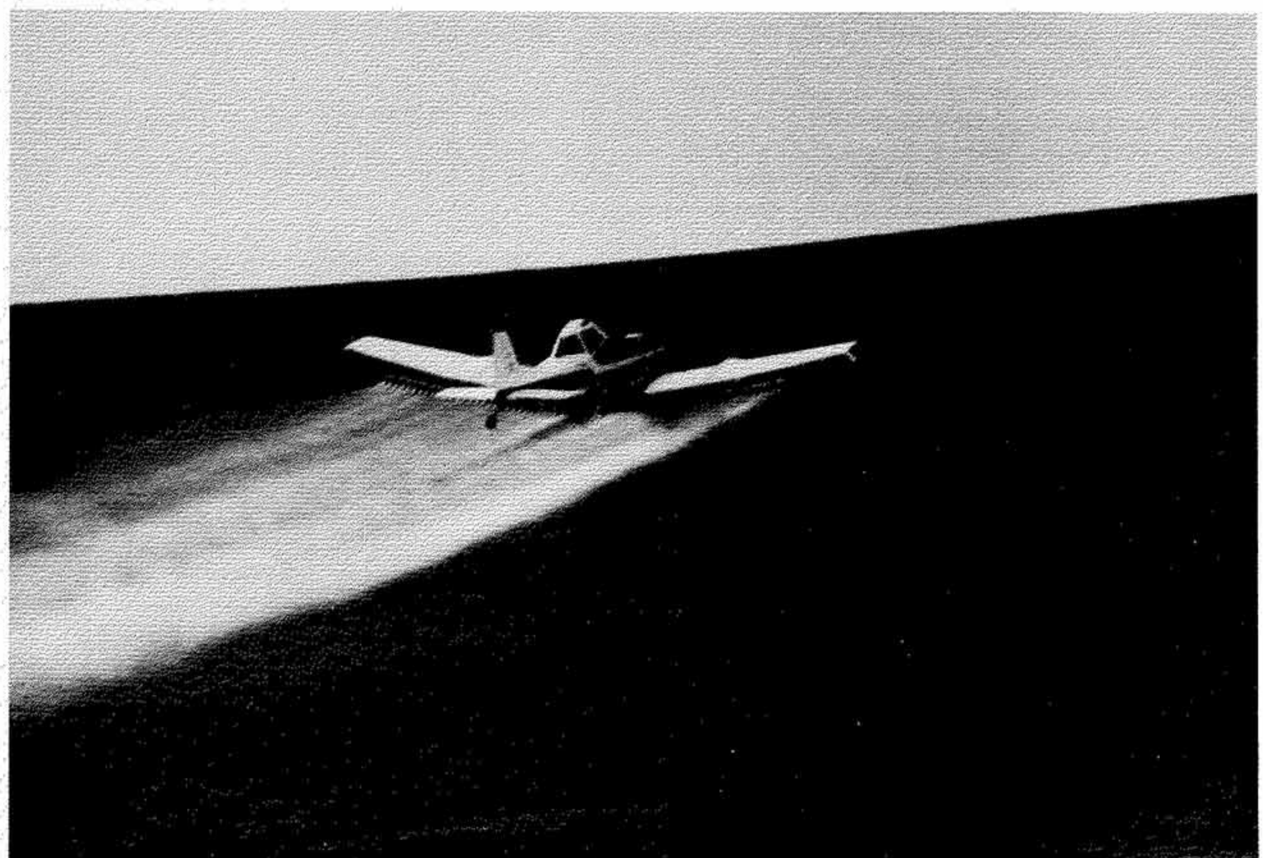


**Figure 3-6. Aerial herbicide application.**

**Figure 3-7. Equipment for ground application of herbicides.**

production facilities, recreation areas, and rights-of-way would be treated by chemical and mechanical methods, with manual and biological methods used when appropriate. Rangeland areas would be treated predominantly by prescribed burning. The impacts to riparian areas would be the same as those under Alternative 1.

## Sagebrush

Under Alternative 2, prescribed fire and mechanical treatment would be substituted for aerial chemical application as much as possible when large acreages are proposed for treatment. More than one-half of the acres proposed for treatment under this alternative are in this analysis region, although total acreage treated would decrease relative to Alternative 1. Prescribed fire could not be substituted on sites without sufficient fine fuel to carry a fire, and mechanical treatment could not be substituted on sites where sprouting species such as rabbitbrush might be increased by such treatment. Alternative 2 would preclude chemical treatment of rangelands dominated by nonnative annual grasses. This could result in potentially significant negative cumulative effects to this analysis region by precluding reclamation of these areas and resulting in further losses of native sagebrush habitat through high frequency of wildfire.

The total vegetative cover would be decreased immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 2 would not be as effective as that under Alternative 1. More acres would continue to be dominated by annual grasses and monotypical stands of shrubs. The herbaceous component of communities would not be as diverse or productive as that under Alternative 1.

## Desert Shrub

The effects of Alternative 2 in this analysis region would be the same as those under Alternative 1.

## Southwestern Shrubsteppe

Under Alternative 2, prescribed fire would be substituted for aerial herbicide application as much as possible when large acreages are proposed for treatment. Prescribed fire cannot be substituted on sites lacking sufficient fine fuel to carry a fire. Controlling sprouting, woody species in areas where an herbaceous community is sought could be difficult because herbicide use would be limited and sprouting may be enhanced by burning alone. Mechanical treatment could not be substituted for aerial chemical treatment on significant acreage, because nonplowing mechanical treatments would not prevent the resprouting and redominance of woody species and plowing treatments kill most perennial grasses and forbs that are unable to reproduce vegetatively. Total acreage treated in this analysis region would decrease relative to Alternative 1.

Under Alternative 2, the vegetative cover would be reduced immediately after treatment but recover in the short term. In the long term, however, this treatment program would not be as effective on upland communities as that under Alternative 1. More acres would continue to be dominated by shrubs, and the herbaceous component of communities would not be as diverse or productive as that under Alternative 1.

### Chaparral-Mountain Shrub

The impacts of Alternative 2 in this analysis region would be similar to the impacts of Alternative 1. Total acreage treated also would be similar to Alternative 1. However, Alternative 2 would preclude the combination of aerially applied herbicides with prescribed fire in situations where a predominantly herbaceous community is desired to replace shrub communities.

### Pinyon-Juniper

The impacts of Alternative 2 in this analysis region would be similar to the impacts of Alternative 1, because mechanical and prescribed fire treatments are most often used for vegetation treatments in this region. Acreage proposed for treatment also is similar to Alternative 1.

### Plains Grasslands

Under Alternative 2, prescribed fire would be substituted for aerial chemical application as much as possible when large acreages are proposed for treatment. Acreage proposed for treatment under this alternative is less than in Alternative 1. Prescribed fire could not be substituted on sites lacking sufficient fine fuel to carry a fire. Mechanical treatment would not be substituted for aerial chemical treatment on significant acreage. Control of large infestations of noxious weeds or other broadleaf species would not be as effective under Alternative 2 as that under Alternative 1. The vegetative cover would be reduced immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 2 would not be as effective as that under Alternative 1 because more acres would continue to be dominated by shrubs. The herbaceous component of communities would not be as diverse or productive as that under Alternative 1.

### Mountain-Plateau Grasslands

Under Alternative 2, treatments proposed to control noxious weeds and broadleaf species would not be as effective over large acreages as those under Alternative 1. However, total acreage proposed for treatment under this alternative is similar to Alternative 1. Ground application of chemicals, prescribed fire, or mechanical treatments would be substituted to the extent possible. The vegetative cover would be reduced immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 2 would not be as effective as that under Alternative 1.

### Coniferous/Deciduous Forest

Alternative 2 would preclude much understory control in new commercial timber areas because prescribed fire or mechanical treatments are not satisfactory substitutes in that situation. Other impacts would be similar to Alternative 1. Total acreage proposed for treatment is similar to Alternative 1.

## Alternative 3: No Use of Herbicides

The application of chemicals would not be permitted under Alternative 3. Control of some target species would not be possible in some areas because of lack of suitable substitute treatments. Vegetation treatment on oil and gas production facilities and rights-of-way would have to be replaced by manual or mechanical methods to the extent possible, or not done at all. The latter option would compromise the safety of oil and gas production facilities and create impossible maintenance problems on some rights-of-way. Recreation areas would be treated primarily by mechanical and manual methods.

The 285,650 acre average annual treatment level proposed under Alternative 3 represents 0.18% of total BLM lands within the EIS area (Table 2-1). Including wildfire occurrence as stated for Alternative 1, average annual disturbance would be about 0.52% of BLM lands within the EIS area for this alternative. Significant adverse long-term and cumulative effects could occur under this alternative in all analysis regions, including riparian areas, by further invasion and increase of noxious weeds or undesirable nonnative species for which no biological control was available. These impacts would reach beyond BLM lands, as public lands would provide a source for infestation of adjacent private lands or lands managed by other agencies by uncontrolled weeds.

Exact combinations of manual, mechanical, biological, and prescribed burning treatments would otherwise be determined as for those under Alternative 1. The method of treatment on the largest number of acres would be prescribed fire, followed by mechanical, biological, and manual methods (Table 1-1).

## Sagebrush

Under Alternative 3, prescribed fire and mechanical treatment would be substituted for chemical application as much as possible. More than one-half of the acreage proposed for treatment under this alternative would occur in this analysis region, but treated acres would be less than under the Proposed Action. Prescribed fire would have to be carefully controlled to avoid promoting invasion of undesirable annual species, and could not be substituted on sites lacking sufficient fine fuel to carry a fire. Mechanical treatment could not be substituted on sites where sprouting species such as rabbitbrush might be increased by such treatment. The total acreage treated in this analysis region would decrease relative to the Proposed Action. Alternative 3 would preclude chemical treatment of rangelands dominated by nonnative annual grasses. This could result in potentially significant negative cumulative effects to this analysis region by precluding reclamation of these areas and resulting in further losses of native sagebrush habitat through high frequency of wildfire.

The total vegetative cover would decrease immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 3 would not be as effective as that under Alternative 1. More acres would continue to be dominated by annual grasses and monotypical stands of shrubs. The herbaceous component of communities would not be as diverse or productive as that under Alternative 1.

## Desert Shrub

The impacts of Alternative 3 in this analysis region would mostly be in riparian areas, on oil and gas facilities, and on rights-of-way. Attempts to control saltcedar in many riparian areas would not be successful, and reestablishment of native vegetation would be poor.

## Southwestern Shrubsteppe

Under Alternative 3, prescribed fire would be substituted for chemical application as much as possible. However, the treated acres in this analysis region under this alternative would be fewer than under Alternative 1. Prescribed fire could not be substituted on sites without sufficient fine fuel to carry a fire. Mechanical treatment could not be substituted for aerial chemical treatment on significant acreage. The vegetative cover would be reduced immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 3 would not be as effective as under Alternative 1, because more acres would continue to be dominated by shrubs and the herbaceous component of communities would not be as diverse or productive. Attempts to control saltcedar in many riparian areas would not be successful, and reestablishment of native vegetation would be poor.

## Chaparral-Mountain Shrub

The impacts of Alternative 3 in this analysis region would be similar to the impacts of Alternative 1, and treated acreage also would be similar. However, Alternative 3 would preclude the combination of aerially applied herbicides with prescribed fire in situations where a predominantly herbaceous community is desired to replace shrub communities.

## Pinyon-Juniper

The impacts of Alternative 3 in this analysis region would be similar to the impacts of Alternative 1, because mechanical and prescribed fire treatments are most often used for vegetation treatments in this region. The total acres treated under this alternative would be only slightly fewer than those under Alternative 1.

## Plains Grasslands

The acreage treated in this analysis region under Alternative 3 would be less than under any other alternative but still constitute nearly 20 percent of total acreage treated under this alternative. Prescribed fire would be substituted for chemical application as much as possible when large acreages are proposed for treatment. Prescribed fire could not always be substituted on sites without sufficient fine fuel to carry a fire or on sites inhabited by sprouting shrubs, such as honey mesquite, sand shinnery oak, or cholla. Mechanical treatment would not be substituted for aerial chemical treatment on significant acreage. The control of large infestations of noxious weeds or other broadleaf species would not be as effective under Alternative 3 as that under Alternative 1.

The vegetative cover would be reduced immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 3 would not be as effective as that under Alternative 1. More acres would continue to be dominated by shrubs. The herbaceous component of communities would not be as diverse or productive as that under Alternative 1.

### Mountain/Plateau Grasslands

Under Alternative 3, treatments proposed to control noxious weeds and broadleaf species would not be as effective over large acreages as those under Alternative 1. Prescribed fire or mechanical treatments would be substituted to the extent possible. The vegetative cover would be reduced immediately after treatment but recover in the short term. In the long term, however, the treatment program under Alternative 3 would not be as effective as that under Alternative 1.

### Coniferous/Deciduous Forests

Alternative 3 would preclude much control of competing vegetation in commercial timber areas, and treated acreage in this analysis region under this alternative would be less than that under Alternative 1. Other impacts would be similar to Alternative 1, except for oil and gas facilities and rights-of-way.

## Alternative 4: No Use of Prescribed Burning

Under Alternative 4, prescribed fire would not be permitted as a management tool to treat vegetation for any reason. The combinations of mechanical, manual, biological, and chemical treatments used would otherwise be determined as was done for Alternative 1. Chemicals would be used on more acres under Alternative 4 than under any other alternative, followed by mechanical, biological, and manual methods (Table 1-1). Noxious weeds would be controlled primarily by chemical and biological means; oil and gas production facilities, recreation areas, and rights-of-way would be treated by chemical, mechanical, biological, and manual methods.

The 318,470 acre average annual treatment level proposed under Alternative 4 represents 0.20% of total BLM lands within the EIS area (Table 2-1). Including wildfire occurrence as stated for Alternative 1, average annual disturbance would be about 0.54% of BLM lands within the EIS area for this alternative. The extent of vegetative disturbance is not additive over the life of the EIS. Repeated wildfires occur in these same areas planned for treatment. When This occurs, acreage is reduced accordingly. A major cumulative effect of Alternative 4 would be that vegetation management objectives of local land use plans would not be met because prescribed fire, a valuable treatment method, is not available.

### Sagebrush

Under Alternative 4, chemicals would probably be substituted for prescribed fire as often as possible, increasing chemically treated acreage to more than that under any other alternative. Effects on nontarget grasses and forbs would be greatest under this alternative, because chemicals commonly used to control woody species in this analysis region also may be detrimental to herbaceous vegetation, particularly forbs, depending on such factors as application rate and soil texture.

Vegetation production would be reduced in the short term after treatment but increase within a few years of treatment. The long-term impact of this alternative would be a decrease in woody species and an increase in herbaceous species. The relative proportion of shrubs to herbaceous species left in treated areas would vary, depending on site management objectives. Grasses would be favored slightly over forbs. Standing dead material left after treatment cannot be burned and would present a physical obstruction to browse and forage use in formerly dense stands.

### Desert Shrub

The impacts of Alternative 4 in this analysis region would be the same as those for Alternative 1.

### Southwestern Shrubsteppe

Chemical treatment would be substituted for prescribed fire under Alternative 4 as much as possible, but treated acreage would be less than that for Alternative 1. Whereas periodic burning can maintain root-sprouting shrubs at a mostly young age class in the community, chemical treatment would tend to kill more of them. Effects on nontarget grasses and forbs would be greatest under this alternative because chemicals commonly used to control woody species in this analysis region also may be detrimental to some herbaceous species, particularly forbs, depending on such factors as application rate and soil texture. Impacts to riparian areas would be the same as those under Alternative 1.

Vegetative production would be reduced in the short term after treatment but would increase within a few years of treatment. The long-term impact of this alternative would be a decrease in woody species and an increase in herbaceous species, but community diversity probably would not be as great as that under Alternative 1 because of the effects on nontarget species and the increased mortality of woody species from the increased use of chemicals. The relative proportion of shrubs to herbaceous species left in treated areas would vary, depending on site management objectives. Standing dead material left after treatment could not be burned and would present a physical obstruction to browse and forage use in formerly dense stands.

## Chaparral-Mountain Shrub

The elimination of prescribed fire under Alternative 4 precludes use of an important tool used to treat vegetation in this analysis region. The available treatment methods are not satisfactory substitutes for fire when a vigorous shrub community is desired. The long-term impact of this alternative would be the aging of shrubs into thick, decadent stands that could die of old age and fuel buildup. The potential for catastrophic wildfire would increase significantly, in place of smaller areas burned under controlled conditions that would be less prone to such events.

## Pinyon-Juniper

Under Alternative 4, most initial mechanical treatments of pinyon-juniper sites would be unaffected. It is common to follow mechanical treatment by burning to kill residual trees and to decrease obstruction from slash piles. This would be precluded under Alternative 4. In addition, no maintenance burning of herbaceous cover established after mechanical treatment would be allowed; therefore, the site would return more quickly to pinyon-juniper. The treated acreage under Alternative 4 would be less than that under Alternative 1. Chemicals would be substituted for fire to some extent, increasing the adverse effects on nontarget grasses and forbs. The substitution of certain chemicals also can increase the potential for post-treatment dominance by annual grasses on some sites. Slash piles remaining on the site contain nutrients that could contribute to site productivity, but the nutrients would only be released by burning. Old slash piles also would present a wildfire hazard. If slash piles were burned by wildfire under severely dry conditions rather than by prescribed fire under controlled conditions, damage could be done to the site because of high fire temperature.

Vegetative production would be reduced in the short term under this alternative but would increase within several years after treatment if revegetation is successful. The long-term impact of Alternative 4 in this analysis region would be to increase abundance and diversity of herbaceous vegetation and understory shrubs and to decrease tree cover. The relative proportion of trees to other species left in treated areas would vary, depending on site management objectives.

## Plains Grasslands

Chemical treatment would be substituted for prescribed fire under Alternative 4 as much as possible. The treated acreage in this analysis region would be less than that under Alternative 1 but would comprise approximately one-fourth of the total acreage treated under Alternative 4. Whereas periodic burning would maintain root-sprouting shrubs at a mostly young age class in the community, chemical treatment would tend to kill more of them. The effects on nontarget grasses and forbs will be greatest under this alternative because chemicals commonly used to control woody species in this analysis region also may be detrimental to herbaceous vegetation, particularly forbs, depending on such factors as application rate and soil texture.

Vegetative production would be reduced in the short term after treatment but would increase within a few years of treatment. On some sites, community diversity would not be as great as that under Alternative 1 because of the effects on nontarget species and the increased mortality of target species from the increased use of chemicals.

## Mountain/Plateau Grasslands

Chemicals are the primary treatment method in this analysis region, so treated acreage under Alternative 4 is similar to that under Alternative 1. This alternative would mostly affect treatments on mountain grassland sites to suppress woody species and would result in treatment being foregone if chemicals were not a satisfactory substitute.

## Coniferous/Deciduous Forests

Eliminating prescribed fire under Alternative 4 would have serious consequences in this analysis region. Slash remaining from timber operations could not be burned, which would increase the potential for serious wildfire. The lack of understory burns in some forest types, especially ponderosa, allows the establishment of fuel ladders, also a serious wildfire hazard. Fire exclusion under this alternative would have a significant cumulative effect by favoring conifers over aspen, resulting in a trend toward a long-term dying out of aspen stands. Chemical and mechanical treatments would still be done to manage species competing with conifers in commercial timber areas, but jeopardy of losing these resources to wildfire would increase.

## Alternative 5: No Action (Continue Current Management)

Under Alternative 5, vegetation treatment would continue as currently being performed. The total acreage treated would be lower than that for any other alternative. Under Alternative 5, all available treatment methods—manual, mechanical, biological, prescribed burning, and chemical—could be used. However, the array of chemicals available for use would be less than that under Alternative 1. The chemically treated acreage under this alternative would be less than that under any other alternative. Exact combinations of manual, mechanical, biological, and prescribed burning treatments would otherwise be determined as was done for Alternative 1. Under Alternative 5, the method of treatment on the largest number of acres would be prescribed fire, followed by biological, mechanical, chemical, and manual methods.

The 242,505 acre average annual treatment level proposed under Alternative 5 represents 0.15% of total BLM lands within the EIS area (Table 2-1). Including wildfire occurrence as stated for Alternative 1, average annual disturbance would be about 0.49% of BLM lands within the EIS area for this alternative. The extent of vegetative disturbance is not additive over the life of the EIS. Repeated wildfires occur in these same areas planned for treatment. When this occurs, acreage is reduced accordingly. Major cumulative effects of Alternative 5 would be that noxious weed and undesirable plant treatment objectives throughout the vegetative regions would not be met.

### Sagebrush

Under Alternative 5, approximately one-half of the acreage would be treated in this analysis region relative to Alternative 1. The acreage proposed for treatment under this alternative would nevertheless constitute approximately one-half of the total acreage treated under Alternative 5. The chemically treated acreage would be proportionally less under Alternative 5 than under Alternative 1. Short-term impacts to nontarget herbaceous species from chemical use, particularly forbs, would be decreased. There also would be a short-term loss of vegetative cover after treatment. Long-term impacts would be more acres dominated by shrubs or annual grasses and less community diversity relative to Alternative 1. The effects of treatment on oil and gas facilities, rights-of-way, and recreation areas would be similar to those under Alternative 1.

### Desert Shrub

The effects on this analysis region under Alternative 5 would be similar to those under Alternative 1, except treated acreage will be slightly less. Acreage of riparian treatments in particular would be reduced under Alternative 5 relative to Alternative 1. In areas where herbicides are not available under this alternative, saltcedar control in riparian areas would not be expected to be very successful, and reestablishment of native vegetation would be poor.

### Southwestern Shrubsteppe

The treated acreage would decrease by nearly one-half in this analysis region under Alternative 5 relative to Alternative 1. Treatment of riparian acres in particular would be reduced relative to Alternative 1. In areas where herbicides would not be available under this alternative, saltcedar control in riparian areas would not be expected to be very successful, and reestablishment of native vegetation would be poor. The chemically treated acreage would be proportionally less under Alternative 5 than that under Alternative 1. Short-term impacts to nontarget herbaceous species from chemical use, particularly forbs, would be decreased. There would be a short-term loss of vegetative cover after treatment. Long-term impacts would be more acres dominated by shrubs or annual grasses and less community diversity relative to Alternative 1. Impacts of treatment to oil and gas facilities, rights-of-way, and recreation areas would be similar to Alternative 1.

### Chaparral-Mountain Shrub

Impacts to this analysis region under Alternative 5 would be similar to those under Alternative 1, except treated acreage would decrease significantly. The proportion of chemically treated acres would decrease relative to Alternative 1. Impacts of treatment to oil and gas facilities, rights-of-way, and recreation areas would be similar to Alternative 1.

### Pinyon-Juniper

Impacts to this analysis region under Alternative 5 would be similar to those under Alternative 1, except not as many acres would be treated. Most treatments proposed in this analysis region would continue to be mechanical and prescribed fire.

Chemicals would continue to be used to control noxious weeds and treat oil and gas facilities and rights-of-way. Recreation areas would be treated with manual, mechanical, or chemical methods.

### Plains Grasslands

The treated acreage in this analysis region would decrease under Alternative 5 relative to Alternative 1, but the proportion of chemically treated acres would remain approximately the same. Treatments proposed for this analysis region under Alternative 5 constitute approximately one-fourth of the total acreage that would be treated under this alternative. Impacts of Alternative 5 in this analysis region would be similar to impacts of Alternative 1.

### Mountain/Plateau Grasslands

Impacts to this analysis region and acreage treated under Alternative 5 would be similar to those of Alternative 1.

### Coniferous/Deciduous Forests

Impacts to this analysis region under Alternative 5 would be similar to those under Alternative 1, except not as many acres would be treated. The proportion of chemically treated acres would remain approximately the same relative to Alternative 1.

# CLIMATE AND AIR QUALITY

## Climate

Because the factors influencing climate are so large in scale compared with the size of any individual proposed vegetation treatment, none of the alternative methods would have any significant impact on climate.

Global carbon dioxide and methane levels are increasing, and have been called "greenhouse gases," implying their increased concentrations may lead to changes in precipitation and temperature (both in timing and intensity). All vegetation is important in the processing and recycling of oxygen and carbon through photosynthesis. By converting carbon dioxide into oxygen and plant fiber, carbon is "fixed;" removed from the atmosphere until the plant material either decomposes or burns. Alternatives 2 and 3 propose the greatest degree of prescribed burning, which would add carbon dioxide and fine particulate matter to the atmosphere.

## Air Quality

The most significant impacts to air quality would be moderate increases in noise, dust, and combustion engine exhaust generated by manual and mechanical treatment methods; smoke from prescribed burning; and moderate noise and minimal chemical drift from the aerial application of herbicides. Impacts would be temporary, small in scale, and dispersed throughout the study area. These factors, combined with standard management practices (stipulations), minimize the significance of potential impacts. Federal, State, and local air quality regulations would not be violated. Potential cumulative impacts may occur when multiple prescribed fires occur simultaneously. In the Pacific Northwest (where cumulative impacts are most likely), smoke management committees limit burning by Federal, state and private groups to minimize cumulative impacts.

## Alternative 1: Proposed Action

Under Alternative 1, more acres would be treated than under any other alternative, and all treatment methods could be used. Air quality impacts are not anticipated to change significantly from current conditions.

## Alternative 2: No Aerial Application of Herbicides

Under Alternative 2, the aerial application of herbicides would not be allowed. Restricting the use of herbicides would increase smoke emissions for prescribed burning by nearly 50 percent, particularly in the sagebrush analysis region.

## Alternative 3: No Use of Herbicides

Chemical treatment would not be used under Alternative 3, increasing the dependence on mechanical and prescribed burning methods and increasing smoke emissions by nearly 50 percent throughout the study area. Specifically, smoke emissions in the desert shrub, southwest shrubsteppe, plains grasslands, and mountain/plateau grasslands analysis regions would nearly double, with smaller increases in the sagebrush and pinyon-juniper analysis regions (50 and 20 percent, respectively).

### Alternative 4: No Use of Prescribed Burning

Under Alternative 4, prescribed burning would not be used, increasing the dependence on chemical and mechanical treatment methods but causing only minor improvements in air quality. This is because risks of wildfires and resulting smoke impacts would increase. The conifer/deciduous forests analysis region currently has the greatest smoke impacts, where prescribed burning helps reduce available fuel under optimal smoke dispersion conditions.

### Alternative 5: No Action (Continue Current Management)

Alternative 5 is the continuation of current vegetation treatment programs. The fewest number of acres would be treated, and chemical treatment would not be performed in some areas. Except in areas of urban and industrial development, the existing air quality is good throughout the study area. The greatest existing air quality impacts are because of prescribed fire smoke in the conifer/deciduous forests analysis region. Federal, State, and local air quality regulations are not violated.

## GEOLOGY AND TOPOGRAPHY

None of the alternatives should significantly affect the geology or topography of the EIS area.

## SOILS

### Alternative 1: Proposed Action

Under the proposed alternative, more acres would be treated than under any other alternative, and all of the treatment methods could be used. Manual treatment methods generally do not directly disturb soils and are used mostly in small isolated areas because of their cost and labor intensiveness. They are not expected to have significant impacts when used under any of the alternatives.

Impacts from mechanical treatments could include runoff, wind and water erosion, compaction, and a reduction in nitrogen-fixing bacteria. These impacts are highly site- and treatment-specific but are most likely to occur on fine-textured soils lacking organic matter and soil structure with low aggregate stability and a tendency to form a crust.

The use of livestock as a biological treatment could result in surface erosion and compacted soil. However, these effects usually would not occur if a careful grazing plan were followed. The use of insects and pathogens has little potential for direct soil impacts. In general, the potential impacts of biological methods are negligible for all of the alternatives considered. Prescribed burning affects the soil's chemical properties, microorganism populations, physical properties, wettability, and erosion. The degree of impact depends on the severity of the burn, fuel type, soil type, soil moisture, weather patterns, topography, plant cover remaining, rate of negative recovery, and frequency and area of bare soil. Prescribed burning provides the positive effect of immediately releasing nutrients into the soil. Under the proposed alternative, prescribed burning would be the second most used treatment method.

Under the proposed alternative, the greatest proportion of program acreage would be treated with herbicides. Although the herbicides would not alter the soil's physical properties, soil microorganisms could be indirectly affected. Herbicides can either stimulate or inhibit soil microorganisms, depending on application rates and the soil environment. The potential adverse effects relate to possible toxic effects on soil microorganisms or changes in species composition of these organisms.

### Alternative 2: No Aerial Application of Herbicides

Under Alternative 2, the impacts to soils may be greater than under Alternative 1. More acreage would be treated by prescribed burning and mechanical methods than under the proposed alternative. This could increase the likelihood of effects such as runoff, wind and water erosion, compaction, and reduced nitrogen-fixing bacteria, depending on the areas treated and the mechanical treatment used. The greatest impacts from burning could occur beneath piles of cut or chained pinyon, juniper, or conifer slash, if they were burned when dry enough to have a significant amount of fuel consumption. Such impacts would be localized, and in most cases, these sites would not be burned under extremely dry, heavy fuel conditions because of the risk of fire escape. Postfire erosion could occur if an extreme precipitation event occurred before revegetation in areas treated by either method.

## Alternative 3: No Use of Herbicides

Alternative 3 has the potential to affect soils the most because more prescribed burning and mechanical treatments would be used than under the other alternatives. Therefore, the possibility of the impacts associated with these treatment methods occurring is greater than under the other alternatives. Because no herbicides would be used, the impacts associated with herbicide use would not apply.

## Alternative 4: No Use of Prescribed Burning

Alternative 4 probably would affect soils the least because fewer acres would be treated mechanically than under Alternatives 2 and 3, and no acres would be treated by prescribed burning. However, when fire is not used to manage fuels, wildfire incidence could increase. Chemicals will be the most widely used treatment method, with more than half of the total acreage treated with them. The possibility of indirect effects on soil microorganisms could increase with so many more acres being treated.

## Alternative 5: No Action (Continue Current Management)

The potential impacts of Alternative 5 are comparable to those under the proposed alternative, only slightly less. The same combination of treatment methods are available for both alternatives, but only fewer acres are treated under Alternative 5.

# AQUATIC RESOURCES

Under all the alternatives, manual and biological treatment methods would have a negligible effect on aquatic resources. Mechanical and prescribed burning treatments (used in all but Alternative 4) would increase short-term erosion and sedimentation. Drift onto surface water may occur from herbicide treatments, (under Alternatives 1, 4, and 5), although mitigation measures make this unlikely. In general, because of the characteristics of the chemicals used, the properties of the soils in the EIS area, and the generally low rainfall in most areas, it is unlikely that herbicides would reach ground water.

The program flexibility under Alternative 1, with all treatment methods available for use, should allow for the best possible management of ground cover and thus the least erosion and sedimentation. Under Alternative 2, with aerial applications of herbicides not permitted, there is a reduced risk of contamination of surface waters from offsite drift. Alternative 3 could cause the greatest effects because it has the combined highest acreage of mechanical and prescribed burning treatments, but no herbicide drift would occur under this alternative because no herbicides are used. Alternative 4 should cause the least impacts because no prescribed burning would be used and relatively few acres would be treated by mechanical methods. However, more acres are treated by herbicides than under any other alternative, thus increasing the possibility of accidental surface water contamination. Alternative 5 should have effects similar to but somewhat lower than Alternative 1.

# FISH AND WILDLIFE

In general, impacts to wildlife would be greatest where vegetation treatments are used most often. The potential for negative impacts is highest when large areas are treated. The greatest positive impacts are achieved when small, irregular shaped blocks are treated. Smaller treatment areas also would be most beneficial to maintaining or improving biological diversity. Proper project design and environmental analysis can ensure improved wildlife habitat and increased species diversity under all of the alternatives. Impacts on upland wildlife species can be beneficial or adverse for any treatment in any analysis region, depending on the individual project designs. All impacts will be analyzed assuming that the site-specific project design includes all necessary considerations for avoiding adverse effects and achieving beneficial impacts, and ensuring that biological diversity is not significantly affected.

In all of the analysis regions, aquatic and riparian habitats, including xeroriparian dry washes, are crucial to wildlife populations. These habitats would generally be avoided with all the alternatives, except the small acreages of hand treatment of saltcedar by stump cutting and brush painting with herbicides, a few acres of mowing saltcedar, and some spot treatment of noxious weeds. The only real adverse effects would be accidental; for example, because of escaped burns, herbicide spills, overland flow, erratic aerial drift, or poor contract supervision. The project design should consider the potential for these accidents and minimize their likelihood. If proper project design and mitigations are used, there will be no significant direct impacts to fish and other riparian wildlife species, which will benefit indirectly through improved watershed conditions and stabilization of stream channels and improved riparian vegetation as a result of upland vegetation treatments.

The risks to terrestrial and aquatic wildlife species from herbicides are greatest when the highest application rates are used, usually on utility rights-of-way and oil and gas sites. Risks are also increased when aerial application of herbicides occurs, especially by fixed wing aircraft, as the degree of control of where the herbicide is actually applied is decreased. Assuming similar degrees of risk to species, potential impacts to wildlife would be proportionate to the density of wildlife species using these areas or habitats. Herbicide treatments in habitats with high wildlife densities will have a greater direct negative impact from the herbicide than in the habitats with low wildlife densities. However, the potential beneficial impacts from vegetation treatments with herbicides are greatest in the habitats with the highest wildlife use.

The presence of threatened, endangered, or special status wildlife species in a proposed treatment area will require Section 7 (of the Endangered Species Act) consultation with the U.S. Fish and Wildlife Service.

Cumulative impacts are difficult to define on this scale without site-specific proposed treatments and a summary of previous treatments within an area being treated. The greatest potential for significant adverse impacts will be in areas with a history of large scale or a large number of past treatments. The sagebrush analysis regions of Oregon, Nevada, and Idaho are areas where extensive treatments have occurred and impacts to major species have been verified. Proposed treatments in these areas need to be well planned to prevent causing further adverse impacts to previously heavily impacted species (e.g. sage grouse). Site-specific analysis of all proposed treatments needs to evaluate the proposed actions as they relate to the surrounding wildlife habitats for all species impacted by the treatment and the effects on the total diversity of the wildlife populations and communities in the region. Treatments that are designed to result in major changes in vegetation communities and perhaps restore past vegetation communities will result in long-term changes in wildlife communities. These long-term changes must consider the overall impact and significance of eliminating and replacing these wildlife communities, especially if special status species are involved.

Since there are many data gaps in the understanding of the affects of specific land treatments on the multitude of wildlife species, it is very important to monitor the specific impacts of a particular treatment on the wildlife community being impacted. These monitoring studies should be accomplished in cooperation with the state wildlife management agency and the results made available to other interested agencies and personnel.

## Alternative 1: Proposed Action

This alternative has the largest acreage for treatment and therefore the greatest potential impacts. The full range of treatment methods—manual, mechanical, biological, prescribed fire, and chemical—would be available. Therefore, the most efficient and environmentally acceptable method could be chosen to achieve the desired result. The maximum positive impact to wildlife habitat would occur under this alternative. This alternative also has the highest potential for adverse impacts. The largest acreage of current wildlife habitats would be disturbed under this alternative. Improper application of any of the proposed treatment methods could result in significant negative impacts to the wildlife communities. It is through application of proper mitigation in the site-specific project proposal and planning that adverse impacts are avoided. With proper planning most adverse impacts would be temporary and localized. The most significant long-term impacts would occur when permanent type-conversion treatments were applied. In these treatments significant long-term changes in the wildlife community would occur, perhaps total loss of some original wildlife species and addition of other new species moving in to replace them. This alternative will also result in the largest number of acres of existing habitat being disturbed. Aerial or ground application of 2,4-D, or diesel fuel as a carrier of herbicides, could have a significant adverse impact to bird eggs, and young of any wildlife species, if applied during these primary reproductive periods.

The largest acreage proposed for treatment is in the sagebrush analysis region, which has already received extensive vegetation treatment. Excessive sagebrush control has had a negative effect on sage grouse in many areas. Future treatments must avoid further impacts to sage grouse, especially in Oregon and Washington where they are being considered for listing as threatened or endangered. Treatment planning should avoid areas where extensive treatments have occurred in the past, unless a definite need is demonstrated. Sagebrush and pinyon-juniper treatments also can be detrimental to wintering big game in years when snow depth makes low plants unavailable and less desirable plants, such as sagebrush and juniper, are the maintenance diet. Climatic extremes and cumulative effects of past and other planned treatments must be considered in environmental analysis to avoid significant negative impacts.

Several vegetation treatments are proposed for recreating historical vegetation communities that have been lost or severely degraded through past land-use practices. These areas have evolved wildlife communities that are adapted to the current situation. The wildlife community in these areas may be quite different than the historic wildlife community. As a result of the proposed actions, which may be desirable from a biological diversity aspect, a significant displacement of wildlife may occur and some species may be eliminated. This would have a short-term negative impact; however, the long-term goal of improving damaged communities is worthy and overshadows the short-term negative impacts. Because the historic wildlife species may no longer exist in the immediate area, it may be necessary to reintroduce these extirpated species. The successful reestablishment of lost wildlife species into historical habitat, in good condition, is an extremely positive impact of this type of vegetation treatment.

The maximum control of noxious weeds would occur in this alternative, minimizing the potential for wildlife problems caused by these plants and preventing the loss of habitat through the encroachment of exotic, noxious vegetation on native ranges. This would have a beneficial effect on wildlife.

Some short-term negative impacts would occur to riparian species displaced by control of saltcedar by mowing and treatment of individual trees with herbicides; however, the long-term beneficial effects of restored native riparian species would be significant and offset any negative impacts.

This alternative contains a mix of all potential land treatments being considered for application. Therefore any impact, either adverse or beneficial, is possible in this alternative, complicating an analysis of cumulative impacts. Several treatments can occur in combination to achieve a desired end product, or treatments could occur in near proximity to each other. Potential effects of aerial and ground application of herbicide spraying could occur over the entire EIS area, in all types of habitats and conditions, complicating the mitigation techniques to be applied. To minimize impacts to fish and other aquatic wildlife, the use of certain chemicals will be minimized, and diesel oil carriers carefully regulated and applied when the treatment area is adjacent to aquatic habitats.

## Alternative 2: No Aerial Application of Herbicides

This alternative allows the use of all treatment methods, but herbicide use is limited to ground applications. Some negative impacts may be expected from the use of less-effective methods as an alternative to the use of aerial application of herbicides. The most common alternative method is prescribed burning, which, if accomplished successfully, may be as beneficial as and have negative short-term impacts similar to the aerial application of herbicides, resulting in no major significant differences. Without the aerial application of herbicides, the potential of problem herbicide drift would be reduced, though not eliminated, with ground application. The control of noxious weeds would be less effective, and some negative impacts would occur to wildlife through direct effects and indirectly through increased competition with desired native forage plants. All other impacts are the same as in Alternative 1. Very few projects specifically designed to benefit wildlife would be foregone with this alternative, making this the most beneficial and least adverse alternative to the wildlife resource, while still retaining most of the treatment options. Again, as in Alternative 1, to minimize impacts to fish and other aquatic wildlife, the use of certain chemicals will be minimized, and diesel oil carriers carefully regulated and applied when the treatment area is adjacent to aquatic habitats.

Cumulative impacts will be more limited than Alternative 1 because there will be no potential for impacts from aerial spraying of herbicides, although all other methods will be available. Specific assessment of cumulative impacts will be accomplished at the site-specific environmental analysis level.

## Alternative 3: No Use of Herbicides

Only manual, mechanical, biological, and prescribed burning treatments would be allowed under this alternative. Except for Alternative 5, this alternative has the least number of acres proposed for treatment. More than 60,000 acres proposed for herbicide treatment in Alternative 1 are proposed under other treatments in this alternative. Being substitutes, the alternative treatments may not be as effective as the original proposed treatments. Nearly 40,000 acres of these substitute treatment acres are for prescribed burning to replace herbicide spraying. Prescribed burning should be more cost effective than spraying and therefore more feasible. Whether prescribed burning would have more or less impacts than herbicides will depend upon the specific habitat and wildlife community being impacted. The most significant loss would be in the nearly 80,000 acres (annually) of potential habitat improvement not treated because of the lack of suitable substitute to herbicide treatments, including habitat type conversion areas without sufficient ground cover to carry prescribed fires. However, without specific site-specific proposals, the actual impact to wildlife is unknown. It is possible that only a few of the foregone treatments would have significant wildlife benefits.

Without the use of herbicides, the potential negative impacts caused directly by the herbicide chemical, carrier, or surfactant would not occur. This would have a beneficial effect on wildlife, although it is not expected to be highly significant with proper mitigation. Without using herbicides, noxious weeds could not be as effectively controlled. In the long-term, the loss of wildlife habitat in some analysis regions could be significant, with a reduction in total habitat area and quality of habitat, and the related biological diversity. Another adverse impact is the loss of the only effective control method for saltcedar. Alternative 3 will have the greatest adverse impact on riparian area condition and management because of eliminating this ability to control saltcedar. This would effectively eliminate the ability to convert areas invaded by saltcedar to riparian areas of native vegetation and could have a significant long-term impact. In areas of currently seriously-degraded habitats, without sufficient vegetation to carry prescribed burns, the limitation on use of herbicides may also prevent recreation of historic native vegetation habitats and their associated wildlife communities.

The cumulative effect of long-term non-use of herbicides as a tool to manage problem vegetative species could be very significant. For many noxious weeds there is no suitable substitute for herbicide control. These species would continue to invade and spread their ranges without significant limitation. Also, there is no suitable substitute for herbicides for habitat type conversion in areas suffering from past abuses that cannot grow sufficient ground cover to carry fires. This alternative would cumulatively have a significant impact on our ability to effectively recover these areas of serious past abuse. This would be most serious in the sagebrush, pinyon-juniper, and southwestern shrubsteppe analysis regions. The spread of saltcedar would also not be significantly abated under this alternative.

## Alternative 4: No Use of Prescribed Burning

As in Alternative 3, eliminating the use of prescribed fire would result in1use of substitute treatments. Almost half of the acreage proposed for burning in Alternative 1 would be proposed for treatment by a different method in this alternative, 34,000 acres would be sprayed with herbicide, resulting in the highest number of acres of herbicide spraying in any alternative. The most significant impacts from use of herbicides, as discussed in Alternative 1, will therefore occur in this alternative. For the other half, there would be no suitable substitute. This would result in the same types of impacts discussed for Alternative 3. The elimination of prescribed fire as a management tool also eliminates the most cost-effective method for large-scale type conversion on sites suitable for burning. These impacts also are the same as those discussed for Alternative 3. Another significant impact of eliminating burning as a tool is that prescribed burning often is used in conjunction with other methods to improve the final project. Fire frequently is used after herbicide treatment to remove the dead, standing woody materials, which often are impediments to wildlife movements. However, wildlife may use these materials for perches, cover, and nesting habitat, so their removal should be carefully considered and analyzed. The impact of removal can be either beneficial or detrimental. Selective removal, or leaving areas unburned, should be considered in the analysis. Fire also is used to clean up slash after chaining and other mechanical and manual treatments. This can be positive or negative, depending on the anticipated wildlife use of the area.

Prescribed fire would have definite short-term impacts on wildlife use of the area, especially immediately after the burn when cover and forage are temporarily extremely reduced. Some direct loss of wildlife, nests, and eggs also would occur. Depending on postburn climatic conditions, the return of high-quality forage (forbs and grasses) may be only a matter of days or weeks. The return of shrubs and trees is slower, as is the return of significant cover. In general, a well-planned prescribed burn is a significant long-term benefit to wildlife, especially when there is a dense cover of trees and undesirable shrubs preceding the burn. Habitat modification by prescribed fire is more beneficial to large mammals and birds than to smaller avian and mammalian species. Impacts from escaped fires that burn areas not proposed for burning, such as riparian areas, would be eliminated under this alternative, which could be significant in areas or situations where fire control is difficult. However, fires are not usually conducted under conditions that would make control difficult.

Other treatment impacts would be the same as for Alternative 1.

Cumulative impacts would be more significant in this alternative than all others. The potential for adverse impacts from aerial and other applications of herbicides would be highest of all alternatives. Most adverse impacts would be avoided through mitigation, but the potential risk from accidents would still be the highest. Since prescribed burning is the most cost effective treatment when it is appropriate, having to use alternative methods would raise the cost of treatment. The cumulative effect of this alternative would be quite significant, costing the Bureau an extra $1.5 million per year. Since the budget would not likely be raised to account for this extra cost, the end result would be a limitation in being able to effectively manage the habitat resources. Over the life of this EIS, this could significantly reduce the overall quality of wildlife habitats.

### Alternative 5: No Action (Continue Current Management)

The impacts of continuing the existing situation would vary by State, depending on whether herbicide use is possible. Without using herbicides, there may be no effective way to achieve large-scale site conversion in areas with a history of abuse, as discussed under Alternatives 3 and 4. Without herbicide use, some States have no suitable means of effectively controlling noxious weeds, also discussed under Alternative 4. In all other situations, the impacts would generally be the same as for Alternative 1.

## CULTURAL RESOURCES

The potential for damage to cultural resources varies among the alternatives depending on: (1) the amount and location of ground disturbance in manual and mechanical treatments; (2) the type of herbicide and application method used in chemical treatments; (3) the type of application method in biological treatments; and (4) the location, temperature, duration, and amount of ground disturbance in prescribed burning treatments.

The alternatives using mechanical methods to treat the greatest number of acres have the greatest potential for adverse impacts on cultural resources. Any adverse impacts of manual, prescribed burning, and chemical methods are likely to be lower than those from mechanical treatments.

### Alternative 1: Proposed Action

Adverse impacts due to cultural resource damage are less likely under this alternative than under all of the other alternatives except Alternative 5. About 313,000 acres would be treated using manual, prescribed burning, and chemical methods; 58,000 acres would be treated mechanically.

### Alternative 2: No Aerial Application of Herbicides

There is less potential for cultural resource damage under this alternative than under Alternative 3 but more than under Alternatives 1, 4, and 5. Approximately 252,000 acres would be treated using manual, prescribed burning, and chemical methods; 71,000 acres would be treated by mechanical methods.

### Alternative 3: No Use of Herbicides

The potential for damage to cultural resources under this alternative is greater than under any of the others because more acres (74,000) would be treated using mechanical methods. A total of 285,000 acres would be treated using manual, mechanical, prescribed burning, and biological methods.

### Alternative 4: No Use of Prescribed Burning

The potential for cultural resource damage under this alternative is less than under Alternatives 2 and 3 and more than under Alternatives 1 and 5. Approximately 249,000 acres would be treated using manual, biological, and chemical methods; mechanical methods would be used on 69,000 acres.

### Alternative 5: No Action (Continue Current Management)

It is likely that less damage to cultural resources would occur under this alternative than under any of the other alternatives. A total of 242,000 acres would continue being treated using manual, prescribed burning, and chemical methods, which includes 42,000 acres that would be treated by mechanical methods.

## RECREATION AND VISUAL RESOURCES

The goals of vegetation treatment on recreation areas include general maintenance, maintenance of the visual appearance of the areas, reduction of potential threats to the areas, plants and wildlife, protection of visitors' health and welfare by controlling noxious weeds and poisonous plants, and fire control. In the program areas that are easily visible where the appearance of the area is important (for example, recreation areas and public domain forests), treatments would be made that cause the least adverse visual impact. Some short-term scenic degradation would be associated with each of the program alternatives.

## Alternative 1: Proposed Action

The proposed alternative allows the best combination of treatment methods for a specific site to be implemented. Manual and mechanical treatment methods are the most widely used techniques in recreation areas, but in some instances, using herbicides is preferable. For example, the preferred treatment for poison oak and other undesirable sprouters is herbicide application, because these weeds are difficult to eliminate otherwise. There may be short-term adverse impacts under Alternative 1, especially in areas where prescribed burning and herbicides are used. Some areas might be temporarily unusable after herbicide applications, and edible fruit and berrypicking opportunities may be lost. Because of smoke and blackened areas from prescribed burns, visitors may spend less time at a particular site. However, the long-term impacts would be beneficial. The risk of visitor exposure to undesirable plant species would be decreased and habitat for desirable plants and wildlife would improve; therefore, recreation hours spent at a particular site would be expected to increase.

Under Alternative 1, the principal area treated would be rangeland, and most treatments would be herbicide applications and prescribed burning. Adverse visual impacts could include a reduced variety of vegetation in chemically treated areas, blackened areas from burns, and visibility impairments from smoke. However, these adverse impacts would be temporary, particularly the visual effects of smoke, and there could be long-term beneficial impacts because regrowth of more aesthetically desirable plants would be possible. Some mechanical treatments would be used under the proposed alternative. These would occur on rangelands and in forests. The adverse visual impacts could include unsightly exposed soil or disrupted land surfaces. However, these impacts would be short term, and the potential long-term impacts would include the regrowth of more visually pleasing annuals, perennials, and shrubs. Manual treatment methods, which are virtually the same under all the alternatives, would have a low visual impact because, in general, they are implemented in areas that are difficult to reach by vehicle (and that are not readily visible to a large number of people, or in areas that are sensitive, so care would be taken to avoid disrupting the area to a great extent. The level of use of biological treatment methods is expected to remain the same under all of the alternatives. Biological treatment would be used in areas where livestock is a common sight, so the visual impacts would be minimal.

## Alternative 2: No Aerial Application of Herbicides

Alternative 2 should have the same impacts as the proposed alternative in recreation areas because herbicides are not applied aerially in these areas and the same treatment methods could be expected to be used. Dispersed recreation activities could be affected because more area would be treated with prescribed burns. Hunting, camping, backpacking, and horseback riding would probably shift to unburned areas. In the long term, the prescribed burning would make the areas more attractive for these activities by improving the habitat for various flora and fauna.

Under this alternative, the principal treatment methods used would be mechanical treatments and prescribed burning. The increase in the use of mechanical methods, such as chaining and tilling, would result in a greater visual contrast between treated and untreated areas (for example, broken trees, disrupted land, and exposed soil). More areas would be burned under Alternative 2; therefore, there would be more blackened areas and more smoke than under Alternative 1. Manual treatment methods would be much the same as under Alternative 1, and the impacts would also be the same. Manual methods would be used in sensitive areas, so care would be taken to avoid disturbing the area to a great extent; or they would be used in areas difficult to reach by vehicle and would therefore not be highly visible. Biological treatments would remain the same as in Alternative 1.

## Alternative 3: No Use of Herbicides

No use of herbicides in recreation areas would have detrimental effects. Compared to the proposed alternative, approximately 20 percent less area would be treated for the control of noxious weeds and poisonous plants. Visitor use in these areas could decline to avoid exposure to the uncontrolled undesirable plants. Manual and mechanical treatment methods have been the preferred techniques in the past, but in some cases (for example, undesirable sprouting species), these methods may not be effective. If nonchemical measures fail to control undesirable species in the areas that are treated, visitor use may also decline. The use of prescribed burning would be expected to increase under this alternative, possibly resulting in decreased air quality from smoke, as well as more blackened areas that would be avoided by recreationists.

If no herbicides are used, most acreage would be treated with prescribed burns, and more mechanical treatments will be used than under any other alternative. Fewer acres in more highly visible areas, such as recreation areas and rights-of-way, would be treated altogether. These differences have the adverse effects of increasing the number of blackened areas readily visible, the number of vehicles disrupting the areas, and the amount of undesirable vegetation crowding out visually pleasing vegetation. The amount of biological treatments would not increase, and they still would be conducted in areas where grazing is expected, so the visual impacts would be negligible. Under Alternative 3, the contrasting brown areas that herbicide use causes would not develop, but in the long term, visually desirable vegetation might be displaced by visually undesirable plants.

## Alternative 4: No Use of Prescribed Burning

Alternative 4 could have both adverse and beneficial impacts. Manual treatment methods under this alternative are not expected to have adverse impacts because these treatments are species selective and are done in sensitive areas with as little disturbance to the environment as possible. The use of mechanical methods could increase; therefore, more exposed soil and disrupted land could be expected. Herbicide applications could be expected to increase under this alternative; therefore, recreational opportunities could be adversely affected because of temporary site closures, wildlife habitat changes, and the loss of edible fruit and berrypicking opportunities (USDA 1988). Habitat improvement opportunities are highest in alternatives that use prescribed fire. These opportunities decrease as the use of fire is restricted (USDA 1988).

Under this alternative, fewer acres would be treated than under the proposed alternative. Most of these acres would be on rangeland and public domain forests. More area would be treated with herbicides than in the other alternatives, which could result in more contrasting brown areas and a decreased variety of vegetation on treated sites. Manual and mechanical methods would be virtually the same as under the proposed alternative; therefore, their visual impacts are expected to be the same. With no prescribed burning, there would be no blackened areas and no problems with smoke inhibiting vision.

## Alternative 5: No Action (Continue Current Management)

Under Alternative 5, fewer total acres would be treated than under the other alternatives. Recreation sites are likely to be treated the same as in the proposed alternative because the goal is the same. Of the alternatives that include prescribed burning, this alternative would have the least effect on dispersed recreation because fewer acres are treated with burns.

Locally, the visual impacts of the treatment methods under Alternative 5 would be the same as under Alternative 1, but overall, the impacts would not be as great because fewer acres are treated. The principal difference in these alternatives is the number of acres treated with herbicides. Under Alternative 5, the area treated chemically is relatively small; therefore, the impacts, both adverse and desirable, would be lower than under Alternative 1.

# LIVESTOCK

## Alternative 1: Proposed Action

Alternative 1 could yield the highest positive impact by providing the largest increase in desirable forage for livestock. Application of herbicides is the most effective and efficient way of controlling competing vegetation and some noxious weeds. However, aerial herbicide application also could kill some shrubs and trees that are used for shelter by livestock. Based on the nontarget species risk assessment, livestock are not expected to be directly affected by any of the proposed herbicides. The number of plants toxic to livestock, such as leafy spurge and knapweed, would be reduced. The use of prescribed burning in some areas could reduce competing vegetation and encourage thicker regrowth of desirable livestock forage plants.

## Alternative 2: No Aerial Application of Herbicides

Under Alternative 2, less forage would be produced than under the proposed alternative because, without the use of aerially applied herbicides, it would be more difficult to control some species of competing vegetation. More acres would be treated with mechanical methods, but these methods are not always effective in encouraging growth of desirable plants. Fewer total rangeland acres would be treated under the second alternative than under the proposed alternative; therefore, infestations of competing vegetation and noxious weeds would be more prevalent.

## Alternative 3: No Use of Herbicides

Under Alternative 3, fewer acres would be treated than under Alternatives 1 or 2. There would be a decline in desirable forage because undesirable species would not be controlled on a greater portion of rangeland than under Alternatives 1 or 2. Livestock could be exposed to more toxic weeds than under the first two alternatives. There would be an increase in prescribed burns, which would have positive impacts on some rangeland sites by increasing desirable forage.

## Alternative 4: No Use of Prescribed Burning

Under Alternative 4, herbicide application would be the principal treatment method used. Manual and mechanical methods would be similar to those used under the proposed alternative. They are sometimes inefficient and ineffective in controlling unwanted vegetation. With the increase in herbicide use, livestock could be more readily exposed. To avoid livestock exposure, more rangeland would have to be made temporarily unavailable for grazing. On brushy sites, herbicide use could result in increased productivity by killing competing vegetation. However, without the use of prescribed burning, woody material serving as physical obstructions to livestock use of some areas would remain.

## Alternative 5: No Action (Continue Current Management)

The principal difference between this and the other alternatives, except Alternative 3, with respect to livestock is that fewer acres would be treated with herbicides under Alternative 5. In some areas, use of herbicides would not be allowed because of current restrictions. Livestock may be adversely affected by having less palatable forage if undesirable plants are not controlled effectively with the other treatment methods. Livestock also would be more likely to be exposed to those toxic weeds most effectively controlled by herbicides.

# WILD HORSES AND BURROS

## Alternative 1: Proposed Action

The use of all methods of vegetation treatment should improve habitat areas, thus benefiting wild horse and burro populations. This alternative should not pose any short-term or long-term threats to these animals' habitat, but the impacts must be addressed on a site-specific basis. Alternative 1 would yield the highest positive impact by providing the largest increase in desirable forage for wild horses and burros. Based on the nontarget species risk assessment, herbicides should not significantly affect horse and burro populations under any of the alternatives that use herbicides. Although adverse impacts to habitat areas would be temporary and localized, the aerial application of herbicides could kill some shrubs and trees that wild horses and burros use for shelter.

## Alternative 2: No Aerial Application of Herbicides

This alternative allows for the use of all five vegetation treatment methods, except chemical treatment would be restricted to ground-based techniques. The use of all methods of vegetation treatment should improve habitat areas, thus benefitting all herd populations. Although the sequence of treatments would be selected to take maximum advantage of the available methods, the control of some target species would not be as effective as Alternative 1. Exact combinations of manual, mechanical, biological, prescribed burning, and chemical treatments would be determined by examining information such as type of undesirable species, composition of understory, composition of canopy, and soil characteristics. In some instances, chemical treatment would be replaced by prescribed fire. The overall effect of Alternative 2 would be less forage production and less control of noxious weeds.

## Alternative 3: No Use of Herbicides

Only four of the five vegetation control methods —manual, mechanical, biological, and prescribed burning—would be used with this alternative. Because nonchemical methods would be employed, the potential exists for the remaining treatments to fail to control vegetation. Target species would compete with and reduce desirable forage species, which could adversely affect herd populations. Wild horses and burros potentially could be harmed if toxic vegetation species are not controlled using these methods.

### Alternative 4: No Use of Prescribed Burning

This alternative allows for the use of only four vegetation control methods—manual, mechanical, biological, and chemical. Because prescribed burning would not be used to control target vegetation, many habitat areas will exhibit only mature seral stages, thus decreasing the desirable habitat and biodiversity of the area. However, over the long term, the available treatment methods could improve some habitat areas, thus increasing the abundance of forage in the area, which would be advantageous for herd populations.

### Alternative 5: No Action (Continue Current Management)

Fewer total acres would be treated under this alternative. The result would be less available forage for wild horses and burros than under other alternatives. These animals also could be affected directly from the ingestion of poisonous noxious weeds not treated under Alternative 5.

## SPECIAL STATUS SPECIES

Probability of adverse impacts to special status plant and animal species from all alternatives is low. Each proposed project is screened for its potential impacts to special status plants and animals during the Environmental Assessment process. Known ranges and habitat preferences of special status species are compared to the proposed project area through information maintained by BLM, through contact with other Federal or State agencies, or through contact with other knowledgeable individuals. Site-specific investigations are conducted when there is likelihood that a special status species may be present in the proposed project area. Potential impacts of the proposed project are determined from the site-specific investigations along with information obtained from other agencies. As a result of field investigations and coordination with knowledgeable individuals, project design or size may be adjusted, the project may be deferred to another time of year, off-site mitigation may be recommended, other stipulations may be applied while the project is being carried out, or the project may be abandoned altogether, based on the nature of potential impacts. No action will be taken under any alternative that would adversely affect the recovery of any threatened or endangered species.

## WILDERNESS AND SPECIAL AREAS

### Alternative 1: Proposed Action

Under Alternative 1, all available treatment methods could be used. Whether these methods would be used in a particular wilderness area would be addressed in a site-specific environmental assessment. With the restrictions already placed on vegetation treatment in special areas, Alternative 1 would allow the most treatment choices.

### Alternative 2: No Aerial Application of Herbicides

Under Alternative 2, aerial application of herbicides would not be allowed. This would decrease any possible adverse effects on sensitive zones located in special areas, such as habitats of aquatic and special status species. However, the removal of particularly widespread target species would be reduced, possibly resulting in increased competition with native species.

### Alternative 3: No Use of Herbicides

Chemical treatment would not be used under Alternative 3. This would increase the dependence on mechanical and prescribed burning methods, which could cause adverse impacts, especially visual, in some areas. Nevertheless, the use of no chemical treatment would prevent some possible adverse effects on fish and wildlife species.

### Alternative 4: No Use of Prescribed Burning

Under Alternative 4, prescribed burning would not be used. This would increase the dependence on chemical and mechanical treatment methods, which could be detrimental in some areas. Under this alternative, prescribed burning would not be used to correct the fire exclusion problem that exists in some regions. Risks of wildfires could increase under this alternative.

### Alternative 5: No Action (Continue Current Management)

Alternative 5 is the continuation of current vegetation treatment programs: fewer acres are treated and no chemical treatment is allowed in some areas. The decrease in acres treated may reduce the wilderness and special areas acres included in the program, thus decreasing potential adverse impacts.

## HUMAN HEALTH AND SAFETY

### Alternative 1: Proposed Action

Under the proposed alternative, manual methods of vegetation treatment should not affect members of the public; however, workers are likely to be affected by minor injuries from the use of hand tools or major injuries from the use of power tools. Mechanical methods should not affect the public, although there is a slight risk of injury from flying debris near mowing operations on highway rights-of-way projects. Workers would be at risk of injuries when they use tractors and other heavy equipment. Neither workers nor members of the public should be affected by any biological vegetation treatment methods.

Sensitive members of the public and some workers may experience minor ill effects, including eye and lung irritation from the smoke of prescribed fires. Workers may suffer burns from igniting or managing prescribed fires, although normal safety precautions should minimize this possibility. Escaped fires may place workers or members of the public at risk, but again, safety precautions in normal fire management practice should minimize the possibility of escapes and limit any risk to human health should wildfires occur.

Amitrole may affect members of the public exposed to it after herbicide treatment of rangeland, public-domain forests, or rights-of-way. None of the other herbicides should affect members of the public in routine applications, although they may be affected if they are exposed as a result of an accidental spraying or spill. Workers may experience health effects in routine applications of a number of the proposed herbicides, particularly in aerial applications to rangeland, oil and gas sites, or rights-of-way. Human health would benefit from treatment of noxious weeds and poisonous plants that adversely affect humans.

### Alternative 2: No Aerial Application of Herbicides

Under this alternative, there would be somewhat increased risks, as compared to Alternative 1, of injury to workers from mechanical treatments and prescribed fire because of the increased acreage for those methods. Sensitive members of the public would be at higher risk of minor effects from smoke. The risks of public and worker health effects from herbicides would be reduced. More untreated acreage than under Alternative 1 increases the possibility of adverse effects from noxious weeds and poisonous plants.

### Alternative 3: No Use of Herbicides

Under this alternative, the risk, as compared to Alternatives 1 and 2, of injuries to workers from manual and mechanical treatments and prescribed fire would increase slightly. Sensitive members of the public would be at higher risk of minor effects from smoke. Risks of public and worker health effects from herbicides would be eliminated. There would be less control of weeds that are hazardous to human health than in Alternatives 1, 2, and 4.

### Alternative 4: No Use of Prescribed Burning

Risks to workers of injury from fire and to workers and the public of effects from smoke would be eliminated under this alternative. Risks of worker injuries from mechanical methods and hand tools would be about the same as those for Alternatives 1 and 2. Risks of health effects from the use of herbicides would be the highest of any of the alternatives because more than half the program acreage would be chemically treated.

### Alternative 5: No Action (Continue Current Management)

This alternative would present risks of the same types of human health effects as described for Alternative 1, but a somewhat lower potential incidence of effects is likely, because the acreages treated by all methods are lower in every case.

# SOCIAL AND ECONOMIC RESOURCES

## Social Resources

Many of the social effects of vegetation treatment programs occur as a result of changes in jobs or personal income. Compared with total employment or personal income, employment or income changes resulting from the implementation of vegetation treatment may seem small. However, these changes may be important when considered on a local or site-specific basis to individuals who rely on the continued productivity of public lands and employment in vegetation treatment activities for their livelihood.

BLM's vegetation treatment program alternatives would directly and indirectly affect social conditions and attitudes. Direct impacts would occur if an individual's sense of well-being or economic security were affected by BLM's decision on the use or restriction of particular vegetation treatment methods. Indirect effects would occur as a result of economic outcomes of BLM policies and in response to gains or losses of recreational opportunities or access to subsistence activities. For example, reactions to changes in the availability of jobs and dependence on certain jobs are social effects derived from economic impacts. All of these impacts, direct and indirect, could affect lifestyles and community stability.

Vegetation treatment can be controversial, as demonstrated by the range of comments received during the scoping period (see Appendix B). For example, smoke from prescribed burning is likely to cause some public concern about air quality, and chemical treatment raises concerns about human health and safety. There would be some unsettling social effects no matter which program alternative is chosen because the affected population is not homogeneous. Opposition could be most intense in areas closest to treatment, but also would occur in more distant areas. Wherever these issues arise, they should be considered in the project-level design and site-specific environmental analyses. Appropriate public participation and other information efforts would likely mitigate these potential negative social effects.

## Economic Resources

The Western States depend on the agriculture and forestry industries for employment and revenues from the sale of related goods and services (see Chapter 2, "Economic and Social Resources"). The direct economic impacts of all of the vegetation treatment program alternatives include increases in both employment and sales of treatment materials. The subsequent increase in personal incomes and revenues would benefit the economies of the Western States if the employees and equipment needed are acquired within these States.

### Vegetation Treatment Costs

Total annual treatment costs were estimated for each program alternative to provide a quantitative basis for comparing the alternatives. Total costs for each alternative were calculated by multiplying the acreage treated by each method by treatment costs per acre. The per acre treatment costs were based on those used in previous vegetation treatment EISs (BLM 1985a, BLM 1987g, USDA 1988). The costs estimated (Table 3-22) include expenditures for chemicals, labor, equipment, and administration of the treatment. Different projects within the same treatment category have variable costs depending on the characteristics of each project.

Estimated program costs range from $15.9 million annually for Alternative 4, No Prescribed Burning, to $9.3 million for Alternative 5, No Action (Continue Current Management). The number of acres treated in each program differ, however, so a comparison of these total costs does not indicate the relative magnitude of per acre treatment costs. Alternatives 1 and 5 are the least expensive at $39 and $38 per acre, respectively; Alternative 4 is the most costly at $50 per acre.

### Direct Economic Impacts

#### Employment Opportunities

The number of jobs that could be available under each program alternative depends on both the labor intensity of the treatment methods used and the number of acres treated. Manual treatment is the most labor intensive and chemical, the least:

| Treatment Method | Percent Labor |
|---|---|
| Manual | 92 |
| Mechanical | 39 |
| Biological | * |
| Prescribed Fire | 58 |
| Chemical | |
| Aerial | 17 |
| Ground | 26 |

* Biological data are not available; grazing management represents a small component of BLM labor.

Source: USDA 1988.

## Table 3-22

## Annual Vegetation Treatment Costs by Program Alternative

| | | Alternative 1: Proposed Action | | Alternative 2: No Aerial Application of Herbicides | | Alternative 3: No Use of Herbicides | | Alternative 4: No Prescribed Burning | | Alternative 5: No Action | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment Method** | **Cost/Acre[1]** | **Acres** | **Cost** | **Acres** | **Cost** | **Acres** | **Cost** | **Acres** | **Cost** | **Acres** | **Cost** |
| Manual | $235 | 14,070 | 3,306,450 | 14,470 | 3,329,950 | 13,870 | 3,259,450 | 13,670 | 3,212,450 | 12,770 | 3,000,950 |
| Mechanical | 100 | 58,115 | 5,811,500 | 71,165 | 7,116,500 | 74,215 | 7,421,500 | 69,165 | 6,916,500 | 41,945 | 4,194,500 |
| Biological | —[2] | 60,175 | — | 60,075 | — | 60,175 | — | 60,175 | — | 57,635 | — |
| Prescribed Burning | 10 | 97,765 | 977,650 | 132,290 | 1,322,900 | 137,390 | 1,373,900 | 0 | 0 | 92,680 | 926,800 |
| Chemical | | | | | | | | | | | |
| Aerial: | | | | | | | | | | | |
| Helicopter | 30 | 55,975 | 1,679,250 | 0 | 0 | 0 | 0 | 94,740 | 2,842,200 | 1,395 | 41,850 |
| Fixed-Wing | 15 | 58,700 | 880,500 | 0 | 0 | 0 | 0 | 46,000 | 690,000 | 24,370 | 365,550 |
| Ground: | | | | | | | | | | | |
| Vehicle | 50 | 21,045 | 1,052,250 | 38,033 | 1,901,650 | 0 | 0 | 28,075 | 1,403,750 | 9,615 | 480,750 |
| Hand | 130 | 5,795 | 753,350 | 7,135 | 927,550 | 0 | 0 | 6,645 | 863,850 | 2,095 | 272,350 |
| **Total** | | **371,640** | **14,460,950** | **322,868** | **14,598,550** | **285,650** | **12,054,850** | **318,470** | **15,928,750** | **242,505** | **9,282,750** |
| **Cost per Acre** | | | **38.91** | | **45.22** | | **42.20** | | **50.02** | | **38.28** |

[1] Costs are in 1987 dollars.

[2] Biological treatment costs vary considerably; therefore, average costs are not available. However, costs for biological treatment in the State of Oregon for 1988 ran approximately $2.75 per acre for grazing treatment on 34,500 total acres; total cost was $95,000.

The increase in employment that would be required to implement Alternatives 1 through 4 is not likely to be significant because current BLM staff levels are adequate to treat the additional acreage with occasional summer employees.

Regional and local employment benefits would be greatest if any new jobs were filled by western residents. Alternatives 2 (No Aerial Application of Herbicides) and 3 (No Use of Herbicides) could provide the most job opportunities because the largest acreages are treated using manual and prescribed burning, the two most labor intensive methods. Alternative 4 (No Use of Prescribed Burning) could provide the least potential for new jobs. Implementation of Alternative 1 (Proposed Action) could provide more employment opportunities than Alternative 4. Under Alternative 5, No Action (Continue Current Management), no new jobs would be created.

#### Sales of Treatment Materials

Materials needed for vegetation treatment include fuel for vehicles and equipment, ignition materials for prescribed burning, and herbicides. Revenues from the sale of these items would depend on the quantities purchased, which in turn depend on several factors: the fuel efficiency of the vehicles or equipment used (as described in Energy Requirements), the type of ignition materials necessary, and the herbicide formulation. The cost of herbicides proposed for use in this vegetation treatment program, for example, ranges from $8 (2,4-D amine) to $130 (Arsenal) per gallon (University of Wyoming 1988). Furthermore, as previously mentioned, local economies would benefit only if these materials were made by or purchased from western suppliers. The effect of the sale of these treatment materials on the local economies therefore cannot be estimated for each program alternative.

### Indirect Economic Impacts

Indirect economic impacts occur as a result of other actions. They are generally difficult to quantify, and the incidence of the cost of these impacts is not always clear. For example, insufficient management of rights-of-way could cause damage to electric transmission lines or railways; the owners must pay for repairs or maintenance, but these additional costs may be passed on to consumers and shareholders. Poor range management may result in the death of livestock and wildlife because of ingestion of noxious weeds and poisonous plants. Or, if public domain forests, cultural resources, and recreation sites are not maintained, visitors' enjoyment of these sites could decline, representing lost value to these visitors, and fewer people may visit in the future. If an admission fee is charged, this would result in less revenues from the site.

The largest number of acres would be treated under Alternative 1 (Proposed Action); thus, indirect costs would probably be lower than under the other four alternatives. The elimination of treatment methods or application methods in the other program alternatives causes the total number of acres treated to decline. Thus, vegetation that could optimally be treated by one method may not be treated or may be treated by an alternate method. As acreage goes untreated, or if alternate means of treatment are not effective, indirect costs are likely to rise.

## UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Implementation of any alternative would result in some adverse environmental impacts that cannot be avoided. Standards and guidelines, from BLM manuals—and mitigation developed in this Final EIS—are intended to keep the extent and duration of these effects within acceptable levels, but adverse effects cannot be completely eliminated.

Because this Final EIS examines alternative programs for treating vegetation, the focus is on how a series of projects conducted over a period of years could affect the environment. From this perspective, there are two areas of potential significant adverse effects: human health risk and degradation of air quality from prescribed burning. The potential for adverse effects varies with each alternative and is discussed in detail in earlier sections of this chapter.

There is the potential for additional adverse effects beyond those described above. The following effects are not expected to be significant; standards, guidelines, and mitigation will be applied:

- Short-term reduction in air quality from dust and engine emissions resulting from vegetation treatment activities other than prescribed burning
- Short-term acceleration of natural rates of sedimentation by soil-disturbing activities associated with the use of heavy equipment
- A temporary increase in fire hazard from waste material (dry vegetation) left on the ground after treatment
- Short-term decrease in habitat for wildlife species (depending on particular plant species and growth changes)
- Damage to soils by compaction from heavy equipment used for vegetation treatments
- Damage or destruction of cultural resources not identified by cultural inventories

- Potential for infringement of the first amendment rights of Native Americans to exercise their traditional religions

Not all of the unavoidable adverse effects that could result from implementing any of the program alternatives can be identified until site-specific projects are identified and environmental assessments are prepared for those projects. Potential unavoidable adverse environmental impacts could include short-term, localized air quality degradation from manual methods that employ power tools, from burning fuels in mechanical equipment, from the smoke of prescribed burning, and from the volatile and drift fraction of herbicides used in chemical methods. However, no air quality standards would be violated.

Adherence to mitigation and operational features built into the program alternatives will minimize the potential for any adverse environmental effects.

# ENERGY REQUIREMENTS

Petroleum fuels would be used in all program alternatives to operate aircraft or equipment during vegetation treatment and to transport personnel, equipment, and materials to a treatment area. In addition, small amounts of diesel oil and kerosene would be used as carriers for herbicide application.

The implementation of biological treatment methods would require little fuel; quantities for the manual, mechanical, prescribed burning, and chemical methods would vary depending on the type of equipment used and relative fuel efficiency. In general, aerial application using fixed-wing aircraft is the most efficient treatment method, especially over large areas.

# IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

## Irreversible Resource Commitment

Irreversible commitments of resources are actions that change either a nonrenewable resource (such as cultural resources or minerals) or a renewable resource to the point that it can be renewed only after 100 years or more. Measures to protect resources that could be irreversibly affected by other resource uses are incorporated into the standards and guidelines of BLM manuals and have been incorporated in the mitigation developed in this Final EIS.

The principal irreversible commitment of resources associated with the treatment of vegetation in the 13 EIS States is the use of fossil fuels. Alternatives that treat more acres would cause higher consumption of fossil fuels. Alternative 1 would require the greatest fuel consumption; Alternative 5 would require the least.

The vegetation treatments proposed can change cultural resources and traditional lifeway values in ways that cannot be anticipated. Since the potential for irreversible commitment of cultural resources generally varies directly with the amount of disturbance, Alternative 5 would probably result in the least commitment and Alternative 1 the most.

## Irretrievable Resource Commitment

An irretrievable commitment of resources is the loss of an opportunity for production or use of a renewable resource for a period of time. It is not irreversible because it can be reversed by changing management direction in the future.

The vegetation treatment alternatives in this EIS would result in one irretrievable resource commitment: localized changes in wildlife populations from changes in habitat.

# SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

"Short-term" uses are generally those that determine the present quality of life for the public. Short-term uses of public lands in the 13 EIS States include livestock grazing, timber harvesting, recreation, and wildlife habitat. Decisions about these uses are made through BLM Land Management Plans. The program presented here for vegetation treatment is designed for the most part to protect and enhance the long-term productivity of these lands as well as contribute to the short-term uses.

"Long-term productivity" refers to the capacity of the land to support sound ecosystems that produce resources such as forage, wildlife, water, and timber. Vegetation treatments that enhance short-term uses may reduce the natural productivity of some portions of these public lands. The herbicides examined in this Final EIS should have no effect on long-term productivity because most dissipate in the environment relatively rapidly, but other vegetation treatments do have the potential to reduce the natural productivity of the land if certain operating guidelines are not followed. How much the long-term productivity may be reduced is not known because investigations of these effects have only recently begun. The standard operating procedures and mitigation described in Chapter 1 of this Final EIS should minimize the potential for those effects.