CHAPTER 2
ALTERNATIVES

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Introduction

Introductory and background information pertinent to BLM herbicide treatment programs were provided in the 2007 PEIS (USDOI BLM 2007a:2-1 to 2-14). This information is still applicable, and is pertinent to the three herbicides addressed in this PEIS in terms of BLM programs that implement herbicide treatments, planning and management of vegetation treatments, and the integration and selection of treatment methods within treatment projects.

The BLM's overarching goals for vegetation management are to improve biological diversity and ecosystem function, promote and maintain native and resilient plant communities, and reduce invasive vegetation and the risk of wildfire. Public lands are administered under the principles of multiple use and sustained yield. Thus, vegetation must be managed to protect and enhance the health of the land.

Under all three action alternatives, the BLM would be able to use the new herbicides immediately after the signing of a ROD. Site-specific NEPA analyses would be required prior to on-the-ground use of the new herbicides. The new active ingredients would be integrated into the BLM's vegetation treatment activities. They could be used anywhere on BLM lands, subject to any applicable restrictions on their usage, such as those identified on the individual pesticide label and by each state's pesticide regulatory agency.

Herbicide Active Ingredients Evaluated Under the Proposed Alternatives

The BLM proposes to add three new herbicide active ingredients—aminopyralid, fluroxypyr, and rimsulfuron—to its approved herbicide list. All three of these herbicides have been registered by the USEPA and deemed effective in controlling vegetation, and have minimal effects on the environment and human health if used in accordance with label instructions.

The new active ingredients were selected based on: 1) input from BLM field offices on types of vegetation needing control; 2) studies indicating that these active ingredients would be more effective in managing noxious weeds and other unwanted vegetation than active ingredients currently used by the BLM; 3) USEPA approval for use on rangelands, forestlands, and/or aquatic environments; 4) input from herbicide manufacturers regarding herbicides not currently approved for use on public lands that may be appropriate to manage vegetation; 5) the effectiveness of the active ingredients on a variety of target species on BLM lands; 6) the level of risk of the herbicidal formulations to human health and the environment; and 7) the funds available to the BLM to conduct HHRAs and ERAs of the proposed herbicides.

All three of the new active ingredients would be used to help reduce the spread of noxious weeds and other invasive plants to reduce the buildup of hazardous fuels, reduce the loss of wildlife habitat, help stabilize and rehabilitate sites impacted by fire, and restore native and desirable plant communities.

Aminopyralid

Aminopyralid, primarily used for the management of broadleaf weeds, is a selective herbicide that is used to manage invasive annual, biennial, and perennial herbaceous species, along with woody species. It is applied either aerially or using ground application equipment. It is mobile in both the xylem and phloem of the target plant, and accumulates in leaf and root meristematic tissue. Species targeted by this herbicide include, but are not limited to: Russian knapweed, musk thistle, spotted knapweed, yellow starthistle, Russian thistle, and tansy ragwort (Lee 2013). These species are rangeland weeds that displace native plant species.

Aminopyralid is registered under the USEPA's reduced risk initiative, indicating that the USEPA believes that it poses less risk to human health and the environment than existing herbicide options (USEPA 2012a). Aminopyralid may be used instead of picloram in certain situations. Although not currently registered for aquatic use, it is likely that aminopyralid will receive an aquatic registration in the near future that would allow

for incidental overspray of this herbicide during treatment of vegetation within close proximity to wetland and riparian areas. Aminopyralid is appropriate for use at rangeland, forestland, recreation, and cultural resource sites; along rights-of-way (ROWs); and at energy and mineral sites. It would be used to manage noxious weeds and other invasive plants to restore native plant communities and wildlife habitat, predominantly on rangelands.

Fluroxypyr

Fluroxypyr is a selective, post-emergence herbicide that is used to manage certain annual and perennial weeds, including broadleaf species that are resistant to sulfonylurea herbicides, such as kochia. It can be used to manage invasive plants while maintaining native rangeland grass species. It is applied to actively growing plants using either aerial or ground-based equipment. Fluroxypyr's mode of action is by mimicking auxins and disrupting plant cell growth. It is mobile in the xylem of the plant, and to a lesser extent the phloem. Fluroxypyr can be tank-mixed with other active ingredients to improve its ability to manage difficult-to-control weeds such as invasive pricklypear cactus. Other invasive plant species targeted by fluroxypyr include marestail and black henbane. The BLM has indicated that the use of fluroxypyr can help reduce the amount of other herbicide products used in treatments. It is appropriate for use at rangeland, forestland, recreation, and cultural resource sites; along ROWs; and at energy and mineral sites (Lee 2013). Fluroxypyr would be used to manage noxious weeds and other invasive plants to restore native plant communities and wildlife habitat, predominantly on rangelands. It would also be used to control weeds in disturbed and cleared areas, such as oil and gas sites.

Rimsulfuron

Rimsulfuron is a selective, ALS-inhibiting herbicide that inhibits the biosynthesis of certain amino acids. It is applied both pre- and post-emergence, by ground or aerial methods. Rimsulfuron is active in both the xylem and the phloem of the plant, but primarily the phloem. Species targeted by this herbicide include winter annual grasses, such as cheatgrass (downy brome) and medusahead rye. Rimsulfuron has been observed to be more effective than imazapic in certain areas and under certain conditions. It is appropriate for use at rangeland, forestland, recreation and cultural resource sites; along ROWs; and at energy and mineral sites. Rimsulfuron would be used predominantly on ROWs and rangelands to reduce the buildup of hazardous fuels, and to restore native plant communities.

Herbicide Formulations Used by the BLM and Tank Mixes

The BLM generally uses several formulations of each active ingredient approved for use on public lands. Current USEPA-registered formulations of the three herbicides proposed for use are shown in Table 2-1, which includes the registration number of each formulation, the concentration of the active ingredient, and the herbicide resistance code.

Additionally, the three new herbicides could be used in tank mixes with one or more of the previously approved herbicides. Both aminopyralid and fluroxypyr can be tank mixed with numerous other active ingredients, including 2,4 dichlorophenoxyacetic acid (2,4-D), chlorsulfuron, clopyralid, dicamba + diflufenzopyr, glyphosate, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Fluroxypyr would most commonly be used with clopyralid, picloram, and triclopyr. Rimsulfuron would usually be applied on its own as a pre-emergent herbicide, but could be tank mixed with chlorsulfuron for certain applications, along with other herbicides registered for the same site of application, unless prohibited by the label instructions.

Description of the Alternatives

Four alternatives have been developed for evaluation in this PEIS, including the Preferred Alternative and the No Action Alternative. Alternative actions are those that could be taken to feasibly attain or approximate the BLM's objectives for herbicide use, as expressed in its programs, policies, and land use plans.

Alternatives were developed based on the alternatives in the 2007 PEIS. These alternatives address many of the concerns raised during scoping for the 2007 PEIS, as well as concerns raised during scoping for this PEIS (in particular concerns about aerial spraying).

Under all alternatives, the BLM would continue to follow all of the herbicide treatment SOPs and mitigation measures stipulated in the ROD for the 2007 PEIS. General herbicide treatment SOPs would pertain to treatments with the currently approved active ingredients, as well as any new active ingredients added under the various action alternatives. The BLM would also continue to follow the monitoring requirements in

TABLE 2-1
Formulations of the Three Herbicides Proposed for Use on Public Lands

Active Ingredient	Trade Name	Manufacturer	USEPA Registration Number	Concentration	WSSA Herbicide Resistance Code[1]
Aminopyralid	Milestone	Dow AgroSciences, L.L.C.	62719-519	2.0 lb a.e./gal	Group 4
	Milestone VM	Dow AgroSciences, L.L.C.	62719-537	2.0 1b a.e./gal	Group 4
Aminopyralid + 2,4-D	GrazonNext	Dow AgroSciences, L.L.C.	62719-587	0.33+2.67 lb a.e./gal	Groups 4 + 4
	GrazonNext HL	Dow AgroSciences, L.L.C.	62719-628	0.41+3.33 lb a.e./gal	Groups 4 + 4
	ForeFront HL	Dow AgroSciences, L.L.C.	62719-630	0.41+3.33 lb a.e./gal	Groups 4 + 4
	ForeFront R&P	Dow AgroSciences, L.L.C.	62719-524	0.33+2.67 lb a.e./gal	Groups 4 + 4
	PasturAll	Dow AgroSciences, L.L.C.	62719-579	0.075+2.67 lb a.e./gal	Groups 4 + 4
	PasturAll HL	Dow AgroSciences, L.L.C.	62719-629	0.1+3.54 lb a.e./gal	Groups 4 + 4
Aminopyralid + Clopyralid	Sendero	Dow AgroSciences, L.L.C.	62719-645	0.5 + 2.3 lb a.e./gal	Groups 4 + 4
Aminopyralid + Metsulfuron Methyl	Opensight	Dow AgroSciences, L.L.C.	62719-597	0.525+0.0945 % a.i.	Groups 4 + 2
	Chaparral	Dow AgroSciences, L.L.C.	62719-597	0.525+0.0945% a.i.	Groups 4 + 2
Aminopyralid + Triclopyr	Milestone VM Plus	Dow AgroSciences, L.L.C.	62719-572	0.1+1.0 lb a.e./gal	Groups 4 + 4
	Capstone	Dow AgroSciences, L.L.C.	62719-572	0.1+1.0 lb a.e./gal	Groups 4 + 4
Rimsulfuron	Matrix	DuPont Crop Protection	352-556	25 % a.i.	Group 2
Fluroxypyr	Comet	Nufarm Americas, Inc.	71368-87	1.5 lb a.e./gal	Group 4
	Fluroxypyr Herbicide	Alligare, L.L.C.	66330-385-81927	2.8 lb a.e./gal	Group 4
	Vista XRT	Dow AgroSciences, L.L.C.	62719-586	2.8 lb a.e./gal	Group 4
Fluroxypyr + Clopyralid	Truslate	Nufarm Americas, Inc.	71368-86	0.75+0.75 lb a.e./gal	Groups 4 + 4
Fluroxypyr +	Surmount	Dow AgroSciences, L.L.C.	62719-480	0.67+0.67 lb a.e./gal	Groups 4 + 4
Picloram	Trooper Pro	Nufarm Americas, Inc.	228-599	1.0+1.0 lb a.e./gal	Groups 4 + 4
Fluroxypyr +	PastureGard	Dow AgroSciences, L.L.C.	62719-477	0.5+1.5 lb a.e./gal	Groups 4 + 4
Triclopyr	PastureGard HL	Dow AgroSciences, L.L.C.	62719-637	1.0+3.0 lb a.e./gal	Groups 4 + 4

[1] Resistance codes: Group 2 = Inhibition of acetolactate synthase, and Group 4 = growth regulators.
lb a.e./gal = pounds of acid equivalent per gallon; % a.i. = percent active ingredient; and WSSA = Weed Science Society of America.

the ROD to ensure that SOPs and mitigation measures are implemented appropriately. New SOPs and mitigation measures that have been developed for the action alternatives will be discussed, as appropriate, elsewhere in this document. SOPs, mitigation measures, and monitoring requirements that carry over from the 2007 PEIS can be found in Chapter 2 and Appendix B of the ROD, as well as Chapter 2 of the 2007 PEIS (USDOI BLM 2007a:2-22 to 2-56).

Alternative A – Continue Present Herbicide Use (No Action Alternative)

This alternative describes an integrated vegetation management program for resource management and habitat enhancement, with only the herbicides approved in the ROD for the 2007 PEIS used to manage competing and unwanted vegetation. This alternative corresponds to Alternative B of the 2007 PEIS, which estimated that approximately 932,000 acres in the western U.S. would be treated annually using herbicides. As shown in Figure 2-1, total treatment acreages using all herbicides have remained well below this number.

Between 2006 and 2012, the BLM treated an average of 315,000 acres per year using herbicides. During this time period, the annual acreage has ranged from about 260,000 to 436,000, with acres treated largely dependent on funding. Increases in funding are typically tied to incidence of wildfire. It is projected that the acreage of public lands treated using herbicides will increase from current levels, but will not exceed the 932,000-acre estimate from the 2007 PEIS. Therefore, the maximum annual treatment area of 932,000 acres is carried over to this PEIS for the purposes of analysis.

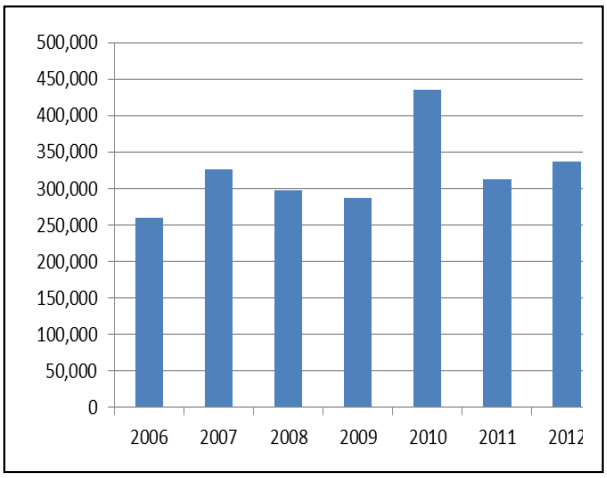

Figure 2-1. Summary of Acres Treated Using Herbicides During 2006 to 2012.

Under this alternative, the BLM would continue to use the 18 active ingredients currently approved for use, which are listed in Table 2-2. The majority of treatments would continue to occur in New Mexico, Idaho, and Wyoming, as inferred from Table 2-3. The projected use of each of the 18 approved herbicides under the No Action Alternative is shown in Table 2-4. The most widely used herbicides would be clopyralid, glyphosate, imazapic, tebuthiuron, and triclopyr. Estimates of herbicide use are based on the BLM's assessment of future needs as far as vegetation treatment is concerned. Usage may vary from year to year and percentages may change based on the total acreage treated. Therefore, projected use of a particular herbicide under the No Action Alternative does not necessarily reflect historic usage of that herbicide.

Alternative B – Allow for Use of Three New Herbicides in 17 Western States (Preferred Alternative)

This alternative would allow the BLM to expand its vegetation management program by permitting the use of three new herbicide active ingredients to manage competing and unwanted vegetation. Although the BLM would likely treat more acres with herbicides than it is currently, the projected maximum treatment acres would remain at 932,000 acres annually.

Under the Preferred Alternative, the BLM would be able to use, in 17 western states, the 18 active ingredients that were approved for use in the 2007 PEIS ROD, as well as aminopyralid, fluroxypyr, and rimsulfuron.

These active ingredients could only be applied for uses, and at application rates, specified on the label and in accordance with the ROD. Under this alternative, herbicides could be applied using ground or aerial methods. Herbicides could be used individually, or tank mixed with previously approved herbicides, as applicable and in accordance with the individual herbicide label.

The projected use of each of the new herbicides, as a percent of use by all approved herbicides, is shown in Table 2-4. It is estimated that aminopyralid would make up 10 percent, fluroxypyr would make up 1 percent, and rimsulfuron would make up 16 percent of the total herbicide use on BLM-administered lands. As a result of adding these new active ingredients, use of other herbicides is expected to decrease, particularly glyphosate, imazapic, and picloram.

Alternative C – No Aerial Application of New Herbicides

This alternative would allow the BLM to use only ground-based techniques to apply the three new herbicides. Projected maximum treatment acres would remain at 932,000 acres annually. This alternative would be similar to Alternative B, except that aerial application (by helicopter or fixed-wing aircraft) of the three new herbicides would not be allowed. The BLM would be restricted to only ground-based methods for applying these herbicides, including by vehicle or on foot with manual application devices. However, aerial application of the 18 previously approved active ingredients, where identified on individual active ingredient labels, and in accordance with BLM policy, would still be able to occur. Herbicides could be used individually, or tank mixed with previously approved herbicides, as applicable. These active ingredients could only be applied for uses, and at application rates, specified on the label, and in accordance with the ROD.

The projected amount of use of the new herbicides under this alternative is shown in Table 2-4. It is estimated that aminopyralid would make up 6 percent, fluroxypyr would make up less than 1 percent, and rimsulfuron would make up 3 percent of the total projected herbicide use on BLM-administered lands. Under this alternative, substantially less rimsulfuron would be used than under Alternative B, as this herbicide would not be applied aerially for large-scale projects to control invasive annual grasses. Aminopyralid use would also be less than under Alternative B. However, all three herbicides would be

TABLE 2-2
Herbicides Approved and Proposed for Use on Public Lands

Herbicide	Herbicide Characteristics and Target Vegetation	Areas Where Registered Use is Appropriate					
		Rangeland	Forestland	Riparian and Aquatic	Oil, Gas, and Minerals	ROW	Recreation and Cultural Resources
Herbicides Approved for Use on Public Lands							
2, 4-D	Selective; foliar absorbed; postemergent; annual/perennial broadleaf weeds. Key species treated include annual kochia, mustard species, and Russian thistle.	●	●	●	●	●	●
Bromacil	Non-selective; inhibits photosynthesis; controls wide range of weeds and brush. Key species treated include annual grasses and broadleaf weeds, annual kochia, and Russian thistle.				●	●	●
Chlorsulfuron	Selective; inhibits enzyme activity; broadleaf weeds and grasses. Key species treated include biennial thistles and annual and perennial mustards.	●			●	●	●
Clopyralid	Selective; mimics plant hormones; annual and perennial broadleaf weeds. Key species treated include knapweeds, mesquite, and starthistle and other thistles.	●	●		●	●	●
Dicamba	Growth regulator; annual and perennial broadleaf weeds, brush, and trees. Key species treated include knapweeds, annual kochia, and Russian and other thistles.	●			●	●	●
Diflufenzopyr + Dicamba	Postemergent; inhibits auxin transport; broadleaf weeds. Key species treated include knapweeds, annual kochia, and Russian thistle and other thistles.	●			●	●	●
Diquat	Non-selective and foliar applied. Key species treated include giant salvinia, water-thyme, and watermilfoils.			●	◘	◘	◘
Diuron	Preemergent control; annual and perennial broadleaf weeds and grasses. Key species treated include annual grasses and broadleaf weeds, kochia, and Russian thistle.				●	●	●
Fluridone	Aquatic herbicide to control submersed aquatic plants. Key species treated include water-thyme and watermilfoils.			●			
Glyphosate	Non-selective; annual and perennial grasses and broadleaf weeds, sedges, shrubs, and trees. Key species treated include annual, biennial, and perennial grasses and broadleaf weeds and woody shrubs.	●	●	●	●	●	●
Hexazinone	Foliar or soil applied; inhibits photosynthesis; annual /perennial grasses and broadleaf weeds, brush, and trees. Key species treated include mesquite and scrub oak.	●	●		●	●	●
Imazapic	Selective postemergent herbicide; inhibits broadleaf weeds and some grasses. Key species treated include cheatgrass, leafy spurge, medusahead rye, and mustards.	●	●		●	●	●
Imazapyr	Non-selective; preemergent and postemergent uses; absorbed through foliage and roots; annual and perennial broadleaf weeds, brush, and trees. Key species treated include saltcedar.	●	●	●	●	●	●
Metsulfuron methyl	Selective; postemergent; inhibits cell division in roots and shoots; annual and perennial broadleaf weeds, brush, and trees. Key species treated include annual and perennial mustards and biennial thistles.	●	●		●	●	●
Picloram	Selective; foliar and root absorption; mimics plant hormones; certain annual and perennial broadleaf weeds, vines, and shrubs. Key species treated include knapweeds, leafy spurge, and starthistle.	●	●		●	●	●
Sulfometuron methyl	Broad-spectrum preemergent and postemergent control; inhibits cell division; grasses and broadleaf weeds. Key species treated include cheatgrass, annual and perennial mustards, and medusahead rye.		●		●	●	●
Tebuthiuron	Relatively non-selective soil activated herbicide; preemergent and postemergent control of annual and perennial grasses, broadleaf weeds, and shrubs. Key species treated include creosote bush, oak, Russian olive, and sagebrush (thinning).	●			●	●	●

TABLE 2-2 (Cont.)
Herbicides Approved and Proposed for Use on Public Lands

Herbicide	Herbicide Characteristics and Target Vegetation	Areas Where Registered Use is Appropriate					
		Rangeland	Forestland	Riparian and Aquatic	Oil, Gas, and Minerals	ROW	Recreation and Cultural Resources
Triclopyr	Growth regulator; broadleaf weeds and woody plants. Key species treated include mesquite and saltcedar.	●	●	●	●	●	●
Herbicides Proposed for Use on Public Lands							
Aminopyralid	Selective herbicide; plant growth regulator; applied postemergence, either aerially or using ground application equipment; mobile in both the xylem and phloem, accumulating in leaf and root meristematic tissue; limited residual activity; microbial degradation. Targeted species include, but are not limited to: Russian knapweed, musk thistle, spotted knapweed, yellow starthistle, Russian thistle, and tansy ragwort.	●	●		●	●	●
Fluroxypyr	Selective; plant growth regulator; disruption of plant cell growth - auxin mimicking; applied to actively growing plants aerially or using ground application equipment; mobile in the phloem, and to a lesser extent the xylem; microbial degradation; management of several annual and perennial broadleaf species, including ALS-resistant kochia biotypes; provides synergistic activity when tank mixed with certain active ingredients, improving the management of selected species, including pricklypear cactus.	●	●		●	●	●
Rimsulfuron	Selective; ALS-inhibiting herbicide, resulting in the inhibition of the biosynthesis of the branched amino acids isoleucine, leucine, and valine; applied both preemergence and postemergence using ground and aerial application equipment; mobile in both the xylem and phloem, but primarily in the phloem; limited residual activity; chemical degradation. Target species include cheatgrass and medusahead rye.	●	●		●	●	●

● = areas where USEPA approved registration exists and the BLM has approval or proposes to use on public lands, and ◘ = areas where USEPA approved registration exists, but where the BLM does not propose to use on public lands.
Source: Lee 2013.

applied using ground-based methods in various treatment scenarios. As a result of adding the new herbicides, it is predicted that use of other herbicides—particularly glyphosate and imazapic—would decrease compared to the No Action Alternative, although not as much as under Alternative B.

Under this alternative, the BLM would develop new SOPs for aminopyralid, fluroxypyr, and rimsulfuron that restrict application by aerial methods.

TABLE 2-3
Average Acreage Treated Annually for Each BLM State Jurisdiction During 2006 to 2012

State	Acres Treated Annually	Percentage of All Public Lands Treated
Alaska	0	0.0
Arizona	5,621	1.8
California	1,525	0.5
Colorado	7,842	2.5
Idaho	35,401	11.2
Montana, North Dakota, and South Dakota	8,857	2.8
Nevada	11,860	3.8
New Mexico, Oklahoma, and Texas	189,654	60.1
Oregon and Washington	12,663	4.0
Utah	8,788	2.8
Wyoming and Nebraska	33,096	10.5
Total	**315,307**	**100.0**

Alternative D – No Use of New Acetolactate Synthase-Inhibiting Active Ingredients (No Rimsulfuron)

This alternative would allow the BLM to utilize the two new herbicide active ingredients that do not belong to the sulfonylurea, or the acetolactate synthase-inhibiting, group of herbicide active ingredients. Aminopyralid and fluroxypyr would be approved for use, but rimsulfuron would not.

Under this alternative, the BLM would be able to use a total of 20 herbicide active ingredients (the 18 previously approved active ingredients, plus aminopyralid and fluroxypyr) on public lands in 17 western states. These active ingredients could only be applied on sites, and at application rates, specified on the individual label. Under this alternative, herbicides could be applied using ground or aerial methods. Herbicides could be used individually or in tank mixes with previously approved active ingredients, in accordance with label directions. The projected maximum annual treatment acreage under this alternative would remain at 932,000 acres.

Under this alternative, it is estimated that aminopyralid would make up 10 percent of the total projected herbicide use on BLM-administered lands, and fluroxypyr would make up 1 percent of the total projected herbicide use, similar to Alternative B (Table 2-4). As rimsulfuron would not be approved for use under this alternative, the amount of glyphosate and imazapic used would be greater than under Alternatives B and C, and similar to levels under the No Action Alternative.

Alternatives Considered but Not Analyzed Further

The BLM based the alternatives being considered in this PEIS on the alternatives that were identified for the 2007 PEIS. As herbicide treatments on public lands have already been approved in the 2007 PEIS, Alternative C from that document (No Use of Herbicides) is not applicable and does not meet the current project purpose and need. Based on a review of scoping comments and the current alternatives, no additional alternatives were considered for analysis in this PEIS.

Herbicide Treatment Standard Operating Procedures and Guidelines

Under all of the alternatives, the BLM would follow SOPs designed to minimize risks to human health and the environment from herbicide treatment actions. Standard operating procedures are management controls and performance standards that are required of all herbicide treatments. They are intended to protect and enhance natural resources that could be affected by herbicide treatments. The 2007 PEIS (USDOI BLM 2007a:2-22 to 2-35) provides a detailed discussion of these SOPs, which include the following:

- Prevention measures during project planning, development, and revegetation phases to minimize the risk of introducing or spreading noxious weeds.

- Herbicide treatment planning, which includes evaluation of the need for chemical treatments

and their potential for impact on the environment, and development of an operational plan that includes herbicide buffers near water bodies, information on project specifications, key personnel responsibilities and communication, safety, spill, and response, and emergency procedures.

- Procedures specific to site revegetation after treatments to promote establishment and/or recovery by the native plant community.

- Special precautions to minimize impacts to special status species, wilderness areas, and cultural resources.

- Standard operating procedures for applying herbicides (listed in the 2007 PEIS; USDOI BLM 2007a:Table 2-8, 2-30 to 2-35), both general and designed to protect specific resource elements (air quality, soils, water resources, wetlands and riparian areas, vegetation, pollinators, fish and other aquatic organisms, wildlife, listed species, livestock, wild horses and burros, cultural and paleontological resources, visual resources, wilderness and other special areas, recreation, social and economic values, ROWs, and human health and safety).

TABLE 2-4
Historic Use of Herbicides by the BLM and Projected Future Use of Herbicides by the BLM Under Each Alternative (as a percentage of all acres treated using herbicides)

Active Ingredient	Historic Use (2006-2012)	Projected Use Under Each Alternative			
		No Action Alternative	Preferred Alternative	Alternative C (no aerial)	Alternative D (no ALS inhibiting)
Herbicides Approved for Use on Public Lands					
2,4-D	9.3	6	5	6	5
Bromacil	1.1	<1	<1	<1	<1
Chlorsulfuron	2.0	2	1	2	1
Clopyralid	18.3	13	14	14	14
Dicamba	1.9	1.5	<1	1	<1
Diflufenzopyr + Dicamba	<1	<1	<1	1	<1
Diquat	<1	<1	<1	<1	<1
Diuron	1.9	2	<1	<1	<1
Fluridone	<1	<1	<1	<1	<1
Glyphosate	8.9	12	5	9	11
Hexazinone	<1	<1	<1	<1	<1
Imazapic	1.5	20	10	15	20
Imazapyr	1.7	2	1	1	1
Metsulfuron methyl	2.7	4	1	1	1
Picloram	7.1	8	4	7	4
Sulfometuron methyl	0.2	1	<1	<1	<1
Tebuthiuron	22.5	13	15	15	15
Triclopyr	20.8	15	16	16	16
Herbicides Proposed for Use on Public Lands					
Aminopyralid	0	0	10	6	10
Fluroxypyr	0	0	1	<1	1
Rimsulfuron	0	0	16	3	0

All applicable SOPs (i.e., pertaining to herbicide treatments) listed in the 2007 PEIS would be followed during treatments with aminopyralid, fluroxypyr, and rimsulfuron under all of the alternatives considered in this PEIS. Additionally, all applicable mitigation measures that were identified in the ROD for the 2007 PEIS (USDOI BLM 2007b:Appendix B) would be followed, as applicable. Many of these mitigation measures are specific to the 18 herbicides covered in the 2007 PEIS, and therefore would not apply to treatments with the three new herbicides unless other herbicides were also involved.

Monitoring

Monitoring of vegetation treatments is used to identify whether treatments are implemented appropriately and determine their effectiveness. The regulations at 43 CFR 1610.4-9 require that land use plans establish intervals and standards for monitoring and evaluating land management actions. Specific monitoring protocols or studies for vegetation treatment projects are developed and implemented at the local level. BLM manuals, handbooks, and other technical documents provide additional information on monitoring of specific resources. A list of applicable reference manuals and handbooks can be found in Appendix F of the 2007 PEIS.

The BLM Assessment, Inventory, and Monitoring (AIM) Strategy outlines the BLM monitoring program, including monitoring for the vegetation resources found on BLM-administered lands and monitoring of the effects of treatments on these resources. The AIM strategy addresses the BLM's multiple-use and sustainable yield mission, and ensures the collection of defensible data to inform BLM managers and the public about key ecological processes for maintaining sustainable ecosystems. The AIM strategy establishes a monitoring framework that is consistent and compatible across scales, programs, and administrative boundaries. The framework includes 1) use of core quantitative indicators and consistent methods; 2) implementation of a statistically valid, scalable sampling framework; 3) application and integration of remote sensing technologies; 4) implementation of electronic field data collectors and enterprise data management; and 5) capture of legacy data in a digital format (Toevs et al. 2011). As of November 2014, the AIM Strategy has adopted core indicators and methods for terrestrial and in-stream aquatic resources. Work is ongoing to establish indicators and methods that will inform the status and trends of other resources the BLM manages.

The BLM has adopted an ecosystem-based management approach, which is applied to projects at the site-specific level. The ecosystem-based management framework ensures that local level decisions about management goals and targets are informed and adapted from learning based on science (monitoring) and local knowledge.

The 2007 PEIS (USDOI BLM 2007a:2-35 to 2-39) provides additional discussion of vegetation treatments monitoring, including BLM guidance, procedures for implementation, monitoring methods, and dissemination of results.

Coordination and Education

As indicated during public scoping for this PEIS and the earlier 2007 PEIS, the public has an interest in the BLM's vegetation treatment activities, particularly individuals that live in close proximity to public lands, have commercial operations that are dependent on vegetation on or adjacent to public lands, or use public lands for recreation. The BLM strives to keep the public informed about its vegetation treatment activities through regular coordination and communication. The BLM also encourages the public to participate in the environmental review process during the development and analysis of local vegetation management programs. The 2007 PEIS (USDOI BLM 2007a:2-39) summarizes the ways in which the public can participate in this process, as well as other applicable coordination efforts between the BLM and the public.

Prior to herbicide treatments, the BLM posts entry points onto public lands where the herbicide application will take place. Information provided in the posting includes the name of the herbicide product to be applied, active ingredients, USEPA registration number, application date, the period of time that must elapse before a person without protective clothing may enter a treatment site, and other warnings or information required to ensure the safety of the public. Postings remain at treatment sites for as long as necessary to protect the public.

Mitigation

This PEIS identifies measures that the BLM proposes to implement to mitigate adverse environmental impacts identified in Chapter 4 (Environmental Consequences). These measures are summarized in Table 2-5. As defined by CEQ regulation 1508.20, mitigation includes: 1) avoiding the impact altogether by not

TABLE 2-5
Mitigation Measures

Resource	Mitigation Measures
Air Quality	None proposed.
Soil Resources	None proposed.
Water Resources and Quality	None proposed.
Wetland and Riparian Areas	None proposed.
Vegetation	• Establish herbicide-specific buffer zones around downstream water bodies, and nearby habitats and non-target plant species/populations of interest for aminopyralid, fluroxypyr, and rimsulfuron. Consult the ERAs for more specific information on appropriate buffer distances under different soil, moisture, vegetation, and application scenarios. • To protect special status plant species, implement all conservation measures for plants presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015). Apply these measures to all special status plant species.
Fish and Other Aquatic Organisms	• To protect special status fish and other aquatic organisms, implement all conservation measures for aquatic animals presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015).
Wildlife Resources	• When conducting herbicide treatments in or near habitats used by sensitive and listed terrestrial arthropods, design treatments to avoid the use of fluroxypyr, where feasible. • To protect special status wildlife species, implement conservation measures for wildlife presented in the *Vegetation Treatments Using Aminopyralid, Fluroxypyr, and Rimsulfuron on Bureau of Land Management Lands in 17 Western States Biological Assessment* (USDOI BLM 2015).
Livestock	None proposed.
Wild Horses and Burros	None proposed.
Paleontological and Cultural Resources	None proposed.
Visual Resources	None proposed.
Wilderness and Other Special Areas	Mitigation measures that may apply to wilderness and special area resources are associated with human and ecological health and recreation. Please refer to the Vegetation, Wildlife Resources, and Recreation sections of Chapter 4.
Recreation	Mitigation measures that may apply to recreational resources are associated with ecological health. Please refer to the Vegetation and Wildlife Resources sections of Chapter 4.
Social and Economic Values	None proposed.
Human Health and Safety	None proposed.

taking a certain action or parts of an action; 2) minimizing impacts by limiting the degree or magnitude of the action and its implementation; 3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and 5) compensating for the impact by replacing or providing substitute resources or environments.

The analysis presented in this PEIS assumes that all of the applicable SOPs identified in the 2007 PEIS (USDOI BLM 2007a:Table 2-8) would be followed during herbicide treatments with the three new active ingredients. Additionally, it assumes that all applicable mitigation measures developed in the 2007 PEIS and included in the ROD for that document (USDOI BLM2007b:Table 2-4) would be followed. Therefore, only new mitigation measures specific to aminopyralid, fluroxypyr, and rimsulfuron are presented in this PEIS.

Summary of Impacts by Alternative

Table 2-6 summarizes the likely effects of vegetation treatments using aminopyralid, fluroxypyr, and rimsulfuron for each alternative. Information contained in this table is discussed in more detail in Chapter 4 (Environmental Consequences).

TABLE 2-6
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
EFFECTS ON AIR QUALITY			
General Effects: None of the predicted emissions by pollutant or state would exceed Prevention of Signification Deterioration (PSD) annual emissions significance thresholds. Particulate matter concentrations from treatments are expected to be substantially lower than National Ambient Air Quality Standard (NAAQS) thresholds, based on modeling. Treatments would result in approximately 206 tons per year (tpy) of total suspended particulates (TSP), 62 tpy of carbon monoxide (CO), and 45 tpy of particulate matter less than 10 microns in diameter (PM_{10}). Estimated GHG emissions would be 3,350 metric tons CO_2 equivalents per year ($MTCO_2e/yr$). Reduction in wildfire risk would benefit air quality.	**General Effects:** Air quality impacts would be similar to those under the other alternatives, as the treatment acreage under all alternatives would be similar. None of the predicted annual emissions by pollutant or state would exceed PSD annual emissions significance thresholds. Treatments would result in approximately 206 tpy of TSP, 62 tpy of CO, and 45 tpy of PM_{10}. Estimated GHG emissions would be 3,350 $MTCO_2e/yr$. Benefits to air quality associated with a reduction in wildfire risk would be similar to those under the other alternatives.	**General Effects:** Air quality impacts would be similar to those under the other alternatives, as the treatment acreage under all alternatives would be similar. None of the predicted annual emissions by pollutant or state would exceed PSD annual emissions significance thresholds. Emissions of criteria pollutants and GHGs would be similar to those under the other alternatives.	**General Effects:** Air quality impacts would be similar to those under the other alternatives, as the treatment acreage under all alternatives would be similar. None of the predicted annual emissions by pollutant or state would exceed PSD annual emissions significance thresholds. Emissions of criterial pollutants and GHGs would be similar to those under the other alternatives.
Cumulative Effects: The cumulative effects of air quality pollutants from wildfire and prescribed fire, vehicle exhaust, commercial and industrial land uses, and residential heating, among other sources, have contributed to deterioration in air quality. Despite these factors, air quality in the U.S. has continued to improve since the early 1980s. Pollutants of primary concern continue to be particulate matter and ozone. Greenhouse gas emissions in the U.S., however, continue to increase. The acreage and average size of wildfires also continues to increase, contributing larger amounts of air quality pollutants each year. In the future, sources of air quality pollutants will continue to contribute to cumulative air quality emissions, and contributions of GHG emissions will also be cumulative, potentially contributing to climate change. Efforts by the BLM to restore historical fire regimes, native vegetation, and natural ecosystem processes that reduce the frequency and intensity of wildfire should help reduce the future contribution of wildfire pollutants to cumulative air quality impacts. All alternatives would contribute a similar amount to cumulative air quality effects.			
EFFECTS ON SOIL RESOURCES			
Herbicides would be used on approximately 932,000 acres annually. None of the herbicides likely to be used would result in substantial effects to soil. Minor effects to soil and soil organisms could occur, but treatments would potentially help reduce populations of invasive species and reduce wildfire risk. Beneficial effects to soil would include improved soil productivity and reduced soil erosion.	Herbicides would be used on approximately 932,000 acres annually. Effects to soil would be similar to those under the No Action Alternative. The new herbicides are not known to cause substantial impacts to soil or soil organisms. With the addition of the new active ingredients, there may be a reduction in use of active ingredients that are relatively persistent in the soil. Beneficial effects to soil would be similar to those under the No Action Alternative, and could be slightly greater if efficacy of treatments is increased.	Herbicides would be used on approximately 932,000 acres annually. Effects to soil would be similar to those under the other alternatives. Use of new herbicides would be less than under the Preferred Alternative, and use of persistent herbicides would be between the No Action and Preferred Alternatives. Benefits to soil resources could be slightly greater than under the No Action Alternative and slightly less than under the Preferred Alternative.	Herbicides would be used on approximately 932,000 acres annually. Effects to soil would be similar to those under the other alternatives. Overall persistence of herbicides in soil and benefits as a result of treatments would be similar to those under the No Action Alternative.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Past effects to soil resources in the western states are predominantly associated with natural resource extraction, grazing, road construction, timber harvesting, recreation, agriculture, development, wildland fire, and natural disturbances. These factors have resulted in soil erosion and loss of soil productivity on public lands and throughout the West. Future effects associated with these factors are expected to occur, but would be offset, to some degree, by watershed-level restoration treatments by the BLM and other agencies, as well as by other conservation programs. All alternatives would contribute a similar amount to impacts to soil resources. Countervailing effects associated with long-term improvement in soil function and productivity would also be similar under all the alternatives. The number of herbicides used by the BLM with the potential to impact soil resources would be greatest under the Preferred Alternative and Alternative C, and slightly lower under the other alternatives.			
EFFECTS ON WATER RESOURCES AND QUALITY			
Herbicide treatments would continue to have minor impacts on water resources through movement into surface water and groundwater from treatment sites. Herbicides of greatest concern for groundwater contamination are 2,4-D, diquat, bromacil, dicamba, diuron, hexazinone, and picloram. Minor concerns are associated with the use of glyphosate and tebuthiuron. Treatments to manage invasive species and reduce wildfire risk would continue to benefit watersheds.	There would be similar risks to water quality, over the same geographic area, as under the other alternatives. Based on projected amounts of herbicide use, the use of known drinking water contaminants would decrease by 11 percent, and use of a possible groundwater contaminant (imazapic) would decrease by 10 percent. The Preferred Alternative would be similar to the other alternatives in terms of level of benefit to watersheds.	There would be similar risks to water quality, over the same geographic area, as under the other alternatives. Use of known drinking water contaminants and possible groundwater contaminants would decrease by 9 percent relative to the No Action Alternative (1 percent less than under the Preferred Alternative). Alternative C would be similar to the other alternatives in terms of level of benefit to watersheds.	There would be similar risks to water quality, over the same geographic area, as under the other alternatives. Use of known drinking water contaminants and possible groundwater contaminants would decrease by 4 percent relative to the No Action Alternative (6 percent less than under the Preferred Alternative). Alternative D would be similar to the other alternatives in terms of level of benefit to watersheds.
Cumulative Effects: Past effects to water resources are predominantly associated with mining activities, exploration and development of oil resources, agriculture (including use of pesticides), industry, and other human activities. Activities that contribute to water quality pollution and depletion will likely continue in the western U.S. These effects will be offset, in part, by efforts by the BLM and other land management agencies to improve water quality and restore degraded wetland/riparian areas. All of the alternatives would contribute a similar amount to cumulative effects to water quality, as the amount of herbicides applied during treatments would be the same, although there would be some variability in the potential for different herbicides to reach surface water and groundwater. Under the action alternatives, the number of herbicides used by the BLM would be slightly greater than under the No Action Alternative. Countervailing effects associated with herbicide treatments would include long-term improvements in the function of wetlands, riparian areas, streams, and other water bodies.			
EFFECTS ON WETLAND AND RIPARIAN AREAS			
Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as risks to non-target plant species. Wetlands and riparian areas would continue to benefit from herbicide treatments that target invasive plants, resulting in improvement in functions.	Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as risks to non-target plant species. Use of glyphosate near wetlands and in riparian areas would likely be reduced with the introduction of aminopyralid. The degree of improvement to the functions of wetland and riparian areas as a result of herbicide treatments would be similar under all alternatives.	Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as risks to non-target plant species. Use of glyphosate near wetlands and in riparian areas would likely be reduced with the introduction of aminopyralid. The degree of improvement to the functions of wetland and riparian areas as a result of herbicide treatments would be similar under all alternatives.	Approximately 10,000 acres of wetland and riparian areas would be treated annually. Herbicide use would continue to be associated with risks for contamination of water and soil, as well as risks to non-target plant species. Use of glyphosate near wetlands and in riparian areas would likely be reduced with the introduction of aminopyralid. The degree of improvement to the functions of wetland and riparian areas as a result of herbicide treatments would be similar under all alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Past effects to wetland and riparian areas in the western U.S. have occurred as a result of natural resource extraction, recreation, dams and diversions, road construction, agriculture, urbanization, and fire exclusion, among other factors. While these factors continue, to varying degrees, ongoing efforts to protect wetlands and riparian areas have reduced their level of impact. Vegetation treatment programs by the BLM and Forest Service, as well as efforts by other agencies, private landowners, and conservation groups, continue to improve the condition of degraded wetland and riparian habitat. Restoring natural fire regimes and native vegetation, and controlling invasive vegetation, would improve wetland and riparian habitat and function, with benefits similar under all the alternatives. Under all alternatives, some herbicides would be released into wetland and riparian areas, and removal of vegetation could have short-term impacts to the functions of these areas. Contributions to cumulative effects would be similar under all alternatives.			
EFFECTS ON VEGETATION			
The BLM would continue to implement vegetation treatments using herbicides that would have the goal of restoring native and desirable plant communities and natural fire regimes. Short-term adverse effects to non-target vegetation could occur, and treatment design would need to consider special status species and populations. Long-term benefits would include a reduction in the spread of invasive plants and a reduction in the risk of future wildfire.	Herbicide treatments would be implemented in similar locations and with similar goals as under the No Action Alternative, but with more options for managing invasive plants in terms of active ingredients used. Short-term adverse effects to non-target vegetation and risks to sensitive species and populations would be similar to those under the other alternatives. The efficacy of some herbicide treatments could be improved through use of the new active ingredients, which may be more effective at managing target species than currently approved herbicides, and may improve control of populations that have developed a resistance to currently approved herbicides. Therefore, long-term benefits may be greater than under the No Action Alternative.	Herbicide treatments would be implemented in similar locations and with similar goals as under the other alternatives, but with more herbicide options for ground-based control of invasive plants than under the No Action Alternative. There would be fewer options for aerial control than under the Preferred Alternative. Short-term adverse effects to non-target vegetation and risks to sensitive species and populations would be similar to those under the other alternatives. The efficacy of some herbicide treatments could be improved through use of the new active ingredients, but only for ground-based treatments. Long-term benefits associated with ground-based treatments would be similar to those under the Preferred Alternative.	Herbicide treatments would be implemented in similar locations and with similar goals as under the other alternatives. Options for managing invasive plants would be greater than under the No Action Alternative but less than under the Preferred Alternative, as rimsulfuron would not be approved for use, so there would be fewer options for management of annual grasses such as cheatgrass and medusahead rye. Short-term adverse effects to non-target vegetation and risks to sensitive species and populations would be similar to those under the other alternatives. The efficacy of some herbicide treatments could be improved through use of the new active ingredients, but likely less than under the Preferred Alternative. Long-term benefits may be greater than under the No Action Alternative, but less than under the other action alternatives.
Cumulative Effects: Past effects to vegetation and native plant communities are predominantly associated with exclusion of fire and alteration of natural disturbance regimes, timber harvest, reseeding and planting programs, and grazing. Human activities have altered native plant communities, and have led to the introduction and spread of invasive plants. Many of these same human activities will continue to do so in the future, with populations of invasive plants continuing to spread and altered disturbance regimes continuing to contribute to large wildfires that further alter vegetation. Herbicide treatments under all alternatives would kill target and non-target species, but would benefit vegetation by controlling invasive plants, restoring native plant communities, and reducing wildfire risk. The types of adverse and beneficial effects would be similar under all alternatives, although the action alternatives may allow the BLM to be more successful at reaching treatment goals by providing additional herbicide options.			

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
EFFECTS ON FISH AND OTHER AQUATIC ORGANISMS			
There would continue to be toxicological risks to fish and other aquatic organisms (including sensitive species) associated with use of herbicides, with buffers and other SOPs required to protect these organisms from harm. Long-term beneficial effects to aquatic organisms would include habitat improvements through management of invasive plants in aquatic habitats, wetlands, and riparian areas, and reduced sedimentation through treatments to reduce the risk of wildfire.	With the introduction of the three new active ingredients, there would be a potential for reduced toxicological risks to fish and other aquatic organisms, relative to the No Action Alternative, from BLM herbicide treatments. Aminopyralid, fluroxypyr, and rimsulfuron have a very low toxicological risk to fish. In some circumstances they would be used instead of currently approved active ingredients with a greater risk, such as picloram and glyphosate. Long-term beneficial effects to aquatic organisms through habitat improvement and reduced fire risk would be similar to those under the other alternatives.	Toxicological risks to fish and other aquatic organisms could be slightly lower than under the No Action Alternative, as there would be slightly less glyphosate and picloram used than under the No Action Alternative, but more use than under the Preferred Alternative. Long-term beneficial effects to aquatic organisms through habitat improvement and reduced fire risk would be similar to those under the other alternatives.	Toxicological risks to fish and other aquatic organisms would be similar to those under the No Action Alternative, as the breakdown of herbicide use would be similar, with only a slight reduction in the use of most of the currently approved active ingredients. Long-term beneficial effects to aquatic organisms through habitat improvement and reduced fire risk would be similar to those under the other alternatives.
Cumulative Effects: Past effects to fish and other aquatic organisms are predominantly associated with natural resource extraction; recreation; fire exclusion; construction of roads, dams, and hydropower facilities; agriculture; and urbanization. In Alaska, oil and gas development, and subsistence and recreational fishing, have been the primary factors affecting fish and aquatic resources. These activities will continue into the future, and will continue to contribute to the degradation aquatic habitats and other adverse cumulative effect to fish. These adverse effects will be offset, to some degree, by protective regulations and restoration efforts, driven by goals to improve water quality and regain the proper functioning condition of riparian areas. Additionally, efforts to remove dams and other blockages to fish passage will continue to benefit fish populations. The contribution to cumulative effects would be similar under all of the alternatives. Herbicide treatments would pose toxicological risks to fish and could alter aquatic habitats, but countervailing effects would be associated with long-term improvement in function of aquatic habitats. The action alternatives would entail use of a slightly greater number of active ingredients than under the No Action Alternative.			
EFFECTS ON WILDLIFE			
Herbicide treatments would continue to benefit wildlife, with goals that include improving wildlife habitat, restoring native plant communities, and reducing wildfire risk. There would continue to be toxicological risks to wildlife (including sensitive species) associated with herbicide use, with the greatest concern associated with 2,4-D, bromacil, diquat, and diuron. Their use would account for 10 percent of acres treated.	Benefits to wildlife would be similar to those under the other alternatives, since the total acreage of wildlife habitat treated would be similar. Some increased efficacy of treatments is possible with the introduction of the three new active ingredients. Overall toxicological risks to wildlife could be slightly lower than under the No Action Alternative. Use of active ingredients with the greatest concern for toxicological effects would account for approximately 8 percent of acres treated.	Benefits to wildlife would be similar to those under the other alternatives, since the total acreage of wildlife habitat treated would be similar. Some increased efficacy of treatments is possible with the introduction of the three new active ingredients, but less than under the Preferred Alternative since aerial treatments of the new herbicides would not be allowed. Use of active ingredients with the greatest concern for toxicological effects would account for approximately 9 percent of acres treated.	Benefits to wildlife would be similar to those under the other alternatives, since the total acreage of wildlife habitat treated would be similar. Some increased efficacy of treatments is possible with the introduction of the three new active ingredients, but less than under the Preferred Alternative since use of rimsulfuron would not be allowed. Use of active ingredients with the greatest concern for toxicological effects would account for approximately 8 percent of acres treated, which is the same as under the Preferred Alternative, and slightly lower than under the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: The primary factors contributing to habitat loss and modification in the western U.S. include land conversion to agriculture, pastureland, and residential, commercial, industrial and other development; grazing by domestic livestock and wild horses and burros; timber management; fire suppression; and invasion by weeds and other undesirable vegetation. Many of these activities will continue to occur into the future, and will continue to contribute to loss, modification, and fragmentation of habitat, potentially increasing the likelihood of local extirpations of wildlife populations and loss of species diversity. Actions to protect sensitive species and their habitat, restore native plant communities and disturbance regimes, control the spread of invasive species, and reduce the risk of wildfire would all be expected to help offset some of the adverse impacts to wildlife and their habitat. Under all alternatives, herbicide treatments would contribute to cumulative effects to wildlife through habitat modifications and release of herbicides into occupied habitat. Countervailing long-term effects associated with restoration of native plant communities and disturbance regimes would also be similar under all the alternatives. By allowing the BLM the flexibility to use additional herbicides, the action alternatives would result in the release of a larger number of active ingredients. As the three herbicides have a very low risk to wildlife, a cumulative effect of adding these active ingredients could be a reduction in overall risk to wildlife associated with herbicide treatments, as herbicides with a greater risk to wildlife would potentially be used less.			
EFFECTS ON LIVESTOCK			
Herbicide treatments would continue to have some risk for toxicological effects to livestock that graze in treated rangelands. Beneficial effects of herbicide treatments would include long-term improvements to rangeland vegetation through management of noxious weeds, reduction of wildland fire risk, and on some rangelands the seeding of non-target species after the herbicide treatment.	The overall toxicological risk to livestock could be lower than under the No Action Alternative; approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock. Beneficial effects to livestock from improvement of rangeland condition would be similar to those under the No Action Alternative. The new active ingredients could increase the efficacy of certain herbicide treatments.	The overall toxicological risk to livestock could be lower than under the No Action Alternative; approximately 5 percent fewer acres would be treated with herbicides that have some level of risk to livestock. Beneficial effects to livestock from improvement of rangeland condition would be similar to those under the No Action Alternative. The new active ingredients could increase the efficacy of certain herbicide treatments, although not to the same degree as under the Preferred Alternative, since aerial applications of the new herbicides would not be allowed.	The overall toxicological risk to livestock could be lower than under the No Action Alternative. Similar to the Preferred Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to livestock. The new active ingredients could increase the efficacy of certain herbicide treatments, although not to the same degree as under the Preferred Alternative, since use of rimsulfuron would not be allowed.
Cumulative Effects: Past effects to livestock are predominantly associated with a decrease in the ability of public lands to support livestock grazing, which has occurred as a result of changes in fire regimes and the spread of noxious weeds. Past livestock grazing has contributed to these adverse effects, as have mineral extraction, recreation, and other activities. Many of these factors are ongoing and will continue to impact the quality of rangelands utilized by livestock. These effects will be minimized or offset by ongoing management programs designed to restore ecosystem processes and maintain livestock populations in balance with the health of rangelands. Under all of the alternatives, herbicide treatments would contribute short-term adverse effects by removing large areas of vegetation and non-target species used by livestock as forage. Countervailing effects of treatments would include improvement in the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to livestock. All of the alternatives would be similar as far as the level of their effects. Under the action alternatives, the toxicological risks to livestock associated with herbicide treatments could potentially decrease, as there would be less use of more potentially harmful active ingredients.			

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
EFFECTS ON WILD HORSES AND BURROS			
Herbicide treatments would continue to have some risk for toxicological effects to wild horses and burros that graze in treated rangelands. Herbicide treatments would continue to benefit wild horses and burros through improvements in the quality of forage on rangelands.	Compared to the No Action Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros. Long-term benefits to rangelands used by wild horses and burros would be similar to those under the No Action Alternative. The addition of the new active ingredients may allow the BLM to more effectively control invasive species and reduce fire risk in certain areas.	Compared to the No Action Alternative, approximately 5 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros. Long-term benefits to rangelands used by wild horses and burros would be similar to those under the other alternatives. The addition of the new active ingredients may allow the BLM to more effectively control invasive species and reduce fire risk in certain areas, although they would not be used for aerial applications.	Compared to the No Action Alternative, approximately 7 percent fewer acres would be treated with herbicides that have some level of risk to wild horses and burros, similar to the Preferred Alternative. Long-term benefits to rangelands used by wild horses and burros would be similar to those under the other alternatives. The addition of the new active ingredients may allow the BLM to more effectively control invasive species and reduce fire risk in certain areas, although use of rimsulfuron would be prohibited.
Cumulative Effects: Populations of wild horses and burros decreased drastically in the 1930s and 1940s as a result of capture and removal activities, which were later halted. Presently, the BLM attempts to maintain populations at levels that can be supported by the available resources, but populations continue to be well above that level. Development, grazing, and building of fences and other structures that impede herd movements have all contributed to cumulative adverse effects to wild horses and burros by reducing the quantity or value of available forage. The BLM will continue management efforts to keep wild horse and burro populations in balance with the condition of rangelands, which will require continued removal and adoption of animals, as well as measures to control reproduction. Under all of the alternatives, herbicide treatments would contribute short-term adverse effects by removing large areas of vegetation and non-target species used by wild horses and burros as forage. Countervailing effects of treatments would include improvement in the quality of rangeland forage and controlling noxious weeds that are unpalatable or toxic to wild horses and burros. All of the alternatives would be similar as far as the level of their effects. Under the action alternatives, the toxicological risks to wild horses and burros associated with herbicide treatments could potentially decrease, as there would be less use of more harmful active ingredients.			
EFFECTS ON PALEONTOLOGICAL AND CULTURAL RESOURCES			
Herbicide use would continue to have risks for adversely affecting fossils and cultural resources through chemical exposure and vehicle travel. Native Americans would be at risk for exposure to herbicides through dermal contact, ingestion of treated materials, or swimming in a treated water body. Currently approved herbicides associated with risks to Native Americans (2,4-D, diquat, and hexazinone) would account for approximately 8 percent of all acres treated. Non-target plants and other subsistence or traditional use resources could potentially be impacted, but there would be long-term benefits to these resources through restoration of native habitats and reduction of fire risk.	Risks to paleontological and cultural resources, including subsistence resources, would be similar to those under the other alternatives. The new active ingredients are not associated with human health risks to Native Americans. Use of currently approved herbicides associated with risks to these receptors would account for approximately 7 percent of all acres treated (just 1 percent lower than the No Action Alternative). Long-term benefits to resources of importance to Native Americans would be similar to those under the other alternatives.	Risks to paleontological and cultural resources, including subsistence resources, would be similar to those under the other alternatives. Use of currently approved herbicides associated with risks to these receptors would be the same as under the No Action Alternative (8 percent; slightly higher than under the Preferred Alternative). Long-term benefits to resources of importance to Native Americans would be similar to those under the other alternatives.	Risks to paleontological and cultural resources, including subsistence resources, would be similar to those under the other alternatives. Use of currently approved herbicides associated with risks to these receptors would be the same as under the Preferred Alternative (7 percent). Long-term benefits to resources of importance to Native Americans would be similar to those under the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Past exploration and development in the western U.S. has led to legal and illegal collection of paleontological resources and inadvertent damage of these resources. Many cultural resources have been lost or damaged by the exposure to the elements and by collection or destruction of cultural sites. These losses are permanent, but have been slowed by legislation designed to protect these resources from damage and removal. While the widespread loss and damage of paleontological and cultural resources has been slowed, ground disturbing activities with the potential to disturb undiscovered resources continue to occur in the western U.S. These activities include resource extraction, livestock grazing, and motorized recreation, among others. Over time, additional buried resources may be exposed naturally through erosion, increasing their susceptibility to damage or collection. Additionally, wildfires and invasive species have altered native plant communities, and continue to displace native plants and animals that provide traditional lifeway values to Native peoples. The contribution of herbicide treatments to adverse effects would be similar under all alternatives, with countervailing effects associated with managing invasive species and reducing the risk of wildfire, which would improve conditions for native plants and animals that provide traditional lifeway values. Potential human health risks to Native peoples would be similar under all alternatives, with low use of herbicides with a toxicological risk to humans, and SOPs implemented to prevent exposure.			
EFFECTS ON VISUAL RESOURCES			
Herbicide treatments would continue to have short-term adverse effects on visual resources by removing vegetation and creating a visual contrast to green, untreated vegetation. Long-term benefits to visual resources would be associated with removal of noxious weeds, restoration of native plant communities, and reduction in visual impacts associated with wildfire.	Short-term adverse effects and long-term beneficial effects to visual resources would be similar to those under the other alternatives, as the geographic locations and size of treatments would be similar.	Short-term adverse effects and long-term beneficial effects to visual resources would be similar to those under the other alternatives, as the geographic locations and size of treatments would be similar.	Short-term adverse effects and long-term beneficial effects to visual resources would be similar to those under the other alternatives, as the geographic locations and size of treatments would be similar.
Cumulative Effects: Humans have altered the visual character of lands in the western U.S. through activities such as resource extraction, agriculture, road construction, urbanization and other development, timber harvesting, livestock grazing, introduction of exotic species, and exclusion of fire. As a result, landscapes have changed, and are now marked by different vegetation composition, structure, and pattern. These activities continue to influence visual characteristics and the scenic quality of landscapes. Ongoing vegetation treatment programs would alter the visual quality of public lands over the short term by removing vegetation, and in some cases creating large areas of open, browned, or blackened landscapes. However the BLM's long-term goals to restore degraded lands and reinstate properly functioning ecosystem processes will likely help improve the visual character of public lands. All of the alternatives would have the same degree of effect to visual resources, and the same level of contribution to visual effects. None of the alternatives would alter land uses on public lands, or introduce long-term changes that would be in conflict with the BLM's visual resource management goals. Over the long term, all of the alternatives would be expected to contribute positively to scenic qualities of public lands. Additionally, all of the alternatives would help reduce the risk of wildfire that has a visual impact on public lands and other scenic lands in the western U.S.			
EFFECTS ON WILDERNESS AND OTHER SPECIAL AREAS			
Herbicide treatments would continue to result in some disturbance to wilderness and other special areas, as well as short-term site closures. Long-term benefits would include a reduction in the establishment and spread of invasive species in these areas, which would improve the naturalness component of wilderness character, and a reduced risk of loss of pristine areas to wildfire.	Adverse effects and long-term beneficial effects to wilderness and other special areas would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar. Treatments would improve the naturalness component of wilderness character.	Adverse effects and long-term beneficial effects to wilderness and other special areas would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar. Treatments would improve the naturalness component of wilderness character.	Adverse effects and long-term beneficial effects to wilderness and other special areas would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar. Treatments would improve the naturalness component of wilderness character.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: Factors that degrade the unique qualities of wilderness and other special areas include invasive species, wildland fire suppression, loss of water and deterioration in water quality, fragmentation and isolation, loss of threatened and endangered species, deterioration in air quality, motorized and mechanical equipment trespass and use, increasing commercial and public recreation use, adjacent land uses, and urbanization and encroachment. These threats are ongoing, and will continue to impact the unique qualities of wilderness and other special areas. Increases in population and pressure to utilize protected areas for resource extraction may result in further loss or degradation of these areas. Vegetation treatment programs in and near these areas that aim to control the spread of noxious weeds and restore natural fire regimes, if successful, would help reduce some of the threats to wilderness and other special areas, but not others. All of the alternatives would contribute short-term adverse effects associated with site closures and disturbances during herbicide treatments. Countervailing effects associated with slowing future degradation of these areas or improving them through management of invasive species and restoration of native habitats and disturbance regimes would also be the same under all the alternatives.			
EFFECTS ON RECREATION			
Herbicide treatments would continue to be associated with temporary closures of recreation sites and potential human health risks to visitors if accidental exposures occur. Beneficial effects would include improving the condition of sites used for recreation and resources sought during recreation, and reducing risk of wildland fire and associated longer-term adverse effects to recreation in burned areas.	Adverse effects and long-term beneficial effects to recreation would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar.	Adverse effects and long-term beneficial effects to recreation would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar.	Adverse effects and long-term beneficial effects to recreation would be similar to those under the other alternatives, as the areas receiving treatments and the goals of treatments would be similar.
Cumulative Effects: The BLM provides opportunities for outdoor recreation for millions of visitors annually. However, other uses of BLM lands, such as livestock grazing, timber harvesting, and oil and gas activities, have limited recreation opportunities in certain locations. Additionally, the spread of invasive plants and wildfires have adversely affected recreation opportunities. With the growth of the population in the West and a continued interest in recreation, the amount of use that BLM lands receive by the public will likely continue to increase. Existing lands and recreational facilities will be used more intensively, potentially reducing the recreation experience in certain areas and resulting in degradation of recreational facilities. Vegetation management programs to improve wildlife habitat quality, control the spread of invasive species, and reduce wildfire risk, will continue to offset some of the impacts caused by recreationists, as well as improve the quality of recreational opportunities on public lands. All alternatives would contribute the same amount to cumulative effects. Short-term adverse effects associated with temporary closures of recreation sites would be offset by long-term beneficial effects associated with management of invasive species, reduction of wildfire risk, and restoration of native plant communities, which would potentially improve recreational experiences.			
EFFECTS ON SOCIAL AND ECONOMIC VALUES			
Social and economic benefits and impacts from herbicide treatments would be similar to what has occurred during the past several years. Herbicide treatments would continue to generate some employment in the geographic areas affected by the treatments. Ongoing consultation with Indian tribes about the location and timing of future treatments would be used to prevent environmental justice effects. Estimated costs to treat vegetation would be approximately $89.1 million per year. Herbicide treatments would continue to	Social and economic benefits and impacts from herbicide treatments would be similar to those under other the other alternatives. Based on estimates of herbicide costs and amount of future use, costs to treat the same amount of vegetation could be 1 to 2 percent lower per year than under the No Action Alternative.	Social and economic benefits and impacts from herbicide treatments would be similar to those under the other alternatives. Based on estimates of herbicide costs and amount of future use, costs to treat the same amount of vegetation could be less than 1 percent lower per year than under the No Action Alternative.	Social and economic benefits and impacts from herbicide treatments would be similar to those under other the other alternatives. Based on estimates of herbicide costs and amount of future use, costs to treat the vegetation would be similar to those under the No Action Alternative.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
provide economic benefits by reducing loss of property to wildfire. Commercial activities that occur on public lands would continue to be impacted a minor amount by herbicide treatments. There would be a risk that herbicide treatments could impact private property and result in damage to crops or other non-target plants of economic value.			
Cumulative Effects: Social and economic factors that are important from the perspective of public lands include the continued population growth in the western U.S., environmental justice concerns associated with communities with high densities of Native Americans and other minority populations, the importance of jobs and industries associated with natural resources and resource extraction, increasing wildfire risks and associated risks to private property, and economic benefits from activities conducted on BLM lands, such as grazing, harvest of timber and other forest products, and oil and gas development. It is expected that populations in the western U.S. will continue to increase, and that use of BLM-administered lands by the public will also continue to increase. Population growth is cumulative, and actions on public lands and elsewhere will continue to affect greater numbers of people, including larger minority and low income populations. BLM lands will continue to provide a source of land for the federal government and local economies, with a possible low-level increase in those benefits through activities to improve the condition of rangelands and other public lands. Oil and gas and mineral resource extraction on public lands are expected to continue to be important sources of income into the future. Recreation is also likely to continue to be an important source of income, with vegetation treatments that improve the quality of public lands for recreation likely to benefit recreational opportunities. It is expected that effects to private property from activities on public lands will be an increasing concern, although efforts by the BLM, Forest Service, and other agencies to reduce wildfire risk may have an overall benefit to private property over the long term if incidence and severity of wildfire is reduced, particularly in the wildland-urban interface. The contribution to cumulative effects to social and economic resources would be similar under all the alternatives, with slight differences in the costs of herbicide treatments.			
EFFECTS ON HUMAN HEALTH AND SAFETY			
Use of herbicides would continue to be associated with some amount of risk to the human health of herbicide applicators and the public. Currently approved herbicides with the greatest amount of associated risk include 2,4-D, bromacil, diquat, fluridone, hexazinone, tebuthiuron, and triclopyr. These herbicides would account for an estimated 38 percent of the total treatment acres under the No Action Alternative. Benefits associated with herbicide treatments would include reductions in the occurrence of noxious weeds and a reduced risk of wildfire, which is associated with smoke-related health risks and loss of life and property.	The three new active ingredients have no to low risk to human health (except for accidental occupational exposures to rimsulfuron). However, projected use of higher risk currently approved herbicides would increase slightly, to approximately 40 percent of all treated acres. Benefits associated with herbicide treatments would be similar to those under the other alternatives.	Projected use of herbicides with the greatest amount of human health risk would increase slightly, to approximately 41 percent of all treated acres. Benefits associated with herbicide treatments would be similar to those under the other alternatives.	Projected use of herbicides with the greatest amount of human health risk would increase slightly, to approximately 40 percent of all treated acres, similar to the Preferred Alternative. Benefits associated with herbicide treatments would be similar to those under the other alternatives.

TABLE 2-6 (cont.)
Summary and Comparison of Effects on Resources by Alternative

No Action Alternative	Preferred Alternative	Alternative C	Alternative D
Cumulative Effects: The public and workers have been exposed to human health and safety risks associated with a wide variety of factors, including use of equipment and tools, exposures to chemicals, and wildfire, among others. These will continue to be concerns in the future. Many occupations (such as firefighting and operation of heavy equipment) will continue to be associated with some level of risk, although ongoing actions to reduce health and safety risks will likely help reduce the incidence of injury and illness. The public will continue to be exposed to various pollutants; the cumulative effects of these exposures could include development of cancer and health conditions. Vegetation management programs by the BLM and other agencies to reduce catastrophic fire risk would continue to offset some of the health risk associated with exposure to smoke/wildfire in targeted areas, such as the wildland-urban interface where the most people are likely to be affected. Under all of the alternatives, herbicides with some risk to human health would be applied in similar locations on public lands, although the number of herbicides used and the amounts of usage would vary among the alternatives. Under the action alternatives, two or three new active ingredients would be used, in addition to currently approved herbicides, resulting in a cumulative increase in the number of ingredients used on public lands. The new herbicides have no to very low risk to human health via various exposure scenarios. The potential for synergistic human health effects associated with mixtures of multiple ingredients is not known. Benefits to human health from herbicide treatments would be similar under all the alternatives. Treatments would help reduce wildfire risk and associated risks to human health. Over the long term, restoration of natural fire regimes and improvement in ecosystem health should reduce risks to human health from activities originating on public lands and affecting public land users or those living near public lands.			