CHAPTER 6

HABITAT AND RANGE FOR SPECIES OF CONCERN

In this chapter, we identify habitat associations for the 11 species of concern in the assessment area and quantify the amount of sagebrush and non-sagebrush habitat available to each species within its range. We estimate the amounts and percentages of sagebrush habitat available to each species by land owner. Finally, we estimate the amount of sagebrush habitat for each species of concern at risk from four widespread threats: 1) encroachment by pinyon-juniper, 2) understory encroachment by non-native herbaceous vegetation, 3) residential development, and 3) energy development. The nature and extent of these threats in the assessment area are described in Chapter 4. In Chapter 7, we designate three species groups and map sagebrush habitat at risk from the four threats for each group at the watershed level.

Methods

Determining Habitat Associations

We reviewed habitat descriptions in the literature to identify habitat associations for each species of concern. For birds, we relied heavily on habitat occurrence records in the *Colorado Breeding Bird Atlas* (Kingery 1998) and data provided by Rocky Mountain Bird Observatory's Monitoring Colorado's Birds (MCB) program (T. Leukering, pers. comm.). We also consulted *Birds of Western Colorado Plateau and Mesa Country* (Righter et al. 2004), *Colorado Birds: A Reference to their Habitat and Distribution* (Andrews and Righter 1992), *Birds of Colorado* (Bailey and Niedrach 1965), and Birds of North America species accounts (Poole and Gill). For mammals, we reviewed habitat descriptions in *Mammals of Colorado* (Fitzgerald et al. 1994), accounts published by *Mammalian Species*, and other peer-reviewed literature. For the purposes of our assessment, we included breeding habitat associations for passerine birds, but not migration or winter habitats. For northern harrier, we included nesting habitat as well as important year-round foraging habitat associations. For mammals, we included habitats types in the assessment area where specimens had been collected or observed. We made subjective selections of additional habitat associations for mammals based on literature review and expert knowledge. We did not select habitat types that were identified in the literature or by reviewers as environmental sinks for any species of concern. For instance, some agricultural lands provide nesting habitat for vesper sparrows but may perform as sinks if harvesting or flood irrigation occurs during nesting periods. Therefore we did not include agricultural lands in our non-sagebrush habitat mapping exercise for vesper sparrow.

Determining Species Ranges

Species ranges depict the outer boundaries of where the species regularly occurs in the assessment area. For the purposes of this exercise, we defined the area of regular occurrence as where a species is present as a summer breeding resident or year-round resident. Dispersing or migrating individuals may commonly occur outside depicted range boundaries. Actual distribution is typically discontinuous within the range, constrained by habitat availability and elevation limits. We attempted to depict major gaps in the species' distributions in our range maps, but many smaller gaps are not depicted.

To determine species ranges in the assessment area, we relied primarily on range maps in the literature sources identified in "Determining Habitat Associations" above. We used scanned images of the published range maps, overlain on the assessment area, to draw range maps in GIS. We modified some published range maps in GIS based on additional data on breeding bird occurrences in the *Colorado Breeding Bird Atlas* (Kingery 1998). Finally, we compared draft

range maps to SWReGAP land cover types, and made additional adjustments to some species ranges based on habitat associations. Because kit fox has undergone a substantial range contraction in historic times in the assessment area, we mapped current range equal to the CDOW "kit fox overall range" coverage, and historic range based on the literature.

Quantifying Habitat

We mapped habitat for each species of concern based on land cover types and elevation. Using GIS, we generated a list of SW ReGAP land cover types within each species' range. Based on the SW ReGAP land cover type descriptions (NatureServe 2004) and known habitat requirements for each species, we categorized each land cover type as sagebrush habitat, non-sagebrush habitat, or non-suitable for each species (Table 6-1). Next, we determined elevation limits for each species (Table 6-2) from published species accounts and other literature described in "Determining Habitat Associations." Finally, we mapped and calculated the area of sagebrush and non-sagebrush habitat for each species within its range and elevation limit. We also calculated the amount of sagebrush habitat for each species by land owner by intersecting species sagebrush habitat coverages with a land ownership dataset.

Quantifying Sagebrush Habitat at Risk for Each Species of Concern

We used the sagebrush threat models described in Chapter 4 to quantify and compare sagebrush habitat at risk for each species of concern. The four types of threats we modeled are 1) pinyon-juniper encroachment, 2) understory encroachment by non-native herbaceous vegetation, 3) residential development, and 4) energy development. These threat models classified each 30 x 30 meter pixel of sagebrush in the assessment area into risk categories of "none," "low," "moderate," or "high" for each type of threat. We also calculated the risk of combined threats for each sagebrush pixel, equal to the highest risk category for any single threat.

To determine the amount of sagebrush habitat at risk for each species of concern, we used GIS to intersect sagebrush habitat for each species with the sagebrush threat data. For each species, we calculated the area and percentage of sagebrush habitat that occurs in each risk level for each threat, and for all threats combined.

Results

Species of concern ranges and habitats are mapped on Figures 6-1 through 6-11 and areas quantified in Table 6-3. The size of species ranges varies from 0.83 million ha (black-throated sparrow; Figure 6-1) to 15.68 million ha (Merriam's shrew; Figure 6-6). Most of the species ranges are fairly extensive in the assessment area. Black-throated sparrow and kit fox (Figure 6-4) ranges are limited to low-elevation deserts of the western-most extents of the assessment area, and sagebrush vole range is limited to the northwest (Figure 6-10).

Our range map for Merriam's shrew in the assessment area significantly extends the range previously mapped by Fitzgerald et al (1994), based on occurrences recorded in Gunnison County (Armstrong and Jones 1971), occurrences in adjacent states, known habitat associations, and expert opinion (D. Armstrong, pers. comm.). Our estimation of kit fox historic range is based on reliable historic occurrence records in the assessment area, habitat associations and elevation limits established by literature review, and expert opinion (T. Beck, pers. comm.; see kit fox profile in the Appendix). We chose to extend historic range into Garfield County in the Colorado River Valley based on kit fox known presence in the Grand Valley and adjacent eastern Utah and historic habitat conditions in Garfield County, although the historic upstream extent of kit fox is unknown. Kit fox historic records north of Mesa County are unsubstantiated trapper's reports, and should be interpreted with caution (J. Fitzgerald, pers.

comm.). We estimate that kit fox historic range encompasses 1.71 million ha and kit fox current range encompasses 0.12 million ha. Our estimate of kit fox current range, based on CDOW range mapping, should also be viewed with caution. CDOW census work through 2000 suggested that kit fox were rare and declining, and they may be extirpated from Colorado (T. Beck, pers. comm.). Our habitat assessment and management recommendations (Chapter 8) focus on kit fox historic range.

Estimated amounts and percentages of sagebrush and non-sagebrush habitat available for each species of concern within its range in the assessment area are presented in Table 6-3 and Figure 6-12. Black-throated sparrow (Figure 6-1) has the least amount of total habitat (0.38 million ha) and Merriam's shrew (Figure 6-6) has the greatest amount of total habitat (6.21 million ha) in the assessment area. Sagebrush habitat constitutes the lowest percentage of the total habitat in kit fox historic range (20 percent; Figure 6-4), and the highest percentage for sagebrush vole (90 percent; Figure 6-10). Habitat within the ranges of other sagebrush obligates (Brewer's sparrow [Figure 6-2], sage sparrow [Figure 6-8], and sage thrasher [Figure 6-9]) is generally about 70 percent sagebrush.

In Table 6-4, we show by landowner the estimated amount of sagebrush habitat for each species in its range, and compare these estimates graphically in Figure 6-12. Overall, at least 85 percent of sagebrush habitat for each species is under private and BLM control combined, and generally less than 15 percent is administered by the USFS, other federal agencies, Colorado State Land Board, and other state entities. Merriam's shrew has more sagebrush habitat under private ownership (45 percent) than any of the other species of concern, while black-throated sparrow has by far the least (16 percent). BLM administers between 41 percent (Brewer's sparrow, green-tailed towhee, Merriam's shrew, vesper sparrow) and 73 percent (black-throated sparrow) of sagebrush habitats of the species of concern.

Table 6-5 presents the estimated amounts and percentages of sagebrush habitat for each species at risk from the four threats individually, and from the four threats combined. In Figures 6-13 through 6-15 we provide a graphic comparison of the estimates presented in Table 6-5, with species ranked in decreasing order of sagebrush habitat at high risk. Risk of understory encroachment by non-native herbaceous vegetation is probably the most extensive sagebrush habitat threat overall, with proportional sagebrush habitat at high risk ranging from about 70 percent for kit fox to about 23 percent for Brewer's sparrow and green-tailed towhee. Threat of residential development in sagebrush habitats for species of concern is probably the least extensive sagebrush habitat threat overall, with habitat at high risk ranging from about 4 percent for kit fox to less than 1 percent for black-throated sparrow and sagebrush vole. Our model predicts that over 90 percent of each species' sagebrush habitat is at no or low risk of residential development.

Proportionally more historic kit fox sagebrush habitat is at high risk of pinyon-juniper encroachment (48 percent), residential development (4 percent), and energy development (24 percent) than the sagebrush habitat of all other species of concern. Sage thrasher has proportionally the least amount of sagebrush habitat (16 percent) at high risk of pinyon-juniper encroachment. Vesper sparrow, Brewer's sparrow, and green-tailed towhee have proportionally the least amount of sagebrush habitat (23 percent) at high risk to understory encroachment by non-native herbaceous vegetation, and black-throated sparrow has the most (69 percent). Risk of energy development is broadly moderate for all species; the proportional amount of sagebrush habitat at moderate risk to energy development across species ranges from 58 to 78 percent.

Combined threats modeling estimated some degree of risk in virtually all sagebrush habitat for each species (Table 6-5 and Figure 6-15). The sagebrush habitats at highest risk of combined

threats are those of kit fox and black-throated sparrow, with over 80 percent estimated at high risk, about 20 percent at moderate risk, and little to none at low or no risk. For the remaining species, the high risk level for combined threats applies to between 37 and 49 percent of their sagebrush habitats, the moderate risk level applies to 42 to 51 percent, and the low risk level applies to 3 to 19 percent.

Discussion

Ranges for species of concern are mostly extensive and tend to be strongly overlapping. One implication of this fact for species conservation is the need for a multi-species approach at the assessment area scale, since the species of concern are not strongly segregated geographically. Because species of concern have differing habitat requirements, another implication for species conservation is the need to identify groups of species with similar or at least non-conflicting habitat needs. We identify these species groups in Chapter 7, and develop multi-species management strategies in Chapter 8.

The percentage of total habitat in sagebrush varies widely between species (Table 6-3 and Figure 6-12), reflecting the variation between species in relative sagebrush dependence in the assessment area. Other habitat types important to the species of concern (Table 6-1) are mixed salt desert scrub, semi-desert shrub steppe, and greasewood flats (used by 9 of the species), pinyon-juniper shrubland (used by 8 of the species); and semi-desert grassland and juniper savannah (used by 7 of the species). A complete conservation strategy for the species of concern must take into account these non-sagebrush habitats. However, sagebrush habitats constitute an average of over half of the total habitats for species of concern in the assessment area, and the focus of this assessment on sagebrush will address a substantial part of the total habitat for the species of concern.

Land ownership patterns of sagebrush habitat for the species of concern (Table 6-4 and Figure 6-12) are similar to the patterns identified for all sagebrush in the assessment area (described in Chapter 3). Sagebrush habitat on private lands ranges from 16 to 45 percent across species, with a mean of 40 percent. Consequently, conservation of sagebrush habitats on private lands is an important aspect of species conservation. BLM manages 41 to 73 percent of sagebrush habitats for the species of concern, with a mean of 48 percent. About 73 to 87 percent of all public land sagebrush habitat for the species of concern is managed by BLM. BLM clearly has the greatest opportunity of any public agency for sagebrush habitat conservation for species of concern in the assessment area, followed by USFS and Colorado State Land Board (each managing a mean of about 5 percent of sagebrush habitats overall and up to 11 percent of publicly owned sagebrush habitats).

Species with the most sagebrush habitat at high and moderate risk tend to be species associated with more arid sagebrush at lower elevations. Kit fox, black-throated sparrow, and northern harrier are consistently among the species of concern with the highest percentages of sagebrush at risk of all threats. Sage sparrow, sagebrush vole, and lark sparrow generally rank next in percentages of sagebrush at risk.

Assumptions and Limitations

- Among the species of concern, ranges of birds are much better known than mammals. Kit fox current and historic range is conjectural and the species may even be extirpated. For sagebrush vole, range is probably approximately correct but distribution within the range is mostly unknown. For Merriam's shrew, the range is conjectural and almost nothing is known of distribution.

- Knowledge of habitat associations is more complete for the avian species of concern and kit fox than for the less well-studied sagebrush vole and Merriam's shrew. Our selections of SW ReGAP land cover types are approximations of species habitat associations, and certainly oversimplify the habitat requirements of the species and the distribution of their actual habitats on the landscape.
- Our selection of SW ReGAP land cover types to map non-sagebrush habitat for species of concern provides only a coarse filter for habitats functioning as environmental sinks. While we attempted to eliminate land cover types with high likelihood to function as sinks, we acknowledge that even primary habitats function as sinks in certain contexts not adequately mapped at the regional scale. Conversely, some eliminated land cover types may not function as sinks in all situations.
- Our mapping of sagebrush habitat within each species' range did not filter patches of sagebrush too small to be useful to sage sparrow, Brewer's sparrow, and sage thrasher. We therefore potentially overestimate the amounts of sagebrush habitat for these area-sensitive species in the assessment area. The dynamics of small patch sizes are too complex, too poorly understood, and too dependent on landscape or matrix context factors to be meaningfully modeled at the scale of this assessment. Field checks of SW ReGAP sagebrush mapping (described in Chapter 3) also suggest that sagebrush habitat may be overestimated by the SW ReGAP model.
- Estimates of habitat at risk were generated from threats models whose performance has not been evaluated in the field.
- Our threats analysis did not consider non-sagebrush habitat types, which provide significant habitat for many of the species of concern. Ideally, conservation planning (particularly for those species that occupy substantial habitats other than sagebrush) should also consider threats to non-sagebrush habitats. Such an approach is beyond the scope of this assessment.
- Our threats analysis models risks to species' sagebrush habitats but does not account for species' responses to threats. For example, green-tailed towhee and lark sparrow are more tolerant of scattered small trees in their shrubland habitats than sage sparrow and sage thrasher. Green-tailed towhee and lark sparrow are therefore not expected to respond to pinyon-juniper encroachment in sagebrush to the same degree as sage sparrow or sage thrasher.
- Although grazing and range treatments may cause widespread direct and indirect threats to sagebrush habitats for species of concern, region-wide GIS coverages of grazing allotments and range treatments are not yet available to use for modeling these threats across the assessment area.

Key Findings

- Species ranges are mostly extensive across the assessment area and are not well segregated geographically, requiring a multi-species conservation approach at the assessment area scale.
- Percentages of sagebrush habitat relative to total habitat for species of concern vary from 20 percent for kit fox to 90 percent for sagebrush vole, and average about 70 percent for other sagebrush obligates (Brewer's sparrow, sage sparrow, and sage thrasher).
- BLM and private lands generally comprise at least 85 percent of sagebrush habitat for species of concern. USFS and Colorado State Land Board lands comprise much of the

remainder. Sagebrush habitat for species of concern is nearly as abundant on private lands as public lands.

- Among threats we modeled, risk of understory encroachment by non-native herbaceous vegetation is probably the most extensive sagebrush habitat threat, with sagebrush habitat at high risk ranging from about 70 percent for kit fox to about 23 percent for Brewer's sparrow and green-tailed towhee.
- Threat of residential development in sagebrush habitats for species of concern is probably the least extensive sagebrush habitat threat overall, with less than 5 percent of sagebrush habitat at high risk and over 90 percent at none or low risk for all species.
- Risk of energy development is broadly moderate for sagebrush habitats of all species of concern, ranging from 58 to 78 percent of sagebrush habitat at moderate risk.
- Combined threats modeling estimated some degree of risk in virtually all sagebrush habitat for each species of concern, underscoring the need for conservation action. Sagebrush habitats for the species of concern constitute an average of over half their total available habitats in the assessment area.

Recommendations

- To gain a more complete understanding of threats and conservation needs of the species of concern in the assessment area, develop models for assessing risk of widespread threats to other important (non-sagebrush) habitat components.

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Table 6-1. Cover types mapped by SW ReGAP in species of concern ranges and designated as suitable or non-suitable habitat.

Notes

"x" = mapped in species range and considered suitable habitat

"-" = mapped in species range but unoccupied or not considered suitable habitat

blank = not mapped in

	Code	Southwest Regional GAP Cover Type	S054 Inter-Mountain Basins Big Sagebrush Shrubland	S056 Colorado Plateau Mixed Low Sagebrush Shrubland	S071 Inter-Mountain Basins Montane Sagebrush Steppe	S128 Wyoming Basins Low Sagebrush Shrubland	S001 North American Alpine Ice Field	S002 Rocky Mountain Alpine Bedrock and Scree	S004 Rocky Mountain Alpine Fell-Field	S006 Rocky Mountain Cliff and Canyon	S008 Western Great Plains Cliff and Outcrop	S009 Inter-Mountain Basins Cliff and Canyon	S010 Colorado Plateau Mixed Bedrock Canyon and Tableland	S011 Inter-Mountain Basins Shale Badland	S012 Inter-Mountain Basins Active and Stabilized Dune	S014 Inter-Mountain Basins Wash	S015 Inter-Mountain Basins Playa	S023 Rocky Mountain Aspen Forest and Woodland	S025 Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine	S028 Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and	S030 Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Wo	S031 Rocky Mountain Lodgepole Pine Forest	S032 Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest a	S034 Rocky Mountain Montane Mesic Mixed Conifer Forest and W	S036 Rocky Mountain Ponderosa Pine Woodland	S038 Southern Rocky Mountain Pinyon-Juniper Woodland	S039 Colorado Plateau Pinyon-Juniper Woodland	S042 Inter-Mountain West Aspen-Mixed Conifer Forest and Wood	S045 Inter-Mountain Basins Mat Saltbush Shrubland	S046 Rocky Mountain Gambel Oak-Mixed Montane Shrubland	S047 Rocky Mountain Lower Montane-Foothill Shrubland	S048 Western Great Plains Sandhill Shrubland	S050 Inter-Mountain Basins Mountain Mahogany Woodland and S	S052 Colorado Plateau Pinyon-Juniper Shrubland	S059 Colorado Plateau Blackbrush-Mormon-tea Shrubland	S065 Inter-Mountain Basins Mixed Salt Desert Scrub
Black-throated sparrow			x	x	-	x				-		-	-	x	x	x		-					-	-	-	-	-	-	-			x	x	x
Brewer's sparrow			x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	x
Green-tailed towhee			x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	x	x	-	x	x	-	-
Kit fox (historic)			x	x	x			-	-	-			x	x	x	x	x				-	-	-	-	-	-	-	-	-	x	-	-			x	x	x
Lark sparrow			x	x	x	x		-	-	-	-	-	x	-	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	x	x	x	x
Merriam's shrew			x	x	x	x		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	-	-	x	x	-	-	x	x	-	-
Northern harrier			x	x	-	x	-	-	-	-		-	-	x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-		-	-	x	x
Sage sparrow			x	x	x	x		-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	x
Sage thrasher			x	x	x	x		-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	x	x
Sagebrush vole			x	x	x	x				-	-	-	-	-	x		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	x
Vesper sparrow			x	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	-	-	x	-	x

Note: Cover types are described in *Landcover Descriptions for the Southwest Regional GAP Analysis Project* available at http://earth.gis.usu.edu/swgap/swgap_legend_desc.pdf.

Table 6-1. Cover types mapped by SW ReGAP in species of concern ranges and designated as suitable or non-suitable habitat.

Notes

"x" = mapped in species range and considered suitable habitat

"-" = mapped in species range but unoccupied or not considered suitable habitat

blank = not mapped in

	Code Southwest Regional GAP Cover Type	S074 Southern Rocky Mountain Juniper Woodland and Savanna	S075 Inter-Mountain Basins Juniper Savanna	S079 Inter-Mountain Basins Semi-Desert Shrub Steppe	S081 Rocky Mountain Dry Tundra	S083 Rocky Mountain Subalpine Mesic Meadow	S085 Southern Rocky Mountain Montane-Subalpine Grassland	S086 Western Great Plains Foothill and Piedmont Grassland	S088 Western Great Plains Shortgrass Prairie	S090 Inter-Mountain Basins Semi-Desert Grassland	S091 Rocky Mountain Subalpine-Montane Riparian Shrubland	S092 Rocky Mountain Subalpine-Montane Riparian Woodland	S093 Rocky Mountain Lower Montane Riparian Woodland and Sh	S095 Western Great Plains Riparian Woodland and Shrubland	S096 Inter-Mountain Basins Greasewood Flat	S100 North American Arid West Emergent Marsh	S102 Rocky Mountain Alpine-Montane Wet Meadow	S120 Western Great Plains Floodplain Herbaceous Wetland	S136 Southern Colorado Plateau Sand Shrubland	N11 Open Water	N21 Developed, Open Space - Low Intensity	N22 Developed, Medium - High Intensity	N31 Barren Lands, Non-specific	N80 Agriculture	D01 Disturbed, Non-specific	D02 Recently Burned	D03 Recently Mined or Quarried	D04 Invasive Southwest Riparian Woodland and Shrubland	D06 Invasive Perennial Grassland	D07 Invasive Perennial Forbland	D08 Invasive Annual Grassland	D09 Invasive Annual and Biennial Forbland	D10 Recently Logged Areas	D11 Recently Chained Pinyon-Juniper Areas	D14 Disturbed, Oil well
Black-throated sparrow			x		-	-				-	-		x		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brewer's sparrow	x	x	x	-	-	-	-	-	x	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green-tailed towhee	x	x	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kit fox (historic)		x	x	-	-	-			x	-	-	-		x	-	-		x	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Lark sparrow	x	x	x	-	-	-	x	x	x	-	-	-	-	x	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Merriam's shrew	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-
Northern harrier		-	x	-	-	-	x	x	x	-	-	x		x	x	-		x	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-
Sage sparrow		-	x	-	-	-	-		-	-	-	-		x	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sage thrasher	-		x	-	-	-	-	-	x	-	-	-	-	x	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sagebrush vole		x	x		-	-	-	-	-	-	-	-	-	x	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vesper sparrow	x	x	x	-	x	x	x	x	x	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6-2. Rules for modeling habitat for the species of concern in the assessment area.

Species	Range clip	SW ReGAP sagebrush coverages	SW ReGAP non-sagebrush coverages	Upper elevation limit (meters)
Black-throated sparrow	current	all	see "Notes"	2,000
Brewer's sparrow	current	all	see "Notes"	None
Green-tailed towhee	current	all	see "Notes"	None
Kit fox	historic	all	see "Notes"	1,981
Lark sparrow	current	all	see "Notes"	2,800
Merriam's shrew	current	all	see "Notes"	2,920
Northern harrier	current	S054, S056, S128	see "Notes"	3,100
Sage sparrow	current	all	see "Notes"	2,500
Sage thrasher	current	all	see "Notes"	3,250
Sagebrush vole	current	all	see "Notes"	2,850
Vesper sparrow	current	all	see "Notes"	None

Notes:

1. SW ReGAP non-sagebrush coverages mapped for each species are shown in Table 6-1 as "suitable habitat."

2. SW ReGAP sagebrush type codes defined in Table 6-1.

3. Sources for elevations: Andrews & Righter (1994), Righter et al. (2004), Fitzgerald et al. (1994), and SW ReGAP Analysis Habitat Notes.

Table 6-3. Estimated amounts and percentages of sagebrush and non-sagebrush habitat available for each species of concern within its range in the assessment area.

	Range Area	Habitat Area	Sagebrush Habitat			Non-Sagebrush Habitat			Non-Habitat Cover Types	
Species	(Million ha)	(Million ha)	(Million ha)	% of range	% of habitat	(Million ha)	% of range	% of habitat	(Million ha)	% of range
Black-throated sparrow	0.83	0.38	0.11	14	30	0.27	32	70	0.45	54
Brewer's sparrow	13.79	3.17	2.19	16	69	0.97	7	31	10.62	77
Green-tailed towhee	14.81	4.41	2.20	15	50	2.22	15	50	10.40	70
Kit fox (historic)	1.71	0.56	0.12	7	20	0.45	26	80	1.15	67
Lark sparrow	8.85	3.44	1.68	19	49	1.77	20	51	5.41	61
Merriam's shrew	15.68	6.21	2.17	14	35	4.04	26	65	9.47	60
Northern harrier	9.52	4.10	1.33	14	32	2.77	29	68	5.42	57
Sage sparrow	3.05	1.32	0.97	32	74	0.35	11	26	1.73	57
Sage thrasher	5.57	2.36	1.66	30	70	0.70	12	30	3.22	58
Sagebrush vole	2.67	1.36	1.23	46	90	0.13	5	10	1.31	49
Vesper sparrow	15.48	5.42	2.20	14	41	3.22	21	59	10.06	65

ha = hectares

Table 6-4. Estimated amounts and percentages of sagebrush habitat by land owner for each species of concern.

	Private		BLM		USFS		Other Federal		State Land Board		Other State		Total Sagebrush
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha (millions)
Black-throated sparrow	17,751	16	82,752	73	42	<1	10,432	9	1,636	1	1	<1	0.11
Brewer's sparrow	974,831	44	889,855	41	155,944	7	49,791	2	99,189	5	23,888	1	2.19
Green-tailed towhee	974,855	44	890,411	41	156,753	7	52,496	2	98,998	5	23,910	1	2.20
Kit fox (historic)	40,379	35	60,703	53	103	<1	12,108	11	330	<1	1,582	1	0.12
Lark sparrow	700,793	42	784,577	47	37,286	2	48,304	3	87,470	5	16,506	1	1.67
Merriam's shrew	968,866	45	883,797	41	141,456	7	52,657	2	98,873	5	23,748	1	2.17
Northern harrier	543,867	41	671,330	50	6,452	<1	41,680	3	58,866	4	10,332	<1	1.33
Sage sparrow	379,476	39	510,511	52	2,603	<1	20,126	2	53,358	5	6,472	<1	0.97
Sage thrasher	697,542	42	766,042	46	52,201	3	40,986	2	89,154	5	15,688	1	1.66
Sagebrush vole	525,025	43	565,222	46	18,596	2	19,392	2	91,111	7	11,142	1	1.23
Vesper sparrow	975,788	44	890,455	41	156,769	7	51,567	2	99,233	5	23,912	1	2.20

Notes:

ha = hectares

BLM = U. S. Bureau of Land Management

USFS = U. S. Forest Service

"Other Federal" includes National Park Service, Bureau of Indian Affairs, U. S. Department of Energy, U. S. Department of Defense, and other federal lands.

"Other State" includes state wildlife areas, parks, and other State of Colorado lands.

County lands are included under "Private."

The discrepancy between total area of sagebrush for lark sparrow shown on this table and other tables in this chapter is due to small spatial errors introduced in GIS by comparing raster (sagebrush) data with vector (land ownership) data.

Table 6-5. Estimated amounts and percentages of sagebrush habitat in each species range at risk from pinyon-juniper encroachment, invasive herbaceous vegetation encroachment, residential development, and energy development.

	Sagebrush habitat (million ha)	Level of risk	Pinyon-juniper encroachment		Invasive herbaceous vegetation encroachment		Residential development		Energy development		Combined threats	
			Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%
Black-throated sparrow	0.11	None	6,358	6	126	<1	104,798	93	4,851	4	32	<1
		Low	42,084	37	4,304	4	6,298	6	4,603	4	236	<1
		Moderate	36,524	32	30,648	27	700	<1	85,793	76	20,362	18
		High	27,680	25	77,568	69	849	<1	17,398	15	92,016	82
Brewer's sparrow	2.19	None	1,224,527	56	7,228	<1	1,792,340	82	363,445	17	1,324	<1
		Low	325,182	15	1,277,377	58	317,446	14	403,632	18	410,108	19
		Moderate	250,195	11	398,698	18	49,986	2	1,262,505	58	938,894	43
		High	393,794	18	510,395	23	33,926	2	164,116	7	843,372	38
Green-tailed towhee	2.20	None	1,225,004	56	7,244	<1	1,796,068	82	364,500	17	1,302	<1
		Low	324,942	15	1,278,903	58	317,273	14	404,365	18	410,917	19
		Moderate	253,555	12	400,766	18	50,216	2	1,263,852	58	940,803	43
		High	394,119	18	510,707	23	34,065	2	164,904	8	844,599	38
Kit fox (historic)	0.12	None	1,405	1	83	<1	90,988	79	4,050	4	2	<1
		Low	12,183	11	10,937	9	14,861	13	2,987	3	407	<1
		Moderate	46,407	40	32,461	28	5,294	5	80,062	69	15,642	14
		High	55,229	48	71,742	62	4,079	4	28,124	24	99,172	86
Lark sparrow	1.68	None	867,275	52	1,038	<1	1,388,111	83	264,823	16	139	<1
		Low	252,878	15	853,880	51	232,066	14	278,615	17	261,188	16
		Moderate	190,866	11	389,205	23	34,507	2	998,368	60	711,651	42
		High	364,031	22	430,926	26	20,364	1	133,243	8	702,072	42
Merriam's shrew	2.17	None	1,198,268	55	4,128	<1	1,770,519	82	345,854	16	997	<1
		Low	323,825	15	1,253,998	58	315,715	15	396,361	18	387,334	18
		Moderate	253,296	12	400,851	18	49,778	2	1,262,482	58	937,649	43
		High	394,124	18	510,536	24	33,500	2	164,815	8	843,532	39
Northern harrier	1.33	None	628,691	47	601	<1	1,112,165	83	124,955	9	44	<1
		Low	225,560	17	558,411	42	173,244	13	136,050	10	87,545	7
		Moderate	119,724	9	373,748	28	30,516	2	935,573	70	585,678	44
		High	358,619	27	399,834	30	16,670	1	136,016	10	659,329	49

Table 6-5. Estimated amounts and percentages of sagebrush habitat in each species range at risk from pinyon-juniper encroachment, invasive herbaceous vegetation encroachment, residential development, and energy development.

	Sagebrush habitat (million ha)	Level of risk	Pinyon-juniper encroachment		Invasive herbaceous vegetation encroachment		Residential development		Energy development		Combined threats	
			Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%	Sagebrush at risk (ha)	%
Sage sparrow	0.97	None	544,783	56	216	<1	848,447	87	61,492	6	19	<1
		Low	118,755	12	376,179	39	100,737	10	70,354	7	30,667	3
		Moderate	98,570	10	291,940	30	15,553	2	755,974	78	481,501	50
		High	210,467	22	304,240	31	7,836	<1	84,755	9	460,387	47
Sage thrasher	1.66	None	993,535	60	1,164	<1	1,413,958	85	283,585	17	119	<1
		Low	227,442	14	901,686	54	204,773	12	304,148	18	304,068	18
		Moderate	167,703	10	353,063	21	27,817	2	964,471	58	741,712	45
		High	272,972	16	405,739	24	15,104	1	109,449	7	615,754	37
Sagebrush vole	1.23	None	807,205	66	269	<1	1,071,179	87	84,225	7	65	<1
		Low	143,234	12	682,166	55	142,952	12	156,705	13	102,794	8
		Moderate	43,670	4	223,041	18	11,685	1	896,065	73	622,932	51
		High	236,386	19	325,020	26	4,679	<1	93,500	8	504,705	41
Vesper sparrow	2.20	None	1,225,848	56	7,327	<1	1,795,748	82	364,492	17	1,327	<1
		Low	325,532	15	1,279,012	58	317,770	14	403,928	18	410,926	19
		Moderate	252,314	11	400,595	18	50,298	2	1,265,178	58	940,998	43
		High	394,236	18	510,995	23	34,113	2	164,332	7	844,678	38

ha = hectares