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Biophysical Assessment for Indemnity Selection of Federal Lands in Colorado

Open-File Report 2018–1167

U.S. Department of the Interior
U.S. Geological Survey

Cover. Swainson's hawk, listed by the U.S. Fish and Wildlife Service as a Bird of Conservation Concern in the Northern Rockies. The species had potential habitat on all indemnity units. Photograph by Michael B. Smith (Creative Commons Attribution 2.0 Generic).

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
meter (m)	1.094	yard (yd)
	Area	
hectare (ha)	2.471	acre
square kilometer (km^2)	247.1	acre
hectare (ha)	0.003861	square mile (mi^2)
square kilometer (km^2)	0.3861	square mile (mi^2)

Scientific Notation

Symbol	Meaning
<	Less than
≤	Less than or equal to
=	Equals
>	Greater than
≥	Greater than or equal to

Abbreviations

BCR	Bird Conservation Region
BLM	Bureau of Land Management
EA	Environmental Assessment
EMU	Ecological Management Unit
FWS	U.S. Fish and Wildlife Service
GIS	geographic information system
IU	indemnity unit
LAU	Lynx Analysis Unit
TDI	terrestrial development index

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Executive Summary

Information on the biophysical features of Federal lands identified as suitable for transfer to the State of Colorado was requested by the Bureau of Land Management (BLM). This information is intended for use in conducting an Environmental Assessment prior to the transfer of ownership (conveyance) to the State. The Enabling Act of 1864 (13 Stat. 32) provided for the conveyance of Federal lands to the State for the support of schools. If designated lands were unavailable for transfer at the time of statehood, the act provided for the transfer of alternative Federal lands in compensation through a process referred to as "school-land indemnity selection." The Colorado State Land Board filed a selective application to obtain public land and mineral estate in lieu of lands to which the State of Colorado was entitled but did not receive at the time of statehood. To address this legal obligation, 339 parcels of Federal lands (organized into 89 indemnity units [IUs]), currently under management by the BLM, have been identified as suitable for transfer to the State. The IUs include 23,130 acres of surface and mineral estate and 6,150 acres of mineral estate only. The specific land parcels to be transferred to the State will be finalized after an Environmental Assessment and other evaluations are completed.

To provide the biophysical information necessary for conducting a future Environmental Assessment of the potential effects of the proposed land transfer, information on ecological communities, soil characteristics, and land use was summarized at three levels: (1) all of Colorado, (2) lands under the jurisdiction of the BLM, and (3) the 89 IUs. Information was also synthesized and summarized for 179 plant and animal species or subspecies of management concern to evaluate which species had the potential for occurrence on IUs. The following questions were developed to guide the compilation and synthesis of data.

1. What land cover classes and ecological communities occur within indemnity units?
2. Which indemnity units have soils with potential for high salinity?
3. Which indemnity units have soils with potential for selenium?
4. What are the current and anticipated future land uses of each indemnity unit?
5. What are the broad-scale effects of development (agriculture, energy, minerals, and roads) on indemnity units?
6. What species of management concern could potentially occur within indemnity units?

Ecological communities, soils, and land uses were summarized for each indemnity unit. The two most abundant land cover classes on indemnity units are (a) shrublands and steppe and (b) grasslands, but mountain forests are also common on many IUs. Only two of the IUs have the potential for moderate salinity, and two additional IUs have potential for elevated selenium. Some land uses would be retained if ownership is transferred to the State, including existing rights of way, oil and gas leases, and active mining claims. In addition, grazing, recreation, and hunting are planned for some of the IUs. The IUs adjacent to State Wildlife Areas would consolidate management of wildlife habitats, and the transfer of mineral-only estates would consolidate existing split estates on some State lands. The intensity of development within and surrounding IUs was slightly higher compared to BLM lands but was similar to Colorado overall.

The potential occurrence or potential habitat on indemnity units were evaluated for a total of 179 species (or subspecies) of management concern in Colorado. A species of management concern can include federally threatened or endangered, BLM Colorado sensitive species, U.S. Fish and Wildlife Service Birds of Conservation Concern, or Colorado Parks and Wildlife big game. Of the 179 species evaluated, 72 species had documented occurrences and (or) potential habitat within at least one IU—1 insect, 3 amphibian, 2 reptile, 43 bird, 18 mammal, and 5 plant species. Of these 72 species, 6 are federally threatened or endangered (interior least tern, *Sternula antillarum athalassos*; black-footed ferret, *Mustela nigripes*; Gunnison sage-grouse, *Centrocercus minimus*; Mexican spotted owl, *Strix occidentalis lucida*; piping plover, *Charadrius melodus*; and Canada lynx, *Lynx canadensis*), 35 are BLM Colorado sensitive species, 24 (not also listed as federally endangered or BLM Colorado sensitive species) are U.S. Fish and Wildlife Service Birds of Conservation Concern, and 7 (not also listed as BLM Colorado sensitive) are Colorado Parks and Wildlife big game species.

Introduction

The Land Ordinance of 1785 was established for the sale and settlement of Federal lands and the funding of education. It was also the basis for the Public Land Survey System, also known as the Rectangular Survey System (White, 1983). The survey system is based on townships with an area of 36 square miles (mi^2) (93.2 square kilometers [km^2]) that are subdivided into 36 sections measuring 1 mi^2 (2.59 km^2) each (White, 1983). In 1787, the Northwest Ordinance established the process for the transition of territories into statehood, which included the transfer of section 16 in each township to the States to provide financial support to public education (Culp and others, 2005). Subsequently, the transfer of Federal land to the States was variously modified. In Colorado, the Enabling Act of 1864 (13 Stat. 32) endowed sections 16 and 36 in every township "for the support of common schools," with a provision granting equivalent lands if the stipulated sections were already occupied by homesteaders, railroad grantees, or various Federal reservations (Culp and others, 2005). Federal lands granted to the States are referred to as "State trust lands."

Colorado currently owns 2.8 million surface acres of State trust lands and an additional 4 million acres of mineral estate (Colorado State Land Board, 2017). The Colorado State Board of Land Commissioners (also known as the State Land Board) manages State trust lands to produce reasonable and consistent income, as well as to provide sound stewardship of the State trust assets for the benefit of public schools and institutions. The State trust lands are leased for a variety of activities including recreation, grazing, agriculture, commercial uses, mining, renewable and nonrenewable energy development, and to benefit wildlife habitat. In 2016, the State trust lands' assets generated $159.3 million in revenues and interest income for Colorado public schools and institutions (Colorado State Land Board, 2017).

The Colorado State Land Board filed a selective application to obtain public land and mineral estate in lieu of lands to which the State of Colorado was entitled but did not receive under the Enabling Act (Bureau of Land Management, 2015b). The designated lands were unavailable for transfer at the time of statehood because they previously had been designated as Indian reservation, forest reserve, or national forest lands or were otherwise encumbered (Bureau of Land Management, 2015b). The process that allows this transfer is known as "school-land indemnity selection"—States can select in-lieu lands as compensation for school lands that were not secured at the time of statehood (Bureau of Land Management, 1980). Under Section 7 of the Taylor Grazing Act of 1934 (Public Law 73–482, 48 Stat. 1269), the Bureau of Land Management (BLM) may classify those public lands and (or) minerals in Colorado that are suitable for transfer to the State in lieu of lands not previously transferred (Bureau of Land Management, 2015b).

To address this legal obligation, the BLM has classified the lands and minerals prior to transfer as required by the Taylor Grazing Act. A total of 339 parcels (organized into 89 indemnity units [IUs]) currently under management by the BLM have been identified as suitable for transfer to the State. The IUs include 23,130 acres of surface and mineral estate (76 IUs) and 6,150 acres of mineral estate only (13 IUs). The 89 IUs are located in six BLM field offices (Colorado River Valley, Kremmling, Little Snake, Royal Gorge, Tres Rios, and Uncompahgre) (tables 1 and 1−1; fig. 1). The list of parcels to be transferred will be finalized subsequent to an Environmental Assessment (EA) of potential effects of the proposed land transfer, as required by the National Environmental Policy Act (Public Law 91–190, 83 Stat. 852). This assessment includes identifying the environmental baseline necessary for species consultation required by the Endangered Species Act (Public Law 93–205, 87 Stat. 884).

Table 1. Attributes of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado, by BLM field office.

[GIS, geographic information system]

County	Indemnity unit code[1]	Area name[2]	Legal area[3] (acres)	GIS area (acres)
		Colorado River Valley (CR)		
Eagle (EAGL)	CR_EAGL_SM_007	Wolcott	130.95	131.11
	CR_EAGL_SM_008	Wolcott	169.49	167.15
Garfield (GARF)	CR_GARF_SM_001	Rifle	160.00	160.41
	CR_GARF_SM_002	Rifle	80.00	79.44
	CR_GARF_SM_003	Carbondale	161.18	162.33
	CR_GARF_SM_004	Carbondale	267.10	283.36
	CR_GARF_SM_005	Carbondale	180.11	175.70
	CR_GARF_SM_006	Carbondale	37.52	36.38
		Kremmling (KR)		
Grand (GRAN)	KR_GRAN_SM_012	Carter Mountain	120.00	119.75
	KR_GRAN_SM_013	Milk Creek	24.59	24.44
	KR_GRAN_SM_014	Trail Mountain	120.00	120.40
	KR_GRAN_SM_015	Granby	436.53	433.83
Jackson (JACK)	KR_JACK_SM_009	Rabbit Ears	80.11	81.23
	KR_JACK_SM_010	Rabbit Ears	120.00	125.58
	KR_JACK_MO_011	MacFarlane Reservoir	2,123.36	2,121.72
		Little Snake (LS)		
Moffat (MOFF)	LS_MOFF_SM_016	Big Gulch	640.00	640.88
Routt (ROUT)	LS_ROUT_SM_017	Jimmy Dunn Gulch	159.21	159.01
	LS_ROUT_SM_018	Jimmy Dunn Gulch	40.00	40.03
	LS_ROUT_MO_019	Jimmy Dunn Gulch	1,583.63	1,680.38
	LS_ROUT_MO_020	Sage Creek	320.00	320.39
	LS_ROUT_SM_021	Moon Hill	7.51	7.48
	LS_ROUT_SM_022	Fly Gulch	80.00	79.95
	LS_ROUT_SM_023	Twenty Mile	40.00	41.03
	LS_ROUT_SM_024	Steamboat Base	40.00	42.03
		Royal Gorge (RG)		
Bent (BENT)	RG_BENT_MO_057	Karney	40.00	40.16
	RG_BENT_MO_058	Timberlake	120.00	120.86
Chaffee (CHAF)	RG_CHAF_MO_067	Mt. Princeton	160.00	160.16
	RG_CHAF_SM_068	Droney Gulch	40.00	39.59
Custer (CUST)	RG_CUST_SM_025	Westcliffe	460.08	646.84
	RG_CUST_SM_026	Westcliffe	329.36	497.82
	RG_CUST_SM_027	Westcliffe	60.66	58.91
	RG_CUST_SM_028	Westcliffe	80.00	77.43
	RG_CUST_SM_029	Westcliffe	40.00	40.96
	RG_CUST_SM_030	Westcliffe	240.00	248.71
	RG_CUST_SM_031	Westcliffe	117.94	116.63

Table 1. Attributes of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado, by BLM field office.—Continued

[GIS, geographic information system]

County	Indemnity unit code[1]	Area name[2]	Legal area[3] (acres)	GIS area (acres)
		Royal Gorge (RG)—Continued		
El Paso (ELPA)	RG_ELPA_SM_037	Chico inholdings	40.00	39.97
	RG_ELPA_SM_038	Chico inholdings	80.02	80.24
	RG_ELPA_SM_039	Chico inholdings	40.00	40.26
Huerfano (HUER)	RG_HUER_MO_032	Silver Mountain	800.00	805.26
	RG_HUER_SM_033	Veta Pass	80.00	80.45
	RG_HUER_SM_034	Veta Pass	467.48	470.19
	RG_HUER_SM_035	Veta Pass	40.00	39.91
	RG_HUER_SM_036	Veta Pass	12.70	12.67
Kiowa (KIOW)	RG_KIOW_MO_050	Rush Creek	40.00	39.80
	RG_KIOW_SM_051	Chivington	880.00	872.37
	RG_KIOW_SM_052	Neenoshee Reservoirs	960.77	955.56
	RG_KIOW_SM_053	Neenoshee Reservoirs	1,240.00	1,244.18
	RG_KIOW_SM_054	Neenoshee Reservoirs	760.00	762.25
	RG_KIOW_SM_055	Neenoshee Reservoirs	200.00	197.87
	RG_KIOW_SM_056	Neenoshee Reservoirs	2,040.00	2,022.64
Park (PARK)	RG_PARK_SM_059	Chase Gulch	480.00	522.94
	RG_PARK_SM_060	Hartsel	852.13	935.73
	RG_PARK_SM_061	Hartsel	240.00	242.57
	RG_PARK_SM_062	Antero	844.46	854.02
	RG_PARK_SM_063	Antero	151.57	153.64
	RG_PARK_SM_064	Antero Salt Creek	160.00	160.39
	RG_PARK_SM_065	Antero Salt Creek	80.00	80.36
	RG_PARK_SM_066	Antero Salt Creek	40.00	40.20
Pueblo (PUEB)	RG_PUEB_SM_040	Chico inholdings	40.00	39.52
	RG_PUEB_SM_041	Chico adjacent	306.84	305.66
	RG_PUEB_SM_042	Chico adjacent	302.71	301.51
	RG_PUEB_SM_043	Chico adjacent	640.00	633.71
	RG_PUEB_SM_044	Chico adjacent	945.80	940.38
	RG_PUEB_SM_045	Chico adjacent	1,760.82	1,755.85
	RG_PUEB_SM_046	Chico adjacent	1,600.00	1,597.34
	RG_PUEB_SM_047	Chico adjacent	1,283.97	1,284.01
	RG_PUEB_SM_048	Chico adjacent	122.99	123.53
	RG_PUEB_SM_049	Chico adjacent	40.00	40.03
Weld (WELD)	RG_WELD_MO_069	Sidney Draw	320.00	319.15
	RG_WELD_MO_070	Cottonwood Creek	160.00	160.15
	RG_WELD_MO_071	70 Ranch	160.00	160.13
	RG_WELD_MO_072	Lazy D	160.00	156.07
	RG_WELD_MO_073	Deerfield	160.00	157.56

Table 1. Attributes of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado, by BLM field office.—Continued

[GIS, geographic information system]

County	Indemnity unit code[1]	Area name[2]	Legal area[3] (acres)	GIS area (acres)
		Tres Rios (TR)		
Dolores (DOLO)	TR_DOLO_SM_074	TJ Bar	40.00	38.78
	TR_DOLO_SM_075	Lone Mesa	74.14	77.93
	TR_DOLO_SM_076	Lone Mesa	38.97	38.62
	TR_DOLO_SM_077	Lone Mesa	76.96	77.44
	TR_DOLO_SM_078	Lone Mesa	160.00	159.27
	TR_DOLO_SM_079	Lone Mesa	440.00	441.40
	TR_DOLO_SM_080	Lone Mesa	78.63	80.13
	TR_DOLO_SM_081	Lone Mesa	80.00	79.56
	TR_DOLO_SM_082	Lone Mesa	280.00	281.53
	TR_DOLO_SM_083	Lone Mesa	80.00	81.20
	TR_DOLO_SM_084	Lone Mesa	80.00	84.16
	TR_DOLO_SM_085	Lone Mesa	120.00	121.40
		Uncompahgre (UN)		
Ouray (OURA)	UN_OURA_SM_086	Ouray	120.00	126.99
	UN_OURA_SM_087	Ouray	96.59	113.85
	UN_OURA_SM_088	Ouray	80.00	81.69
San Miguel (SANM)	UN_SANM_SM_089	Miramonte	129.73	133.44

[1]Indemnity unit code combines 2 letters for field office, 4 for county name, and 2 for kind of estate (SM, surface and mineral; MO, mineral only) followed by a three-digit unique numeric identifier.

[2]Area name was provided by the Colorado State Land Board (C. Smith, Colorado State Land Board written commun., 2017).

[3]Legal descriptions of indemnity units are provided in table 1−1. The legal area associated with the legal descriptions can differ slightly from the area calculated by using GIS data. For all analyses in this report, we used the GIS-based area calculations.

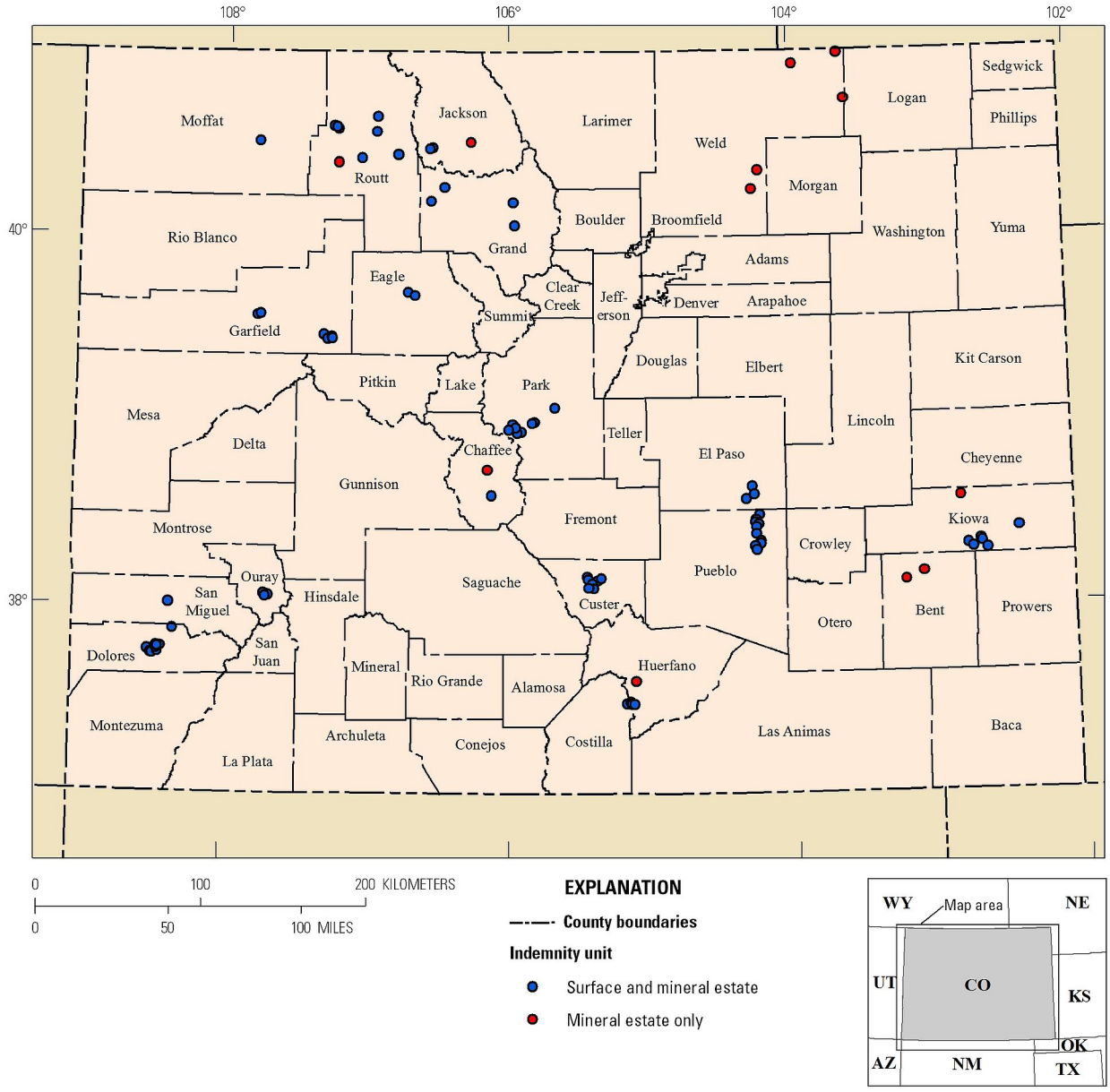

Figure 1. Location of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado. See table 1 for list of indemnity units by BLM field office and county.`

Approach

To compile information necessary for conducting a future Environmental Assessment of the potential effects of the land transfer, information on ecological communities, soil characteristics, and land use was synthesized and summarized at three levels: (1) all of Colorado, (2) lands under the jurisdiction of the BLM, and (3) the 89 IUs. Information was also synthesized and summarized for 179 plant and animal species or subspecies of management concern to evaluate which species had the potential for occurrence on IUs. The following questions were developed collaboratively by the BLM and the U.S. Geological Survey to guide the compilation and synthesis of data.

1. What land cover classes and ecological communities occur within indemnity units?
2. Which indemnity units have soils with potential for high salinity?
3. Which indemnity units have soils with potential for selenium?
4. What are the current land uses (identified by the BLM) and anticipated future land uses (identified by the Colorado Land Board) of each indemnity unit?
5. What are the broad-scale effects of development (agriculture, energy, minerals, and roads) for indemnity units?
6. What species of management concern (federally threatened or endangered, BLM Colorado sensitive species, U.S. Fish and Wildlife Service [FWS] Birds of Conservation Concern, and Colorado Parks and Wildlife big game) could potentially occur within indemnity units?

Report Organization

For each of the six management questions, we provide a brief narrative overview, summary tables, and maps. The methods and datasets used in this report are summarized in appendix 1. Additional methodological details and the summarized information used in this report are available online as U.S. Geological Survey data releases (Burris and others, 2018; Carr and others, 2018) (see table 1–2).

Synthesis and Summaries

What Land Cover Classes and Ecological Communities Occur Within Indemnity Units?

Ecoregions are ecologically defined areas representing a mosaic of biotic and abiotic components of terrestrial and aquatic ecosystems. The ecoregion classification system (Omernik, 1987) provides a spatially explicit framework that facilitates the assessment, monitoring, and management of terrestrial ecosystems across land management agencies and organizations within the same geographic areas (McMahon and others, 2001; Omernik and Griffith, 2014). Because ecoregions are useful for defining broad geographic areas within a State, the BLM uses Level-III ecoregions (Omernik, 1987) to conduct Rapid Ecoregional Assessments (Wood and others, 2017). The BLM has conducted Rapid Ecoregional Assessments covering five of the six Level-III ecoregions in Colorado (table 2); The Nature Conservancy used a different approach to assess the Southern Rockies ecoregion (Neeley and others, 2001). Ecological descriptions of the portions of each ecoregion that are located within Colorado have been summarized by Chapman and others (2006). Most of the IUs are in the Southern Rockies and Southwestern Tablelands ecoregions (table 2; fig. 2). None of the IUs are located in the Arizona/New Mexico Plateau ecoregion.

To classify ecological communities and land cover classes, we developed a vegetation classification system based on the Colorado State Wildlife Action Plan habitat types (Colorado Parks and Wildlife, 2015) and LANDFIRE (2016a) (table 1–3). The Colorado State Wildlife Action Plan habitat types are based on vegetation structural characteristics that are relevant to wildlife management (Colorado Parks and Wildlife, 2015). We mapped ecological communities and land cover classes for Colorado, using primarily LANDFIRE Existing Vegetation Types (LANDFIRE, 2016b) as described in appendix 1 and Carr and others (2018).

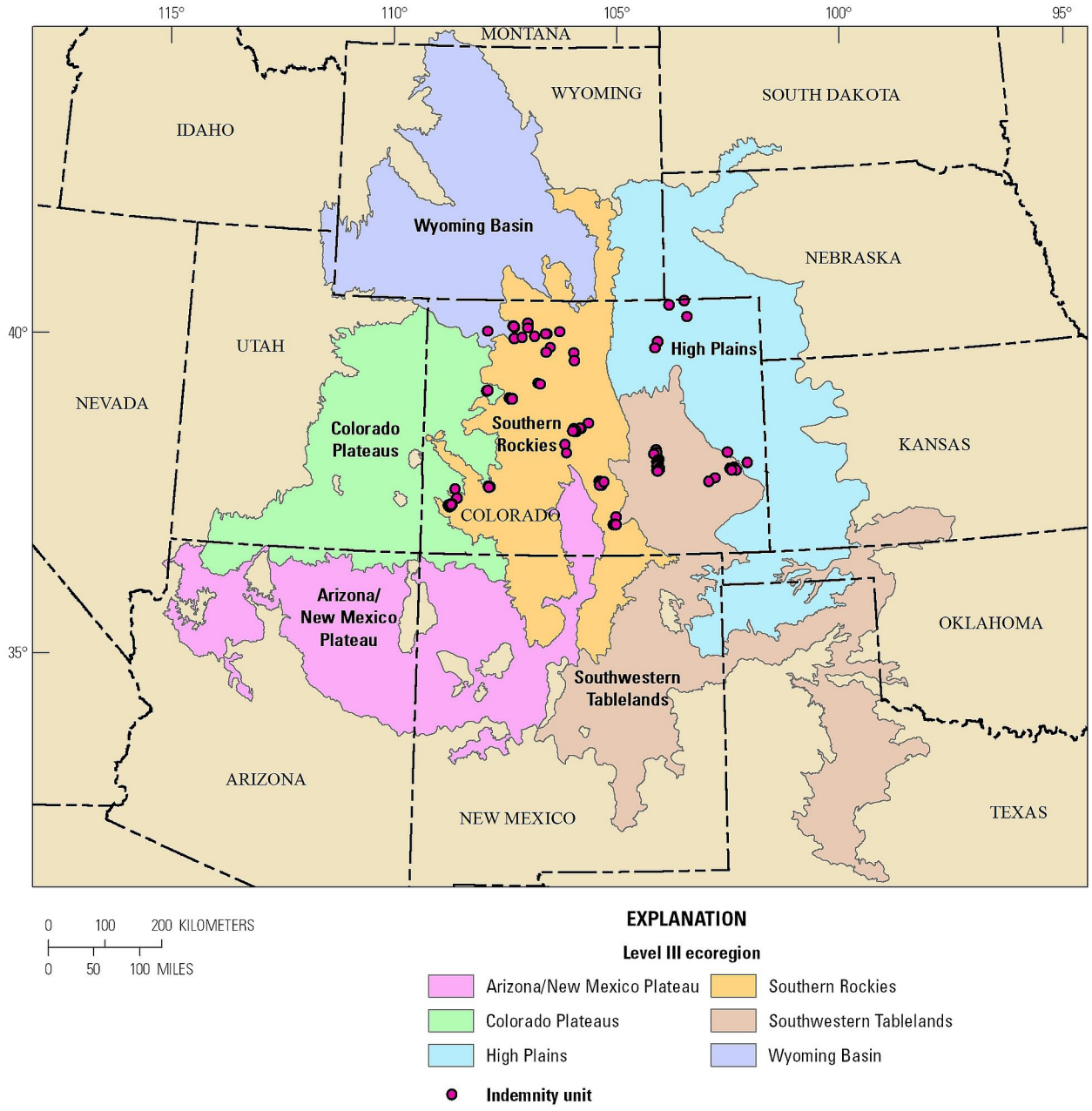

Figure 2. Level-III ecoregions (Omernik, 1987) in Colorado. Locations of indemnity units are shown.

Table 2. Summary of indemnity units by Level-III ecoregions (Omernik, 1987).

[BLM, Bureau of Land Management]

Level-III ecoregion	Percentage of total area		Indemnity units	
	Colorado	BLM lands	Number of indemnity units	Area in each ecoregion (acres)
Arizona/New Mexico Plateau[1]	3.2	3.6	0	0
Colorado Plateaus[2]	13.5	53.7	3	373
High Plains[3]	23.8	0.0	7	1,865
Southern Rockies[4]	38.1	29.7	57	14,482
Southwestern Tablelands[3]	18.2	0.6	20	12,526
Wyoming Basin[5]	3.2	12.4	2	682

[1]San Luis Valley–Taos Plateau Landscape Assessment (Watson and others, 2016).

[2]Colorado Plateau Rapid Ecoregional Assessment (Bryce and others, 2012).

[3]Southern Great Plains Rapid Ecoregional Assessment (Reese and others, 2017).

[4]Southern Rocky Mountains Ecoregional Assessment (Neeley and others, 2001).

[5]Wyoming Basin Rapid Ecoregional Assessment (Carr and Melcher, 2017).

Land Cover Classes and Ecological Communities

Ecological communities are dynamic assemblages of plant communities that are characterized by a suite of underlying abiotic gradients and ecological processes. The communities are typically dominated by a few species and form units that are readily identifiable from remotely sensed imagery and on the ground. To provide a broader ecological context, we classified ecological communities that share many coarse-level physiological characteristics into six natural land cover classes (table 3; figs. 3 to 10).

Aquatic Communities

Aquatic communities include open water (lakes and reservoirs), streams, playa and nonplaya wetlands, and riparian woodlands and forests (fig. 5). Aquatic communities, excluding streams, cover approximately 17 percent of the total area of IUs, including reservoirs that intersect five IUs in the Royal Gorge Field Office (table 3; figs. 4 and 5) (Burris and others, 2018). Because streams are mapped as linear features, their total area was not calculated and they are not included in tables and figures.

Lakes are created by natural processes, whereas reservoirs are artificial impoundments developed to control flooding, enhance water storage, and create hydraulic head for electric power generation. Reservoirs tend to be shallower and to have higher levels of suspended solids and greater nutrient loading than natural lakes (Havel and others, 2005; Johnson and others, 2008). Shoreline vegetation along reservoirs associated with hydropower dams is often poorly developed because of significant fluctuations in water levels.

Streams are flowing waters that vary widely in geomorphology, streamflow pattern, and biota (Poff and Ward, 1989; Dodds and others, 2004; Costigan and Daniels, 2012). Streamflow dynamics are influenced by snowmelt in western regions and by convective storms in eastern regions. Climatic dynamics result in high variation in and low predictability of streamflow (Poff and Ward, 1989).

Wetlands and riparian communities form transition zones between aquatic and terrestrial ecosystems and are shaped by processes affecting both ecosystems (Culver, 2014). Wetlands include playa wetlands, shallow ponds, marshes, and wet meadows. They occur where the water table is at or near the land surface and may be inundated permanently or intermittently (Haukos and Smith, 2003; Culver, 2014). Wetlands may be dominated by herbaceous wetland obligate or facultative species, depending on the timing and duration of inundation. Riparian areas are strongly influenced by fluvial dynamics including periodic flooding and desiccation, and many riparian plants are adapted to rapidly resprout or recolonize recently disturbed areas (Naiman and Decamps, 1997). Woody riparian species include cottonwood (*Populus* spp.) and willow (*Salix* spp.). Riparian and wetland communities may also be influenced by disturbance from fire, wind, and herbivory (Gregory and others, 1991; Naiman and Decamps, 1997; Mitsch and Gosselink, 2000).

Table 3. Percentage of total area of ecological communities by land cover class, summarized for Colorado (statewide), Bureau of Land Management (BLM) lands in Colorado, and indemnity units. Total area excludes altered vegetation.

[Ecological communities adapted from habitat types in Colorado Parks and Wildlife (2015). For additional details on methods, see appendix 1 and Carr and others (2018)]

Ecological community	Percentage of total area[1]		
	Colorado (52,773,771 acres)	BLM lands (8,114,067 acres)	All Indemnity Units (28,949 acres)
Aquatic communities			
Open water	0.69	0.38	17.01
Wetlands	0.73	0.33	0.05
Riparian woodlands and shrublands	1.25	0.97	0.30
Total	2.67	1.68	17.36
Grasslands			
Shortgrass prairie	23.55	0.46	19.93
Mixed-grass and tallgrass prairies	0.56	0.00	0.06
Foothill and mountain grasslands	2.61	0.71	0.65
Total	26.72	1.17	20.64
Shrublands and steppe			
Sandsage	4.00	0.41	11.34
Sagebrush steppe	10.99	27.12	26.12
Desert grasslands and shrublands	2.57	7.58	0.88
Greasewood	1.14	1.64	0.18
Saltbush	0.45	2.35	0.01
Cool interior chaparral	0.01	0.03	0.00
Mixed mountain shrublands	6.89	8.34	8.94
Total	26.05	47.47	47.47
Savanna and woodlands			
Juniper woodlands and savanna	0.05	0.13	0.00
Pinyon-juniper woodlands and shrublands	9.73	31.85	2.92
Limber-juniper woodlands	0.05	0.19	0.01
Total	9.83	32.17	2.93
Mountain forests and alpine zone			
Ponderosa pine savanna and woodlands	3.94	1.83	1.23
Mixed-conifer forests	4.72	4.36	4.52
Aspen woodlands and forests	9.66	4.39	4.63
Lodgepole pine forests	3.18	1.01	0.26
Spruce fir forests	8.87	1.77	0.03
Subalpine five-needle pine woodlands and forests	0.10	0.07	0.01
Alpine zone	3.00	0.98	0.06
Total	33.47	14.41	10.72
Sparsely vegetated communities			
Barren and sparsely vegetated	0.82	2.09	0.83
Cliffs and canyons	0.39	1.01	0.03
Dunes	0.05	0.00	0.00
Total	1.26	3.10	0.86

[1]Streams were mapped as linear features (Carr and others, 2018), so total area was not calculated and is not presented here.

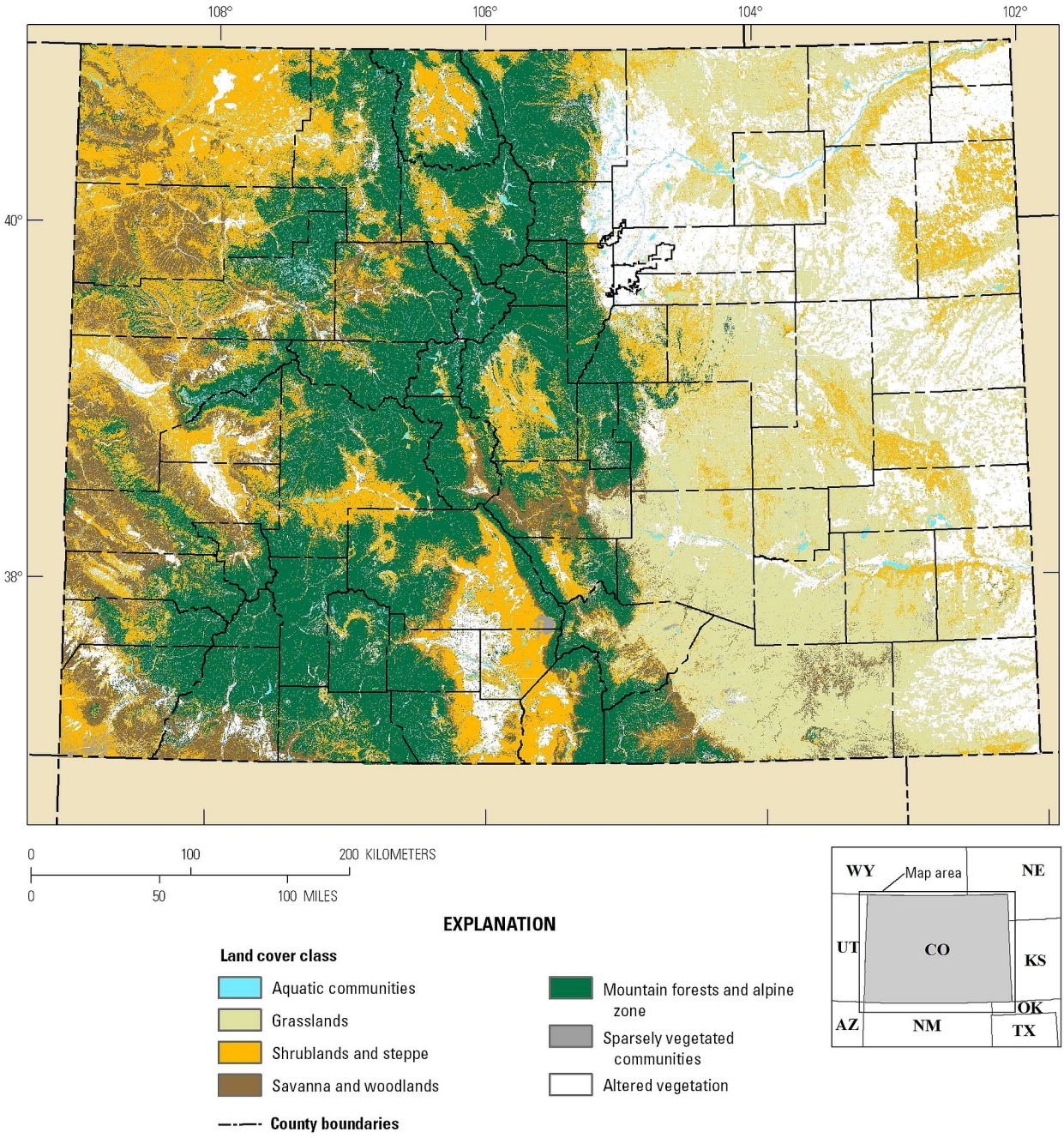

Figure 3. Land cover classes in Colorado.

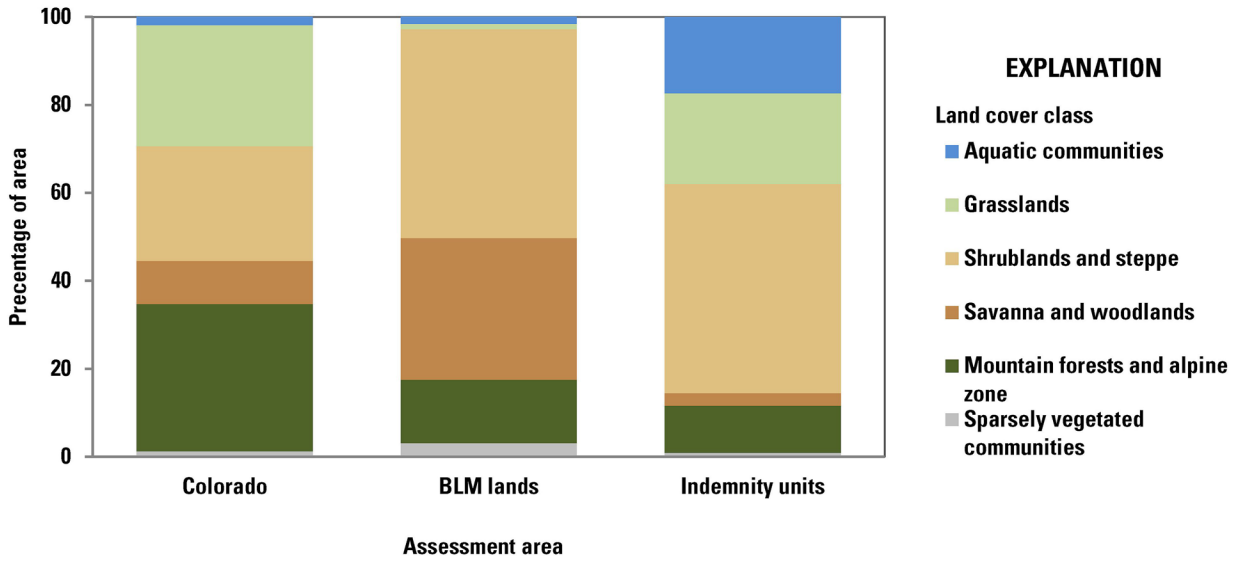

Figure 4. Land cover classes summarized for Colorado (statewide), Bureau of Land Management (BLM) lands in Colorado, and indemnity units.

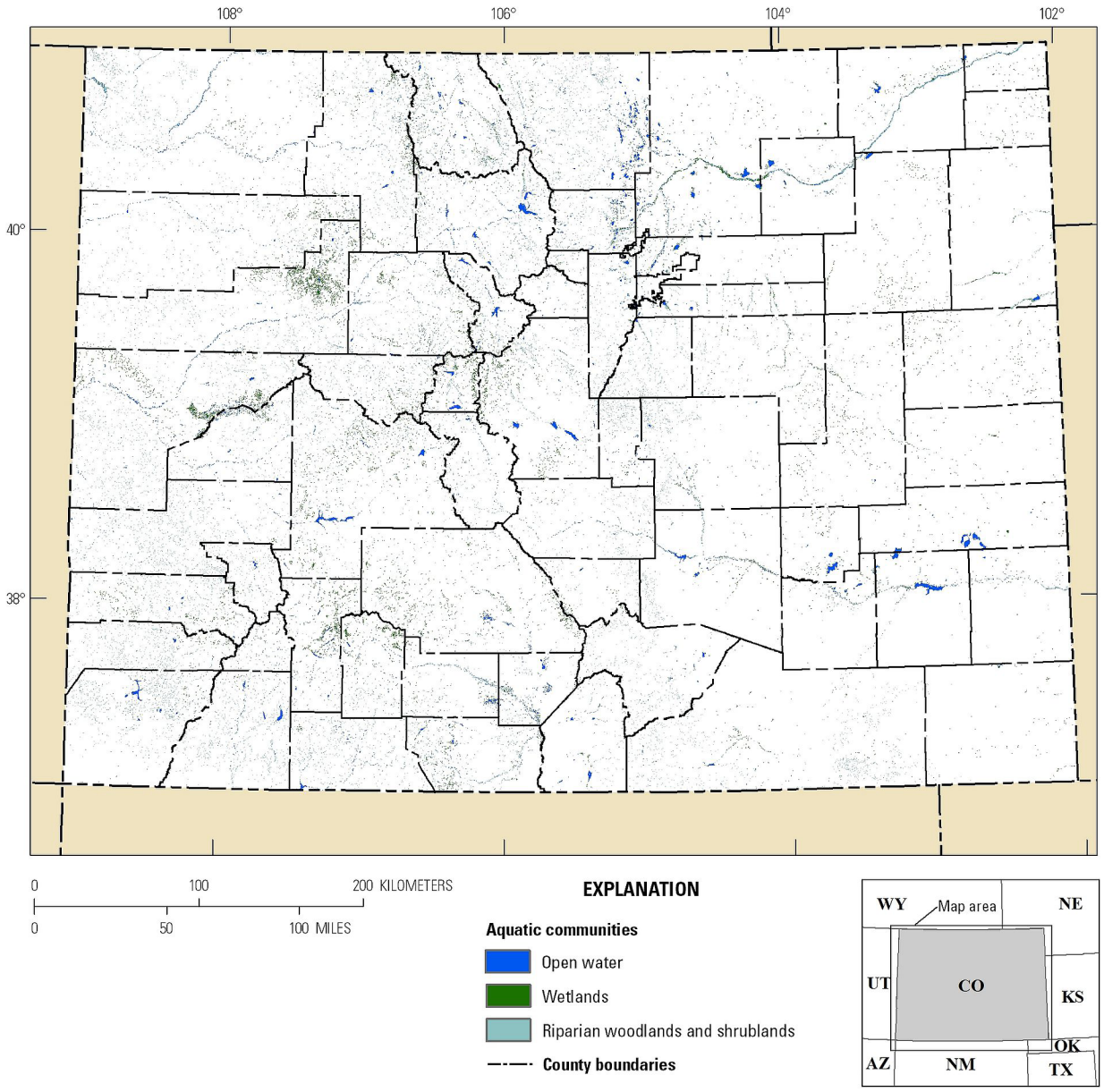

Figure 5. Aquatic communities in Colorado. Streams are mapped as linear features and are not displayed.

Grasslands

Grassland communities include shortgrass prairie, mixed-grass and tall grass prairies, and foothill and mountain grasslands (fig. 6). Grasslands, primarily shortgrass prairie, cover approximately 21 percent of the total area of IUs (table 3; fig. 4). Prairies are dominant on the eastern plains of Colorado, but they have been greatly altered and fragmented by conversion to cropland, fire exclusion, loss of native herbivores, altered grazing regimes, energy development, and spread of invasive species (Conner and others, 2001). In general, the distribution and structure of grasslands have been shaped primarily by relatively high average summer temperatures, persistent wind, and highly variable moisture regimes (Sims, 1988). These conditions often create annual summer droughts that favor perennial warm-season grasses and forbs over woody vegetation (Sims, 1988). Historically, fire, drought, herbivory, and other activities of animals also affected grassland community structure (Knight and others, 2014). Other important influences on landscape structure and dynamics of grasslands include heterogeneity in soil type and topography (Weaver and others, 1996; Knight and others, 2014).

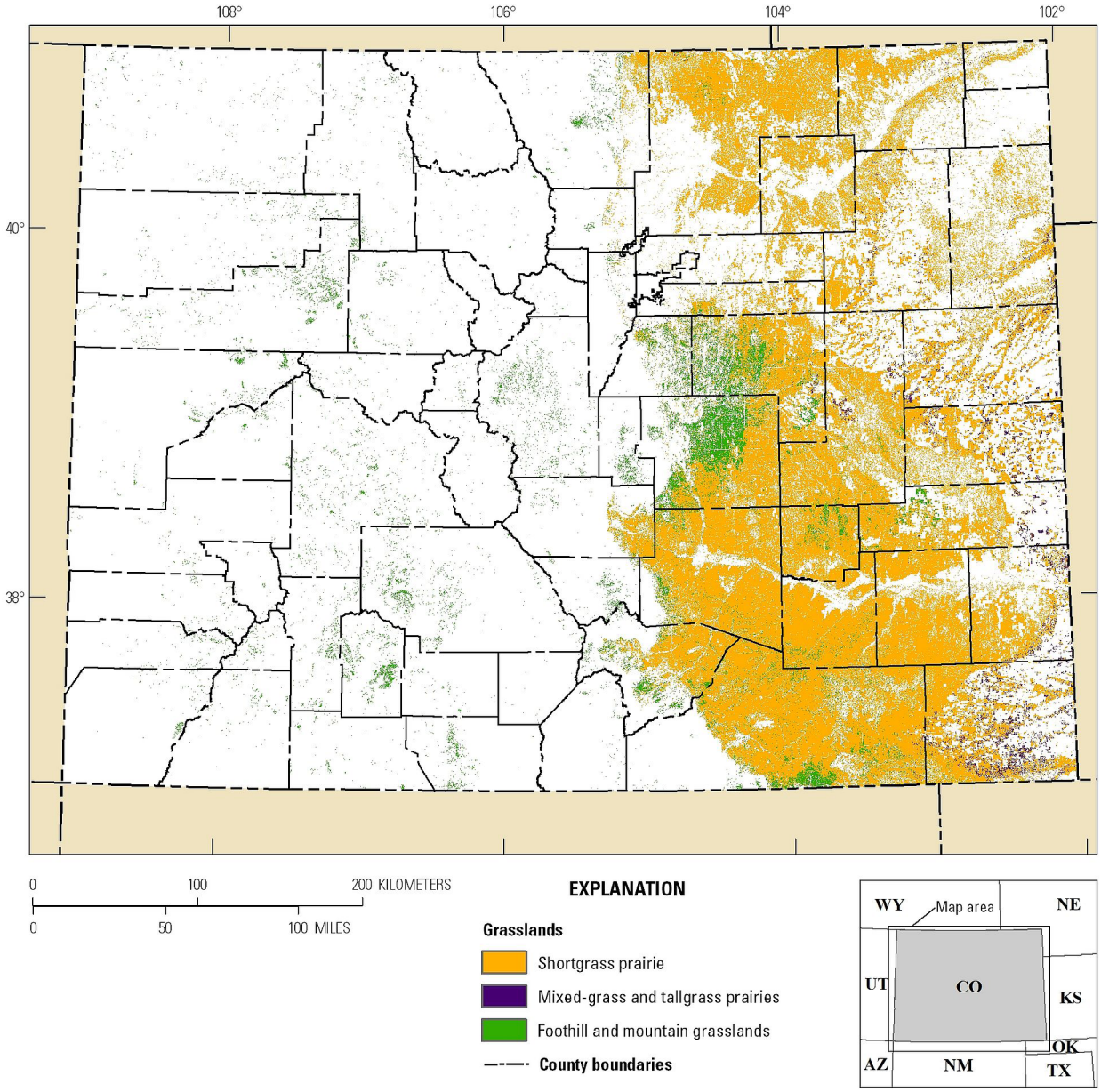

Figure 6. Grasslands in Colorado.

The codominant plants of shortgrass prairie are blue grama (*Bouteloua gracilis*) and buffalograss (*B. dactyloides*), which characterize this community's short vertical structure (Bragg and Steuter, 1996). Mixed-grass prairie includes both shorter species (such as sideoats grama [*Bouteloua curtipendula*], blue grama, and buffalo grass) and taller species characteristic of tallgrass prairie (such as little bluestem [*Schizachyrium scoparium*]) (Bragg and Steuter, 1996). Foothill grasslands, which often include taller grass species, occur along the lower slopes of the Front Range foothills and among the mesas and escarpments of the Southwestern Tablelands (Bragg and Steuter, 1996). Mountain grasslands can be interspersed with trees in savannas, open woodlands, or forest openings (Knight and others, 2014).

Shrublands and Steppe

Shrublands and steppe communities include sandsage (dominated by sand sagebrush [*Artemisia filifolia*]), sagebrush steppe, desert grasslands and shrublands, greasewood (*Sarcobatus vermiculatus*), saltbush (*Atriplex* spp.), cool interior chaparral, and mixed mountain shrublands (fig. 7). Shrublands and steppe—primarily sagebrush steppe, sandsage, and mixed mountain shrublands—cover approximately 47 percent of the total area of IUs (table 3; fig. 4); cool interior chaparral is uncommon in Colorado and is not present in any IUs.

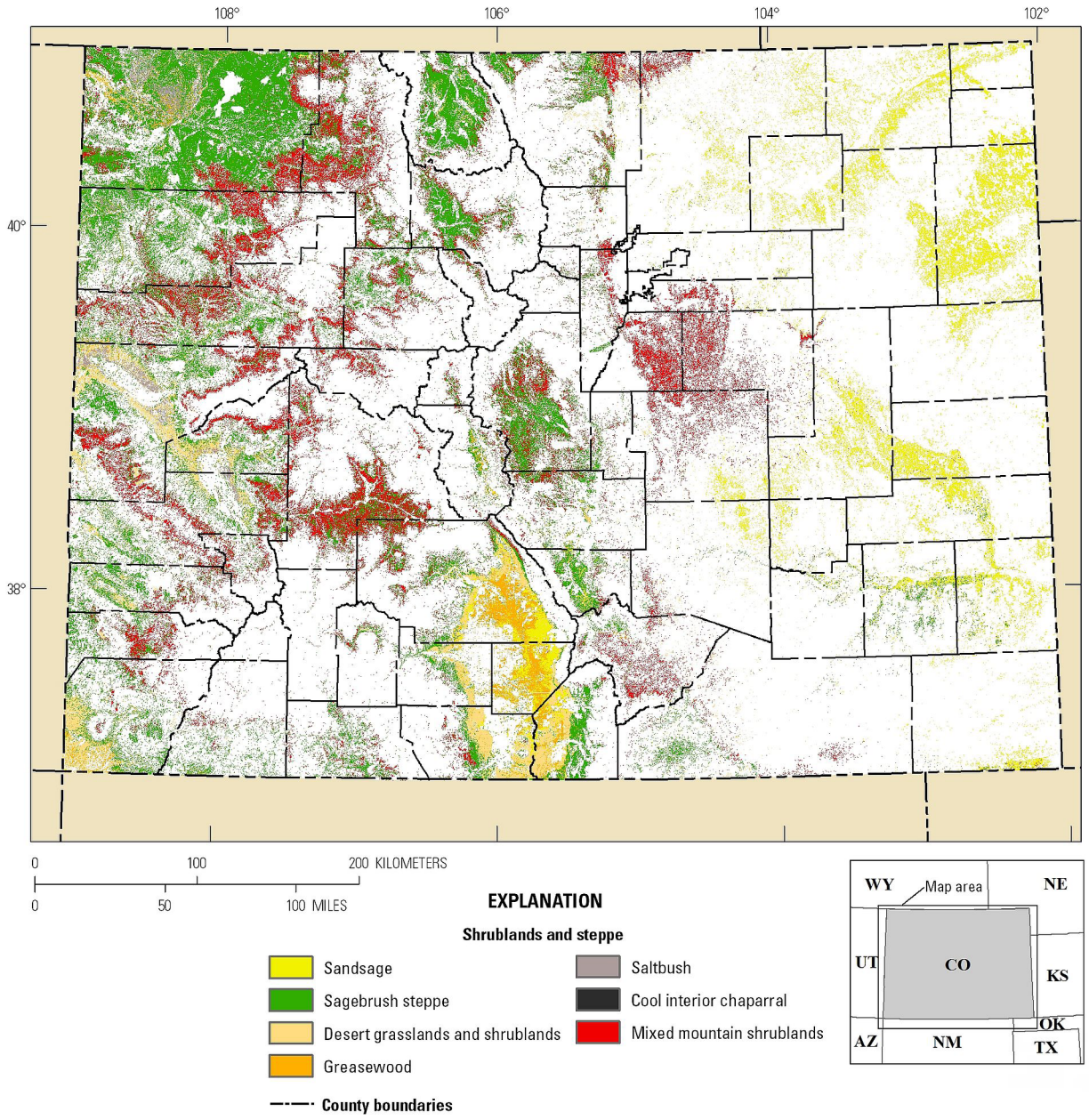

Figure 7. Shrublands and steppe in Colorado.

Sandsage occurs on the eastern plains of Colorado, whereas sagebrush steppe is more common on the Western Slope, occurring across a broad elevational gradient (Knight and others, 2014). At lower elevations, Wyoming big sagebrush (*Artemesia tridentata wyomingensis*) is dominant, and at higher elevations where soils are deeper and moisture is greater, mountain big sagebrush (*A. tridentata vaseyana*) is more common (Knight and others, 2014). Mixed mountain shrublands—dominated by deciduous shrub species such as mountain mahogany (*Cercocarpus* spp.) and antelope bitterbrush (*Purshia tridentata*)—typically form mosaics with grasslands, sagebrush shrublands, or woodlands in the foothills (Knight and others, 2014).

In more arid areas, the distribution of desert grasslands and shrublands, greasewood, and saltbush depends on differences in precipitation, temperature, soils, topography, and past disturbance. During wet periods, water can accumulate in depressions or flat areas, and the high rates of evaporation can lead to higher soil salinity in these areas (Knight and others, 2014). Many plants that grow in desert shrublands, such as saltbush and greasewood, can tolerate high soil salinity (West and Young, 2000). As a result of the combined stresses of high salinity and low precipitation levels, species diversity and plant cover, especially for shrubs, is generally lower than it is in the more mesic sagebrush steppe and grasslands (Barbour and others, 1999; Knight and others, 2014).

Savanna and Woodlands

Savanna and woodland communities include juniper woodlands and savanna, pinyon-juniper woodlands and shrublands, and limber-juniper woodlands (fig. 8). Pinyon-juniper woodlands and shrublands cover only 3 percent of the total area of IUs (table 3; fig. 4); no other savanna and woodland communities occur in IUs.

Junipers (*Juniperus* spp.) are short-stature evergreen trees generally found in semiarid landscapes—on rocky soils on hills, escarpments, and rocky terrain. In more arid settings, juniper species generally are dominant in open woodlands characterized by a sparse understory of shrubs, grasses, and forbs. In relatively mesic juniper woodlands, limber pine (*Pinus flexilis*), ponderosa pine (*Pinus ponderosa*), aspen (*Populus tremuloides*), and Douglas fir (*Pseudotsuga menziesii*) may be present (Knight and others, 2014); in some landscapes, juniper woodlands may develop into closed-canopy "pygmy forests" with very sparse understories. Throughout most of their range in Colorado, junipers may co-occur with pinyon pines or, in some areas, limber pine, both of which have large seeds that are eaten and dispersed by animals (Balda, 2002; Tomback and others, 2011).

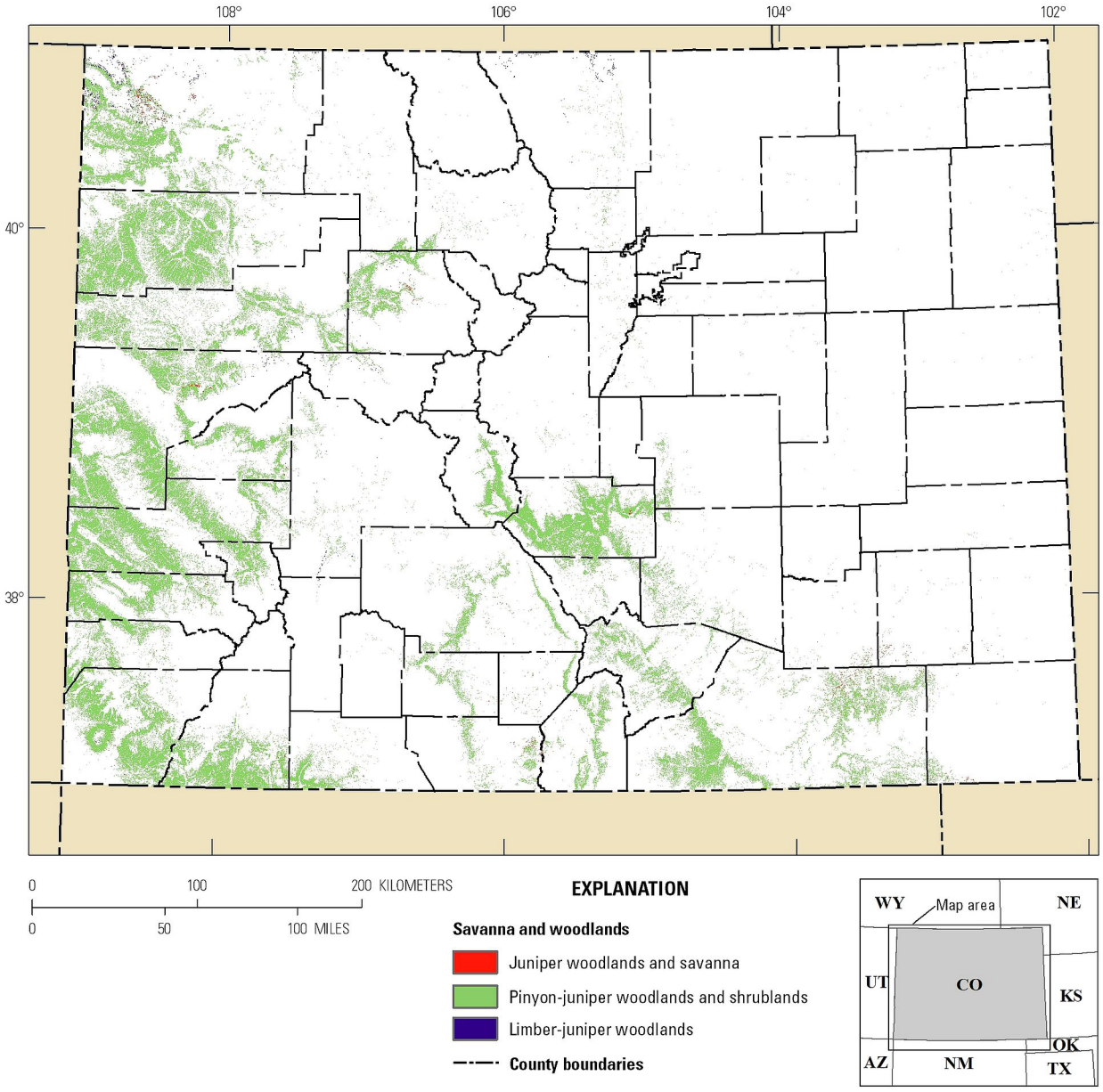

Figure 8. Savanna and woodlands in Colorado.

Mountain Forests and Alpine Zone

Mountain forest communities include ponderosa pine savanna and woodlands, mixed-conifer forests, aspen woodlands and forests, lodgepole pine (*Pinus contorta*) forests, spruce fir forests, and subalpine five-needle pine (limber and bristlecone [*Pinus aristata*]) woodlands and forests; the alpine zone occurs above treeline (fig. 9). Mountain forests, primarily aspen and mixed-conifer forests, cover approximately 11 percent of the total area of IUs (table 3; fig. 4).

At the foothills-montane ecotone, ponderosa pine savanna or woodlands are typical, whereas ponderosa pine forests and mixed-conifer forests are more prevalent at higher elevations (Knight and others, 2014). Upper montane forests are dominated by the cold-tolerant lodgepole pine. In the subalpine, the dominant tree species in spruce fir forests are Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) (Knight and others, 2014).

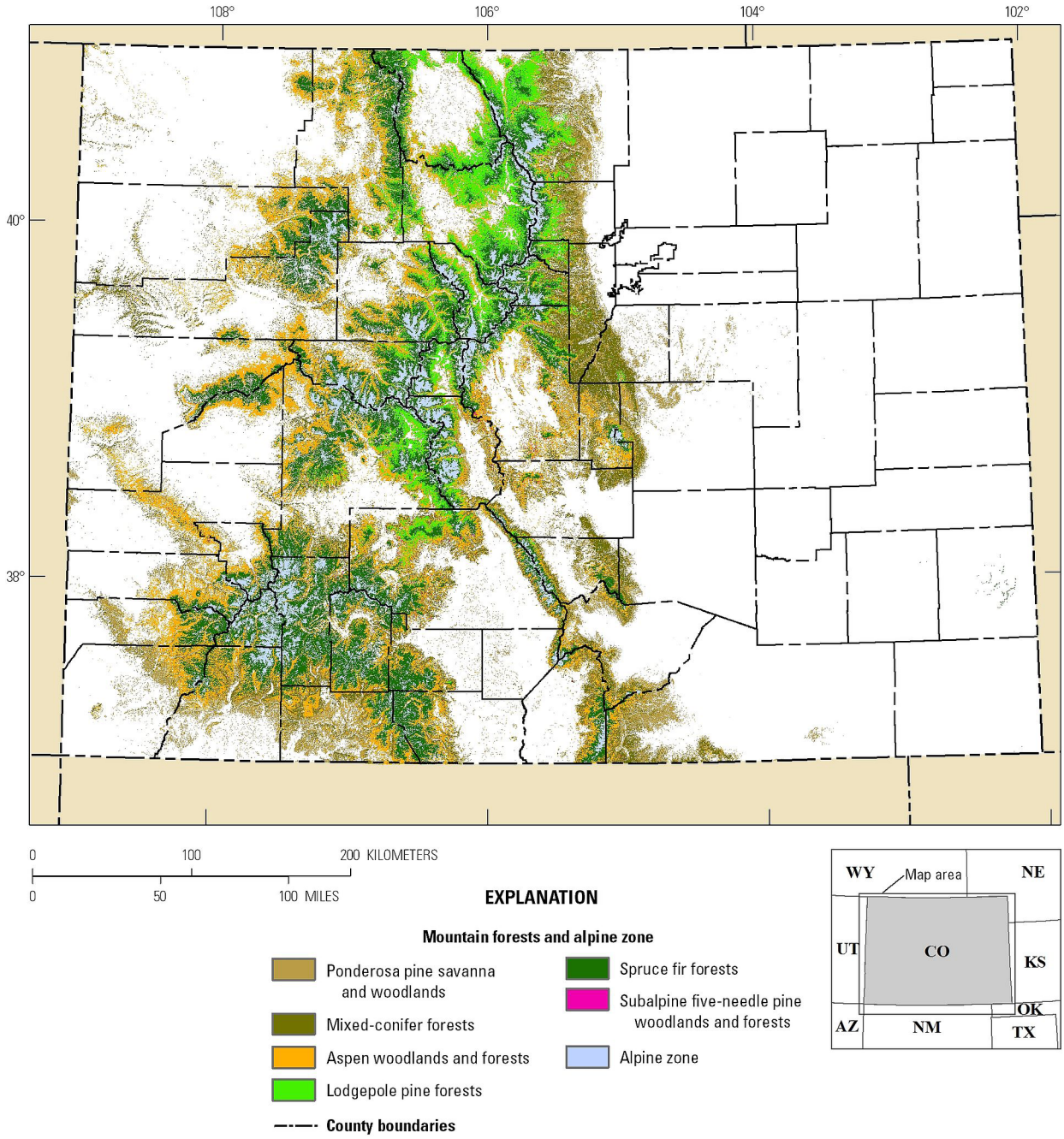

Figure 9. Mountain forests and alpine zone in Colorado.

Aspen and limber pine occur across a broad elevational range in mountain forests. Throughout the montane zone, especially the middle to upper montane, aspen may occur in pure or mixed aspen-conifer stands. Because aspen seedlings are much less drought tolerant than mature trees, aspen typically occur where soil moisture persists during the growing season (Knight and others, 2014). Limber pine may occur from the lower montane to the treeline and typically occurs in drier, windswept areas that are unfavorable to other tree species (Knight and others, 2014).

Sparsely Vegetated Communities

Sparsely vegetated communities include barren and sparsely vegetated lands, cliffs and canyons, and dunes (fig. 10). Less than 1 percent of IUs has barren and sparsely vegetated lands and cliffs and canyons (table 3; fig. 4). These communities are prevalent in the Colorado Plateaus ecoregion of western Colorado. The Great Sand Dunes are located in the San Luis Valley, and dunes do not occur on any of the IUs.

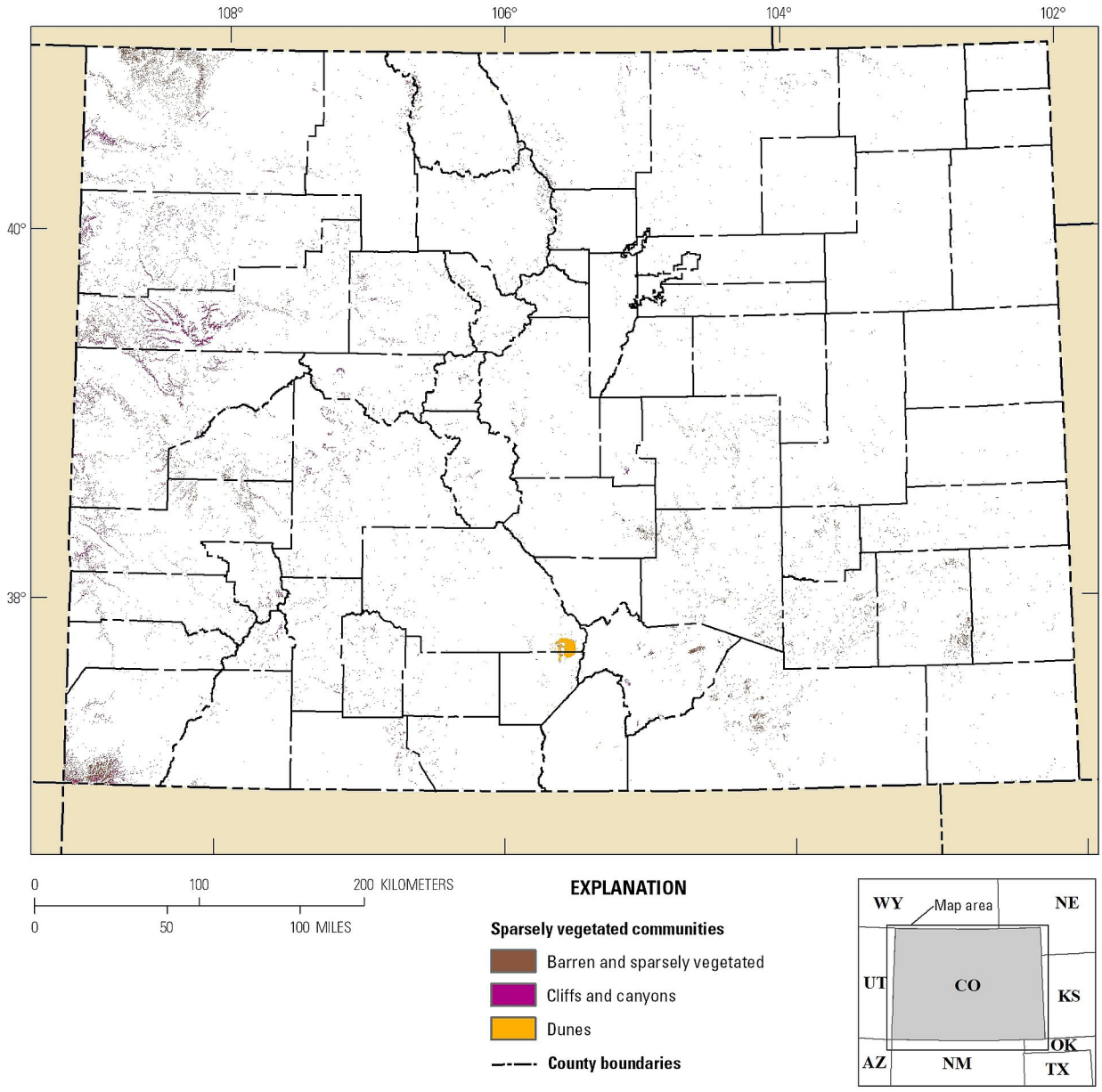

Figure 10. Sparsely vegetated communities in Colorado.

Summary of Land Cover Classes and Ecological Communities

- The shrublands and steppe land cover class (predominantly sagebrush steppe, sandsage, and mixed mountain shrubland communities) covers the greatest area in IUs and covers a proportionally similar area on BLM lands overall (table 3; fig. 4).
- The second most abundant land cover class on IUs is grasslands (predominantly shortgrass prairie); its coverage on IUs is proportionally much greater than its coverage on BLM lands overall.
- Indemnity units with the largest area of open water are in the Royal Gorge Field Office (Burris and others, 2018). These IUs have a relatively high proportional area of open water compared to BLM lands or Colorado overall because they include reservoirs in addition to lakes.
- The mountain forests land cover class (primarily aspen and mixed-conifer forests) is common on many of the IUs, and the total area on IUs is proportional to the total area on BLM lands overall (table 3; fig. 4).

Which Indemnity Units Have Soils With Potential For High Salinity?

High salinity in soils can affect the composition of vegetation as well as leaf water potential and water use efficiency in plants, which can limit their production (Katerji and others, 2003; Parida and Das, 2005). Elevated salinity is often created by soil moisture relations that promote wicking of salts from low in the soil profile up to the surface, where they become concentrated by evaporation. Soil salinity can also be affected by land uses and can negatively affect water quality (Butler, 2001).

Salinity is typically measured by electrical conductance in wet soils; soils with an electrical conductance of <2 decisiemens per meter (dS/m) are nonsaline, 2 to <4 dS/m are very slightly saline, 4 to <8 dS/m are slightly saline, 8 to <16 dS/m are moderately saline, and ≥16 dS/m are strongly saline (fig. 11) (Schoeneberger and others, 2002). (See table 1–3 for datasets used to evaluate salinity.) Only two IUs (table 1–4) have soils with an electrical conductance of ≥8 dS/cm (Burris and others, 2018).

Which Indemnity Units Have Soils With Potential For Selenium?

The surface distribution of selenium (Se) is poorly understood. It is found in greater concentrations in the Earth's crust than in lower layers and occurs in very low concentrations compared to other important elements such as iron, manganese, and zinc (Malisa, 2001). Some selenium originates from atmospheric and extraterrestrial deposition, but the selenium content of soils is highly dependent on the underlying bedrock. There are approximately 50 known selenium minerals (Malisa, 2001). Geologic selenium is known to occur in deep-seated plutonic rock (Malisa, 2001). Selenium in the Earth's crust is typically associated with sulfides, which are usually associated with heterogeneous parts of rock such as fissures and shear zones. Selenium is enriched in vein rocks, such as dolerites, and basalts have the highest content of all common magmatic rocks. Selenium content is generally very low in areas dominated by granitic and sedimentary rocks (Malisa, 2001).

Although naturally occurring, selenium can be mobilized and concentrated by land uses, such as agriculture and mining activities (Lemly, 2004). In aquatic systems, the bioaccumulation of selenium can negatively affect aquatic organisms as well as the species that feed on them (Ohlendorf and others, 1990). As a result, small increases in selenium pose significant ecological risks to systems (Lemly, 2004).

To evaluate the potential for high selenium in soils, we mapped bedrock geology by using surface geology (see table 1–3 for data used to evaluate selenium). Only two IUs (table 1–5) had deep-seated plutonic rocks, which have the highest potential for selenium (Burris and others, 2018). Sedimentary rocks, which typically contain very low selenium levels, are common in Colorado and in the remaining IUs.

Summary of Soil Salinity and Selenium

- Most soils in Colorado do not have high salinity (fig. 11), and only two IUs have the potential for moderate salinity (table 1–4).
- Two additional IUs have potential for elevated selenium levels as evidenced by the presence of deep-seated plutonic rocks (table 1–5).
- Several IUs did not have soils data available for all or a portion of the unit, so potential for elevated salinity and selenium could not be fully evaluated (Burris and others, 2018).

What Are the Current and Anticipated Future Land Uses of Each Indemnity Unit?

We summarized current land uses based on existing or pending grazing allotments, rights of way, oil and gas leases, and active mining and mineral claims as summarized by the BLM (J. Krickbaum, Bureau of Land Management, written commun., 2017) (table 4). Future land uses were provided by the Colorado State Land Board (C. Smith, Colorado State Land Board, written commun., 2017). Many IUs are adjacent to existing State Wildlife Areas.

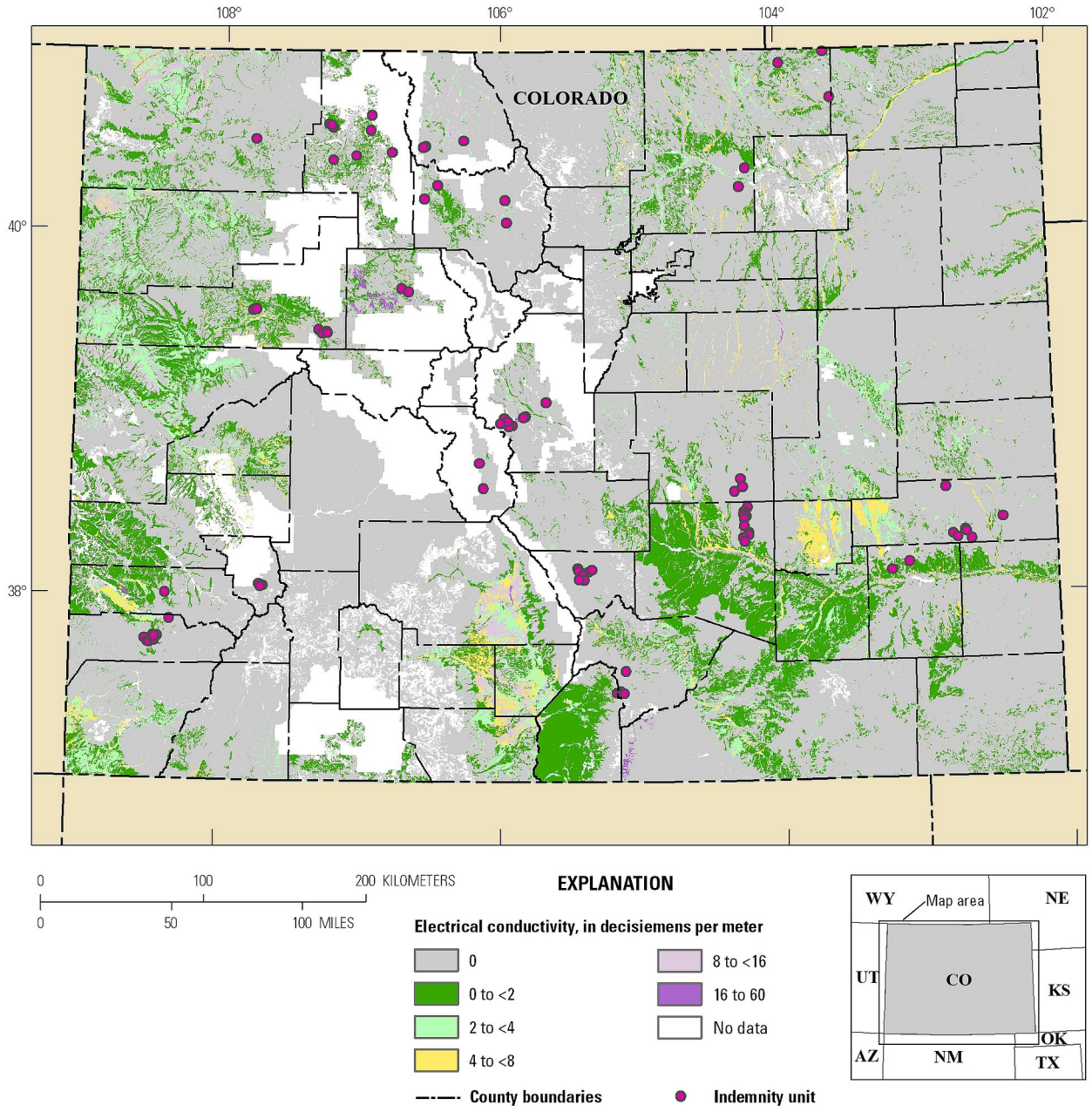

Figure 11. Map of soil salinity based on electrical conductivity in Colorado. Soils with an electrical conductivity of ≥8 decisiemens per meter are moderately to strongly saline.

Table 4. Summary of current, pending, and future land uses for all indemnity units.

[–, not applicable]

Land use or management status	Number of Indemnity units[1]		
	Current use	Pending[2]	Future use
Grazing allotment	60	–	65
Recreation[3]	89	–	6
Hunting[3]	89	–	28
Right of way[4]	34	3	34
Oil and gas lease[4]	17	3	17
Active mining claim[4]	3	–	3
Mineral materials site[4]	1	–	1
State Wildlife Area	–	–	8
Consolidation of a split estate	–	–	13

[1]See table 1−6 for summaries of land use by indemnity unit.

[2]Permits for land use that are currently in review.

[3]There are potential access limitations for hunting on 30 indemnity units and for recreation on 58 indemnity units.

[4]Existing uses would be transferred with the conveyance of indemnity units to the State.

Grazing

Livestock production accounted for approximately 69 percent of the revenue generated by agricultural activities in Colorado in 2012 (National Agricultural Statistics Service, 2017). The BLM manages livestock grazing on approximately 8 million acres of public lands in Colorado. Sixty IUs have grazing allotments, and the State of Colorado has indicated that 65 IUs would be leased for grazing (table 4).

Recreation

Hunting and general recreation (including hiking, fishing, and horseback riding) are permitted on all BLM lands. For areas that are surrounded by private lands or State trust lands, however, potential access limitations may limit or preclude such uses. To evaluate the potential for access limitations, we examined land ownership and road access to all IUs. Those that are accessible by county roads or bordered by BLM lands, U.S. Forest Service lands, or State trust lands that permit hunting or general recreation were assumed to be accessible for hunting or general recreation. Those that are surrounded by private lands or State trust lands not designated for hunting or recreation and that otherwise lack access via county roads or named roads were assumed to have access limitations for hunting or recreation by the general public. Some State trust lands have an open season for hunting, but not all of these lands are open for general recreation. Using these criteria, we determined that access was potentially limited for hunting on 30 IUs and for recreation on 58 IUs (table 1−6).

Energy and Minerals

Colorado is among the top 10 natural gas- and oil-producing States in the United States (Weiner, 2014). Coal bed methane accounts for approximately 50 percent of all natural gas produced in the State and constitutes more than 25 percent of all coal bed methane production in the United States. The majority of active oil and gas wells are in Weld and Garfield Counties. There are 17 existing oil and gas leases on IUs, all of which would transfer with conveyance of the property to the State (table 4).

Renewable energy sources in Colorado include hydropower, wind, and solar (Colorado Energy Office, 2016b). There are more than 60 hydropower facilities in Colorado with a combined capacity of 1,150 megawatts, accounting for 3.52 percent of electricity generated in Colorado. Wind energy production has increased from 1.5 to 17.3 percent of electricity generated in the State between 2005 and 2016. Solar energy production in Colorado accounted for 1 percent of the State's electricity production in 2016. There are no wind or solar energy facilities on BLM lands in Colorado. Nonrenewable sources account for the majority of electricity production in Colorado, with coal accounting for 55 percent, and natural gas 23 percent (Colorado Energy Office, 2016a).

The mineral resource industry in Colorado generated $3 billion in 2008. This total includes $1.2 billion from molybdenum, $887 million from coal, $286 million from sand and gravel, and $16 million from uranium (Colorado Geological Survey, 2008). The worlds' largest molybdenum-producing mine is in Empire, Colo. There are three mining claims and one mineral materials site on IUs; existing claims would transfer with ownership (table 4).

Summary of Land Use on Indemnity Units

- Existing rights of way, oil and gas leases, and active mining claims on 55 IUs would transfer with the conveyance of these IUs to the State (tables 4 and 1−6).
- Grazing is currently permitted on 60 IUs, and the State has indicated that a similar number of IUs would be leased for grazing (table 4).
- Six IUs would be included in existing State Wildlife Areas, and 12 IUs would be used to consolidate split estates.

What Are the Broad-Scale Effects of Development For Indemnity Units?

We summarized the effects of development at three analysis scales. The local-scale analysis covered the footprint from development, and the broad-scale analyses (figs. 12 to 14) used the terrestrial development index (TDI) at 1 kilometer (km) and 5 km. Low levels of development are indicated by TDI scores less than or equal to 2 percent and high levels of development are indicated by TDI scores greater than 5 percent. See appendix 1 and Burris and others (2018) for methods.

Summary of Broad-Scale Effects of Development

- At the 1-km scale, effects of development were slightly higher on IUs than on BLM lands but were similar to Colorado overall (figs. 12 and 14*A*). Based on TDI scores, approximately 75 percent of BLM lands have relatively low development compared to approximately 58 percent of the combined IU area.
- A similar pattern of development based on TDI scores was observed for IUs at the 5-km scale (figs. 13 and 14*B*).
- The TDI scores for individual IUs were highly variable at each scale (Burris and others, 2018).

What Species of Management Concern Could Potentially Occur Within Indemnity Units?

We evaluated 179 species or subspecies of management concern identified by the Colorado office of the Bureau of Land Management that could potentially occur on the 89 IUs. The species of management concern in Colorado include federally threatened or endangered (U.S. Fish and Wildlife Service, 2017), BLM Colorado sensitive species (Bureau of Land Management, 2015a), FWS Birds of Conservation Concern (U.S. Fish and Wildlife Service, 2008), and big game (Colorado Parks and Wildlife, 2017b). The full list of 179 species, scientific names, and agency status are provided in Burris and others (2018).

Three primary data types were used to evaluate the potential for each of the species to occur on at least one IU: (1) overall range, (2) habitat (designated critical habitat for threatened and endangered species, seasonal habitat, specialized habitat, or potential general habitat), and (3) documented occurrences (see Burris and others, 2018, for methods and data sources used). Range maps were available for all species; 79 species were eliminated from further consideration because their overall ranges do not include any IUs. Of the remaining species within range of at least one IU, 72 species had documented occurrences or potential habitat within at least one IU: 1 insect, 3 amphibian, 2 reptile, 43 bird, 18 mammal, and 5 plant species (tables 5, 1–7, and 1–8).

Threatened and Endangered Species

Of the 33 federally threatened or endangered species that occur in Colorado (Burris and others, 2018), 6 species have documented occurrences and (or) have potential habitat within at least one IU (table 6). A total of 50 IUs had the potential for occurrence of one or two threatened or endangered species (tables 6 and 1–8). Two species, the interior least tern (*Sternula antillarum athalassos*) and the black-footed ferret (*Mustela nigripes*), are both listed as endangered (the black-footed ferret is designated as an experimental nonessential population). The Gunnison sage-grouse (*Centrocercus minimus*), Mexican spotted owl (*Strix occidentalis lucida*), piping plover (*Charadrius melodus*), and Canada lynx (*Lynx canadensis*) are designated as threatened (U.S. Fish and Wildlife Service, 2017).

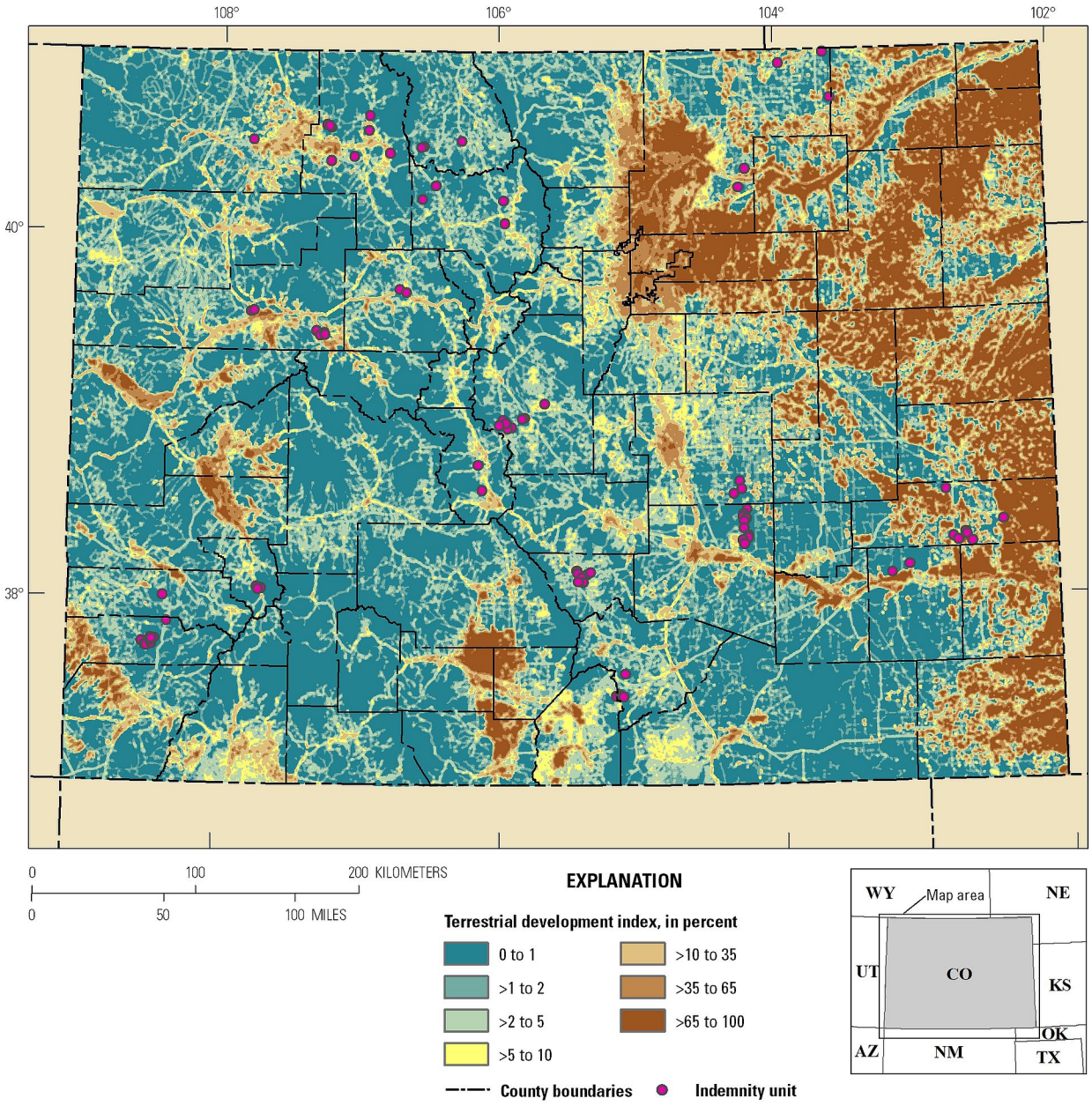

Figure 12. Terrestrial development index (TDI) at 1 kilometer (km) for Colorado. The 1-km TDI summarizes the total area of the surface disturbance from development as a percentage of a circular moving window with a 1-km radius. The locations of indemnity units are shown.

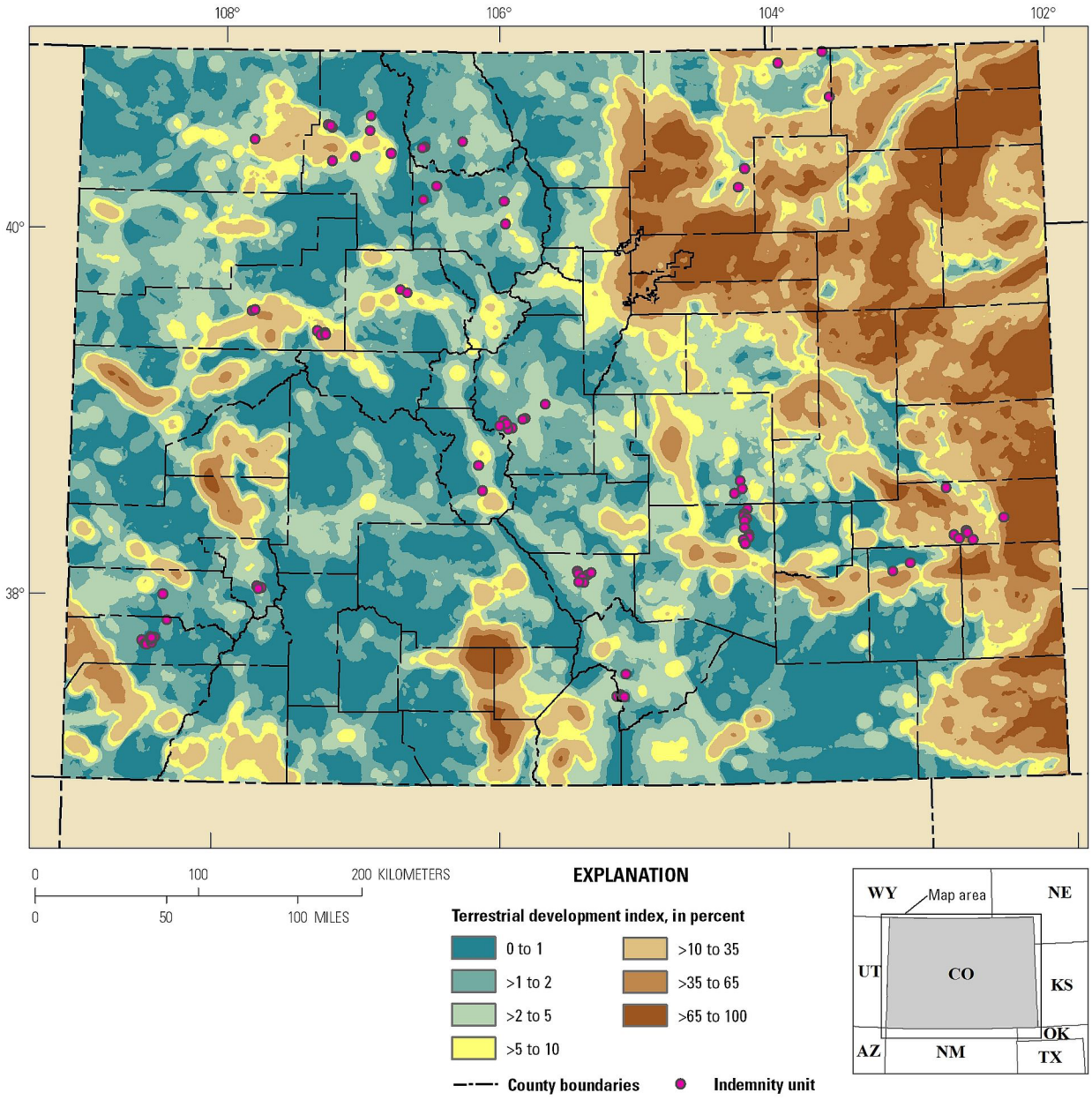

Figure 13. Terrestrial development index (TDI) at 5 kilometers (km) for Colorado. The 5-km TDI summarizes the total area of the surface disturbance from development as a percentage of a circular moving window with a 5-km radius. The locations of indemnity units are shown.

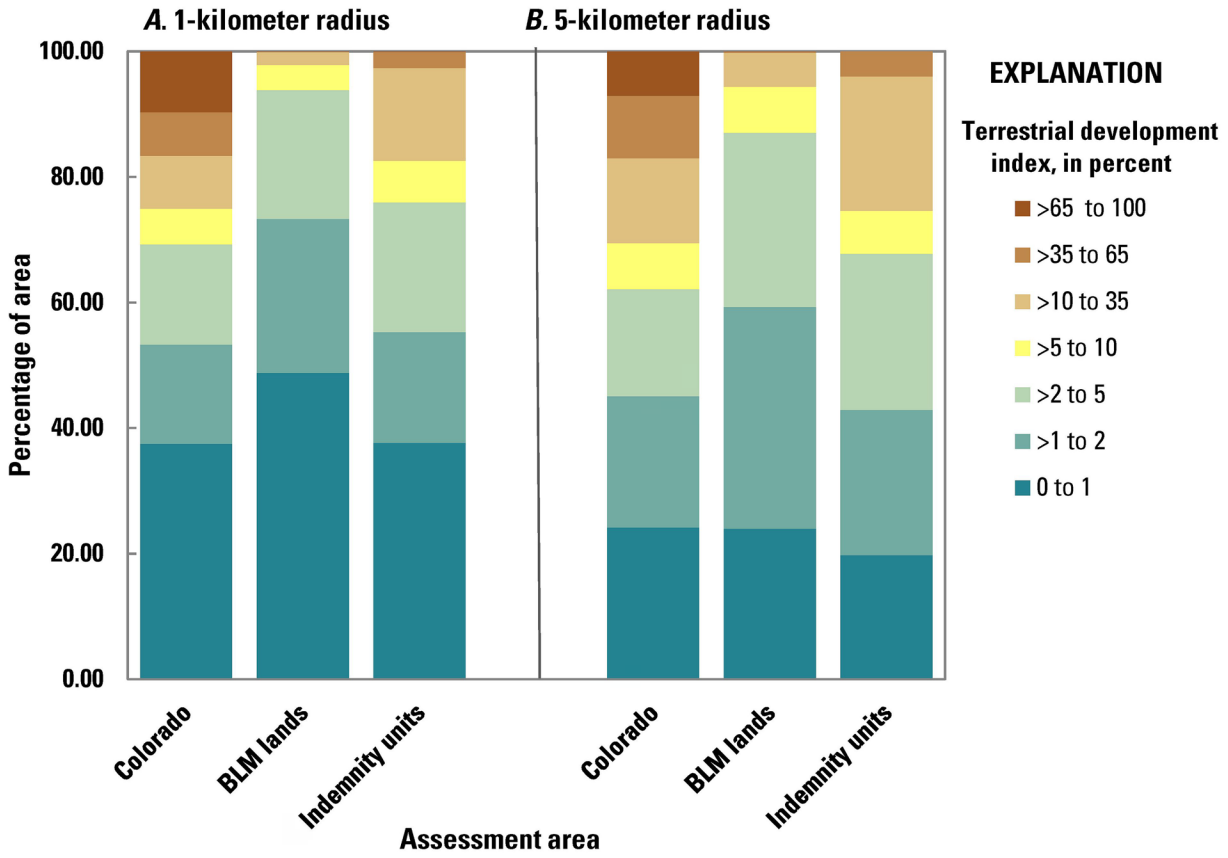

Figure 14. Terrestrial development index (TDI) based on a circular moving window summarized for Colorado (statewide), Bureau of Land Management (BLM) lands in Colorado, and indemnity units. *A*, 1-kilometer radius TDI. *B*, 5-kilometer radius TDI.

Table 5. Summary by status and taxa of the 72 species that have documented occurrences and (or) potential habitat within at least one indemnity unit.

[BLM Colo., Bureau of Land Management Colorado; FWS, U.S. Fish and Wildlife Service; CPW, Colorado Parks and Wildlife]

Taxa	Federally threatened or endangered[1]	BLM Colo.—sensitive[2]	FWS—Birds of Conservation Concern[3,4]	CPW—big game[5]	Total number of species per taxa
Insect	0	1	0	0	1
Amphibian	0	3	0	0	3
Reptile	0	2	0	0	2
Bird	4	15	24	0	43
Mammal	2	9	0	7	18
Plant	0	5	0	0	5
Total number of species per status[6,7]	6	35	24	7	0

[1]See table 6.

[2]See table 7.

[3]Bird Conservation Regions in Colorado: Northern Rockies (10), Southern Rockies/Colorado Plateau (16), and Shortgrass Prairie (18) (U.S. Fish and Wildlife Service, 2008).

[4]See table 8.

[5]See table 9.

[6]See table 1–7 for the status of each species by agency. Some species may be listed by more than one agency.

[7]The interior least tern (*Stenula antillaurm athalassos*), which is also listed as federally endangered, and ten species also listed as sensitive by the BLM Colorado are not included in the total Birds of Conservation Concern (see table 1–7); the Rocky Mountain bighorn sheep (*Ovis canandensis canadensis*) is also listed as sensitive by the BLM Colorado and is not included in the total big game species.

Table 6. Federally threatened and endangered species that have documented occurrences and (or) potential habitat within at least one indemnity unit.

[See table 1–7 for species scientific names]

Status	Species	Number of indemnity units		
		Occurrences and potential habitat	Potential habitat without occurrence	Total
		Birds		
Endangered	Interior least tern[1]	4	3	7
Threatened	Gunnison sage-grouse[2]	0	1	1
	Mexican spotted owl[2]	0	3	3
	Piping plover[3]	5	0	5
		Mammals		
Endangered	Black-footed ferret[1,4]	0	10	10
Threatened	Canada lynx[3]	0	30	30
Total number of indemnity units[5,6]		5	46	50

[1]Critical habitat not designated.

[2]Critical habitat designated in Colorado.

[3]Critical habitat designated outside of Colorado.

[4]Experimental nonessential populations.

[5]Note that some indemnity units will have occurrences or potential habitat for more than one species.

[6]See table 1–8 and Burris and others (2018) for the indemnity units that have documented occurrences or potential habitat for federally threatened and endangered species.

Interior Least Tern

Distribution and status.—The interior least tern is separated geographically and ecologically from the east and west coast subspecies of the least tern (*Sternula antillarum*), the smallest of the North American terns. Once widely distributed along large rivers of the Great Plains and lower Mississippi Valley, the primary populations of interior least terns currently are located along the lower Mississippi River (Lott and others, 2013). As a result of population declines caused by habitat loss, the interior least tern was listed as federally endangered (U.S. Fish and Wildlife Service, 1985). In 2012, the population was estimated at more than 13,855, and because population recovery goals had been achieved, it was recommended that the subspecies be delisted (U.S. Fish and Wildlife Service, 2013b).

Nesting colonies in Colorado are at the western periphery of the interior least tern's range and are restricted to shoreline or island habitat in reservoirs near or along the Arkansas River (Lott and others, 2013; Wickersham, 2016). Between 2003 and 2006, the average number of nesting pairs in Colorado was approximately 25 (Wickersham, 2016). In 2013, only two nesting pairs were observed after island nesting sites were accessible by dry land as a result of decreased reservoir levels (Wickersham, 2016). The current nesting status of interior least terns in Colorado is uncertain because of the loss of habitat and the potential loss of recruitment caused by the isolation of Colorado least tern colonies from colonies in Nebraska, Kansas, and Oklahoma (Lott and others, 2013; Wickersham, 2016).

Habitat.—Historically, the interior least tern primarily nested on sparsely vegetated and coarse sandy substrates occurring on river islands or sandbars that were created and maintained by alluvial processes (Kirsch and Sidle, 1999; Lott and others, 2013). Altered frequency and timing of spring flooding has reduced the availability of naturally occurring suitable nesting habitat, and the terns now also nest on sites created by human activities, such as areas along reservoirs or in sand and gravel pits (Lott and others, 2013). Least terns feed on small fish and forage in the shallow, open waters of rivers, marshes, ponds, and reservoirs near colonies (Lott and others, 2013). In Colorado, all recently used colony sites were along reservoir shorelines or on islands (Wickersham, 2016).

Threats and Conservation.—Major threats to interior least terns include habitat loss and degradation, human disturbance, and predation. The dynamics of their habitat have been affected by alteration of natural flows, which are no longer sufficient to scour vegetation across much of their historical range, allowing herbaceous and woody vegetation to become established in many areas. The focus of recovery activities is to protect, create, or restore suitable nesting sites; obtain water rights to more optimally regulate water levels; and reduce negative effects of human disturbance and predation. Critical habitat has not been designated for the interior least tern.

Potential for Occurrence on Indemnity Units.—A total of seven IUs have potential for occurrence of interior least terns (table 6). All seven of the IUs have potential habitat, four of which also have recent observations of interior least terns. Five of the IUs are in Kiowa County along the shorelines of several small reservoirs (such as Nennoshe Reservoir) and adjacent to State Wildlife Areas. The other two IUs are in Bent County; they are mineral estates for which the State currently owns the surface estate. However, they have no documented occurrences of interior least terns, and potential habitat is not evident from aerial imagery (Esri, 2017). The largest interior least tern colony in the State is in John Martin Reservoir State Park along the Arkansas River (Wickersham, 2016), approximately 20 km from all seven IUs.

Black-Footed Ferret

Distribution and Status.—The black-footed ferret is a medium-sized member of the weasel family (Mustelidae). Once widespread across the Great Plains and intermountain basins of the Rocky Mountains, black-footed ferret populations have declined severely, primarily as a result of the control of prairie dogs, conversion of grasslands to croplands, and disease (U.S. Fish and Wildlife Service, 2013d). The black-footed ferret was listed as endangered in 1967 and is currently classified as extinct in the wild (U.S. Fish and Wildlife Service, 2013d). Captive breeding and reintroduction programs have resulted in only four wild populations (in South Dakota, Arizona, and Wyoming) that are considered self-sustaining; the current wild population is estimated at 300 individuals (Colorado Parks and Wildlife, 2018). In Colorado, released surviving ferrets are found primarily at the Rocky Mountain Arsenal National Wildlife Refuge (D. Biggins, U.S. Geological Survey, oral commun., 2018). All black-footed ferret populations in Colorado are designated as endangered but nonessential.

Habitat.—The historical habitat for black-footed ferrets was coincident with the historical range of black-tailed, Gunnison's, and white-tailed prairie dogs (*Cynomys ludovicianus*, *C. gunnisoni*, and *C. leucurus*, respectively) (U.S. Fish and Wildlife Service, 2013d). Ferrets are largely dependent on prairie dogs as prey and for their burrows, which they use for denning and shelter. The size, density, and spatial arrangement of prairie dog colonies and the potential for disease and predator abundance all affect the suitability of sites for ferret release (Biggins and others, 2006; Eads and others, 2014).

Threats and Conservation.—Threats to black-footed ferrets include canine distemper and plague, habitat loss and fragmentation, and low genetic diversity (U.S. Fish and Wildlife Service, 2013d). Reintroduction success is limited by predation, the availability of a sufficient prairie dog prey base, and the prevalence of plague (Biggins and others, 2011; Eads and Biggins, 2015). Ongoing management of plague by control of fleas on release sites is typically required to ensure ferret survival.

Potential for Occurrence on Indemnity Units.—Critical habitat for black-footed ferrets has not been designated. Potential black-tailed prairie dog habitat within counties where black-footed ferrets have been released was used to map potential habitat for ferrets. All of the 10 IUs with potential for black-footed ferret occurrence are within the Royal Gorge Field Office, in Pueblo County (Burris and others, 2018). These IUs are within or adjacent to State trust lands.

Gunnison Sage-Grouse

Distribution and Status.—The Gunnison sage-grouse inhabits sagebrush steppe of western Colorado and eastern Utah. The historical distribution is presumed to have included Arizona, Oklahoma, and New Mexico (BirdLife International, 2016), and it has been estimated that they now occupy less than 9 percent of their historical range (Wickersham, 2016). Although similar to the greater sage-grouse in many respects, it was proposed as a unique species in 1991, and in 2014 was classified as threatened (U.S. Fish and Wildlife Service, 2014). The Gunnison sage-grouse occurs in seven delineated populations, with approximately 75 percent of the overall population occurring in the Gunnison Basin in Colorado (Gunnison Sage-grouse Rangewide Steering Committee, 2005). The Gunnison Basin population has been relatively stable (based on lek counts), whereas the remaining satellite populations have generally been declining, and their viability is of concern (U.S. Fish and Wildlife Service, 2014). Many of the satellite populations have been augmented by transplanted birds (Wickersham, 2016).

Habitat.—Gunnison sage-grouse require large expanses of sagebrush within a mosaic of other cover types (Gunnison Sage-grouse Rangewide Steering Committee, 2005; Wickersham, 2016). Lek sites are characterized by low vegetative cover within a broader sagebrush-steppe landscape required for nesting. Brood rearing habitat is typically in riparian and wet meadows, and winter habitat includes sagebrush where snow pack remains low (Gunnison Sage-grouse Rangewide Steering Committee, 2005).

Threats and Conservation.—Habitat loss and fragmentation resulting from alteration and conversion of sagebrush steppe are the primary threats to the Gunnison sage-grouse. Invasive plants, inappropriate grazing practices, and energy development can contribute to habitat loss or degradation (Gunnison Sage-grouse Rangewide Steering Committee, 2005). Because of low population sizes, genetic diversity is low and populations are at risk of inbreeding depression (Oyler-McCance and others, 2005). Conservation strategies were developed in 2005 to help coordinate management activities by Federal and State agencies to achieve conservation goals for the species (Gunnison Sage-grouse Rangewide Steering Committee, 2005).

Potential for Occurrence on Indemnity Units.—Only one indemnity unit is coincident with designated critical habitat for the Gunnison sage-grouse, and it is also designated as a production area and winter range. This unit (UN_SANM_SM_089) is within the Uncompahgre Field Office, in San Miguel County (table 1–1). Of the 1,281,480 acres of critical habitat for Gunnison sage-grouse in Colorado (representing 89 percent of the critical habitat in the United States), 130 acres are within this indemnity unit.

Mexican Spotted Owl

Distribution and Status.—The Mexican spotted owl is one of three subspecies of spotted owl (*Strix occidentalis*) and is geographically isolated from the other subspecies (U.S. Fish and Wildlife Service, 2012). The current range for the Mexican spotted owl, which generally corresponds to its historical range, includes forested mountains and canyons extending from the southern Rocky Mountains in Colorado and the Colorado Plateau in southern Utah southward to Arizona and New Mexico, as well as western Texas and northern Mexico (U.S. Fish and Wildlife Service, 2012). Across their range, populations of this subspecies are small and disjunct, and their habitat is primarily within lands administered by the U.S. Forest Service and BLM (U.S. Fish and Wildlife Service, 1995). In 1993, the Mexican spotted owl was listed as threatened (U.S. Fish and Wildlife Service, 1995). The U.S. Fish and Wildlife Service designated almost 1 million acres of critical habitat for the Mexican spotted owl, of which 392,907 acres are in Colorado (U.S. Fish and Wildlife Service, 2013c). The U.S. distribution of the Mexican spotted owl is divided into six Ecological Management Units (EMUs), two of which (the Southern Rocky Mountains and Colorado Plateau) occur in Colorado. Approximately 14 percent of the Southern Rocky Mountains EMU and 22 percent of the Colorado Plateau EMU are on BLM lands (U.S. Fish and Wildlife Service, 2012).

Habitat.—Mexican spotted owls nest and roost in multi-layered stands of montane forests across steep and rocky canyonlands. Habitat is variable throughout their range, but it primarily includes mixed conifer, pine-oak, and riparian forests with dense canopies. In Colorado, they commonly nest on rocky ledges, often within steep canyons (Wickersham, 2016).

Threats and Conservation.—A primary threat to Mexican spotted owl is the loss and alteration of habitat resulting from commercial timber management practices that create even-aged forest stands, but such practices have become less pervasive in recent years (U.S. Fish and Wildlife Service, 2012). Fire exclusion and the concomitant increase in stand density, fuel loads, and the risk of high-severity wildfires have increasingly been recognized as a potential risk in some areas. Loss of riparian forests in canyons is an additional potential threat (U.S. Fish and Wildlife Service, 2012).

Potential for Occurrence on Indemnity Units.—Three IUs are coincident with potential Mexican spotted owl habitat. Two of them are within the Royal Gorge Field Office, in Custer County. None of the IUs are coincident with designated critical habitat for the Mexican spotted owl.

Piping Plover

Distribution and Status.—Piping plovers are small shorebirds that breed in three regions of North America: the Atlantic Coast, Northern Great Plains, and the Great Lakes (Haig and others, 2005). The Northern Great Plains interior subspecies (*C. m. circumcinctus*), which includes the Colorado population, is classified as threatened (U.S. Fish and Wildlife Service, 2009). The Colorado breeding population may total fewer than 30 adults (Wickersham, 2016). Piping plovers breeding in Colorado are geographically separated from other Northern Great Plains populations, but long-distance dispersal among these populations can occur (Haig and others, 2005; Miller and others, 2010). The reservoirs providing the majority of their breeding habitat in the State (Neeskah and Neenoshe) have been drawn down and no longer support any breeding pairs (Wickersham, 2016). Despite high nest failures caused by hail in 2009, the plovers have been successfully reproducing at John Martin Reservoir (Wickersham, 2016) and the Colorado population was relatively stable between 1991 and 2001 (Haig and others, 2005). Because of the limited number of nesting birds in the State, the future of the Colorado population is precarious (Wickersham, 2016).

Habitat.—Piping plovers form loose colonies along coarse, sandy, or saline shorelines; sandflats; and sand or gravel bars. In Colorado, piping plovers typically use human-created habitat along sandy shores of reservoirs or gravel pits with limited vegetative cover (Wickersham, 2016). There are 46,494 acres of designated critical habitat for piping plovers in the United States, none of which are within Colorado.

Threats and Conservation.—Major threats to the piping plover are similar to threats to least terns, including habitat loss and degradation, human disturbance, and predation. Active management to prevent vegetation encroachment, maintenance of appropriate water levels, and control of predators and human disturbance will likely be necessary to ensure continued nesting in the State (Wickersham, 2016).

P*otential for Occurrence on Indemnity Units.*—All five IUs with documented occurrences and within the overall breeding range of piping plovers are located within the Royal Gorge Field Office, in Kiowa County. All five IUs also have potential habitat for interior least terns, and the species have similar nesting habitats. Only one of these IUs (RG_KIOW_SM_56) has both documented occurrences and breeding habitat for piping plovers (Burris and others, 2018).

Canada Lynx

Distribution and Status.—The Canada lynx (hereafter referred to as lynx) is a medium-sized cat (family Felidae) widely distributed across Canada and Alaska, with the southern margin of its range extending into the southern Rocky Mountains (U.S. Fish and Wildlife Service, 2000). Canada and Alaska support healthy populations of lynx, but within the conterminous United States, the lynx is listed as threatened (U.S. Fish and Wildlife Service, 2000). Lynx are believed to have been largely or completely extirpated from Colorado by the late 1970s (U.S. Fish and Wildlife Service, 2000). In 1999, a lynx reintroduction program was initiated, releasing 218 individuals by 2006 (Devineau and others, 2010). The distribution of the lynx habitat has been partitioned into core areas (areas with the strongest long-term evidence of persistent lynx populations), secondary areas (areas with historical records but no record of reproduction or no recent occurrences), and peripheral areas (sporadic historical records). A provisional core area in the Southern Rocky Mountains (Colorado and southern Wyoming) contains the reintroduced population (U.S. Fish and Wildlife Service, 2013a). A re-evaluation of the Southern Rocky Mountains core area reinforced the original designation as provisional because the area is not likely to provide the habitat features necessary to sustain viable lynx populations over time (U.S. Fish and Wildlife Service, 2013a). Early in 2018, the U.S. Fish and Wildlife Service completed a scientific review of the Canada lynx and concluded that the species should be considered for delisting because of recovery (U.S. Fish and Wildlife Service, 2018).

Habitat.—Lynx habitat is primarily boreal forests that include large heterogeneous stands of vegetation types and successional stages of subalpine conifer and mixed conifer-aspen forests (Armstrong and others, 2011). The lynx's distribution corresponds closely to the distribution of the snowshoe hare, which is its primary prey (Ivan and Shenk, 2016). The presence of dense, multi-layered understory with variable snow depths provides ideal conditions for snowshoe hares. Lynx are highly mobile and can disperse considerable distances in response to prey availability.

Threats and Conservation.—Predator control, including poisoning and trapping, contributed to the decline in lynx populations. The natural disturbance process of fire and bark beetle outbreaks, as well as some forest management activities, creates forest openings and mosaics of successional stages that can support greater prey densities than closed canopy forests (U.S. Fish and Wildlife Service, 2013a). But some timber management, such as clear cutting or understory thinning, may reduce habitat quality for snowshoe hares and, in turn, for lynx (U.S. Fish and Wildlife Service, 2013a).

Potential for Occurrence on Indemnity Units.—There is no designated critical habitat for lynx in Colorado. There were three IUs with documented seasonal habitat within the Royal Gorge Field Office, in Huerfano County (the State currently has surface ownership) (Burris and others, 2018). There were an additional 27 IUs that are coincident with Lynx Analysis Units (LAUs; the LAUs are currently undergoing revision and are in review) (Burris and others, 2018). The 27 IUs span a broad geographic area within the following counties: Eagle (2 IUs), Grand (3 IUs), Jackson (2 IUs), Routt (2 IUs), Chaffee (1 mineral-only estate IU), Huerfano (4 IUs), Park (4 IUs), Dolores (8 IUs), and Ourey (1 IU) (Burris and others, 2018).

Colorado Bureau of Land Management Sensitive Species

Of the 112 BLM Colorado sensitive species that were evaluated, 35 species had documented occurrences or potential habitat on at least one IU (table 7). None of the 9 sensitive fish species had documented occurrences or potential habitat on any IUs (Burris and others, 2018). There is only one sensitive insect (currently under review by the U.S. Fish and Wildlife Service under the Endangered Species Act) in Colorado, the Great Basin silverspot, and there were occurrences of this species on 3 IUs (table 7). Only 3 amphibians (boreal toad, northern cricket frog, and northern leopard frog) and 2 reptilies (massasauga and midget faded rattlesnake) had potential habitat on at least one indemnity unit (table 7).

All 15 sensitive bird species had documented occurrences or potential habitat on at least one IU (table 7). Species primarily associated with aquatic habitats are the American white pelican, long-billed curlew, snowy plover, and white-faced ibis. Species primarily associated with grassland habitats are the burrowing owl, ferruginous hawk, golden eagle, and mountain plover. Species primarily associated with shrubland habitats are the Brewer's sparrow, Columbian sharp-tailed grouse, and greater sage-grouse. Other species include the northern goshawk, American peregrine falcon, bald eagle, and black swift.

Of the 11 sensitive mammal species, 9 species had documented occurrences or potential habitat on at least one IU (table 7). The three species of prairie dog, black-tailed, Gunnison's, and white-tailed, are associated with grasslands or shrublands. There were four sensitive bat species with potential summer habitat: Allen's big-eared bat, fringed myotis, spotted bat, and Townsend's big-eared bat. The two other sensitive mammals were the Rocky Mountain bighorn sheep and swift fox.

Of the 67 sensitive plant species, 5 species were potentially present on at least one unit: few-flower ragwort, fragile rockbreak, hairy Townsend daisy, Harrington's beardtongue, and pale blue-eyed grass (table 7). A total of 10 IUs had at least one sensitive plant species potentially present (Burris and others, 2018).

Birds of Conservation Concern

The U.S. Fish and Wildlife Service has identified Birds of Conservation Concern for 37 Bird Conservation Regions (BCRs) in North America. Portions of three BCRs overlap Colorado: Northern Rockies (BCR 10), Southern Rockies/Colorado Plateau (BCR 16), and Shortgrass Prairie (BCR 18). There were 26 Birds of Conservation Concern that have overall ranges coinciding with Colorado (not including 2 federally listed species and 10 species also listed as BLM sensitive species; Burris and others, 2018), 24 of which have potential habitat on at least one IU (table 8). The potential habitat for most of these species is widely distributed throughout Colorado.

Species primarily associated with aquatic communities are the American bittern and upland sandpiper. Species primarily associated with grassland habitats are McGown's longspur, grasshopper sparrow, lark bunting, lesser prairie-chicken, Swainson's hawk, loggerhead shrike, and prairie falcon. Species primarily associated with sagebrush steppe are sage thrasher and sagebrush sparrow. Species primarily associated with woodlands and forests are Bell's vireo, gray vireo, Cassin's finch, flammulated owl, pinyon jay, Grace's warbler, juniper titmouse, Lewis's woodpecker, olive-sided flycatcher, veery, and Williamson's sapsucker. Both the black rosy-finch (winter range only) and brown-capped rosy finch are associated with alpine tundra.

Colorado Big Game Species

Of the 8 big game species managed by Colorado Parks and Wildlife (excluding the Rocky Mountain bighorn sheep listed as sensitive by BLM Colorado), 7 species had potential habitat coincident with at least one IU (table 9). The ungulates include elk, moose, mule deer, pronghorn, and white-tailed deer. The predators include black bear and mountain lion (table 9).

Table 7. Species listed as sensitive by the Bureau of Land Management Colorado that have documented occurrences and (or) potential habitat within at least one indemnity unit.

[See table 1–7 for species scientific names]

Species	Number of indemnity units		
	Occurrences and potential habitat	Potential habitat (without occurrences)	Total
Insects			
Great Basin silverspot	3	0	3
Amphibians			
Boreal toad	4	0	4
Northern cricket frog	0	2	2
Northern leopard frog	0	29	29
Reptiles			
Massasauga	3	17	20
Midget faded rattlesnake	0	6	6
Birds			
American peregrine falcon	5	61	66
American white pelican	0	3	3
Bald eagle	0	19	19
Black swift	0	24	24
Brewer's sparrow	0	63	63
Burrowing owl	0	71	71
Columbian sharp-tailed grouse	0	7	7
Ferruginous hawk	0	64	64
Golden eagle	0	84	84
Greater sage-grouse	0	10	10
Long-billed curlew	0	28	28
Mountain plover	5	36	41
Northern goshawk	0	60	60
Snowy plover	11	1	12
White-faced ibis	5	12	17
Mammals			
Allen's big-eared bat	0	19	19
Black-tailed prairie dog	0	27	27
Fringed myotis	0	86	86
Gunnison's prairie dog	0	36	36
Rocky Mountain bighorn sheep	0	5	5
Spotted bat	0	19	19
Swift fox	0	19	19
Townsend's big-eared bat	0	62	62
White-tailed prairie dog	0	21	21
Plants			
Few-flower ragwort	1	0	1
Fragile rockbrake	4	0	4
Hairy Townsend daisy	2	0	2
Harrington's beardtongue	1	0	1
Pale blue-eyed grass	2	0	2
Total number of indemnity units[1]	27	89	89

[1]Note that indemnity units have occurrences or potential habitat for more than one BLM Colorado sensitive species (table 1–8).

Table 8. Species listed as Birds of Conservation Concern by the U.S. Fish and Wildlife Service that have potential habitat within at least one indemnity unit.

[See table 1–7 for species scientific names. Bird Conservation Regions in Colorado: Northern Rockies (10), Southern Rockies/Colorado Plateau (16), and Shortgrass Prairie (18).]

Species[1]	Number of indemnity units
American bittern	29
Bell's vireo	4
Black rosy-finch	64
Brown-capped rosy-finch	4
Cassin's finch	63
Flammulated owl	34
Grace's warbler	13
Grasshopper sparrow	18
Gray vireo	7
Juniper titmouse	20
Lark bunting	41
Lesser prairie-chicken	2
Lewis's woodpecker	35
Loggerhead shrike	87
McCown's longspur	6
Olive-sided flycatcher	49
Pinyon jay	47
Prairie falcon	89
Sage thrasher	59
Sagebrush sparrow	26
Swainson's hawk	89
Upland sandpiper	3
Veery	21
Williamson's sapsucker	50
Total number of indemnity units[2]	89

Table 9. Species listed as big game by Colorado Parks and Wildlife that have potential habitat within at least one indemnity unit.

[See table 1–7 for species scientific names. This table does not include the Rocky Mountain bighorn sheep, which is also listed as sensitive by the Bureau of Land Management Colorado (table 7) (see also table 1–7)]

Species	Number of indemnity units
Black bear	35
Elk	56
Moose	9
Mountain lion	72
Mule deer	68
Pronghorn	16
White-tailed deer	7
Total number of indemnity units[1]	87

[1]Note that indemnity units may have potential habitat for more than one species (table 1–8).

Summary of Key Findings

Ecological communities, soils, and land uses were summarized for 89 IUs. The most abundant land cover classes in IUs are (a) shrublands and steppe and (b) grasslands. Several IUs with open water border a reservoir. Mountain forests are common on many of the IUs. Only two of the IUs have the potential for moderate salinity, and two additional IUs have potential for elevated selenium. Some land uses would be retained if ownership is transferred to the State, including existing rights of way, oil and gas leases, and active mining claims. In addition, grazing, recreation, and hunting is planned for some of the IUs. Several of the IUs would be included in existing State Wildlife Areas, and a dozen of the IUs would be used to consolidate split estates. The broad-scale effects of development were slightly higher on IUs as compared to BLM lands but were similar to Colorado overall.

There were 72 species of management concern that had documented occurrences or potential habitat within at least one IU, including 1 insect, 3 amphibian, 2 reptile, 43 bird, 18 mammal, and 5 plant species. At total of 50 IUs had documented occurrences or potential habitat coincident with either one or two threatened or endangered species, including the interior least tern, black-footed ferret, Gunnison sage-grouse, Mexican spotted owl, piping plover, and Canada lynx. There were 35 BLM Colorado sensitive species that have potential habitat on at least one IU. In addition, there were 24 Birds of Conservation Concern and 7 big game species (not also listed as federally endangered or BLM Colorado sensitive species) that have potential habitat on at least one IU.

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Appendix 1. Datasets and Methods

Legal Descriptions of Indemnity Units

Table 1–1. Legal descriptions of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado, by BLM field office.

[T., township; R., range; sec., section; N., N, north; S., S, south; E., E, east; W., W, west; NE, northeast; NW, northwest; SE, southeast; SW, southwest; PM prime meridian; MS mineral survey]

County	Indemnity unit code	Legal description
		Colorado River Valley (CR)
Eagle (EAGL)	CR_EAGL_SM_007	T. 4 S., R. 83 W., sec. 17, NE¼SW¼, NW¼ SE¼, Lot 2, Lot 5
	CR_EAGL_SM_008	T. 4 S., R. 83 W., sec. 22, SE¼SE¼; sec. 23, W½SW¼, Lot 6 thru Lot 8
Garfield (GARF)	CR_GARF_SM_001	T. 5 S., R. 93 W., sec. 36, NW¼NE¼, N½NW¼, NE¼SW¼
	CR_GARF_SM_002	T. 5 S., R. 92 W., sec. 30, W½SE¼
	CR_GARF_SM_003	T. 7 S., R. 89 W., sec. 3, SE¼NE¼, E½SE¼, E½NW¼SE¼, E½W½NW¼SE¼, Lot 1
	CR_GARF_SM_004	T. 7 S., R. 89 W., sec. 12, W½SW¼, Lot 22; sec. 13, NW¼
	CR_GARF_SM_005	T. 7 S., R. 88 W., sec. 7, Lot 12, Lot 13; sec. 8, SW¼NE¼, SE¼NW¼, Lot 7
	CR_GARF_SM_006	T. 7 S., R. 88 W., sec. 17, Lot 3, Lot 19
		Kremmling (KR)
Grand (GRAN)	KR_GRAN_SM_012	T. 4 N., R. 81 W., sec. 34, W½NW¼, NW¼SW¼
	KR_GRAN_SM_013	T. 3 N., R. 82 W., sec. 26, Lot 1
	KR_GRAN_SM_014	T. 3 N., R. 77 W., sec. 25, S½SW¼, SW¼SE¼
	KR_GRAN_SM_015	T. 1 N., R. 76½ W., sec. 1, Lot 15, Lot 16; sec. 12, Lot 1 thru Lot 6, Lot 11, Lot 12; T. 1 N., R. 77 W., sec. 12, E½NE¼, NE¼SE¼
Jackson (JACK)	KR_JACK_SM_009	T. 6 N., R. 81 W., sec. 18, Lot 5; T. 6 N., R. 82 W., sec. 13, SE¼SE¼
	KR_JACK_SM_010	T. 6 N., R. 82 W., sec. 23, N½NE¼, SE¼NE¼
	KR_JACK_MO_011	T. 6 N., R. 79 W., sec. 3, SW¼SW¼; sec. 4, Lot 3, Lot 4, SW¼NE¼, S½NW¼, SW¼, SE¼; sec. 5, Lot 1, Lot 2, S½NE¼, SE¼; sec. 8, N½NE¼, SE¼NE¼, E½SE¼; sec. 9 (all); sec. 10, W½NW¼, W½SW¼; T. 7 N., R. 79 W., sec. 32, SE¼; sec. 33, W½SW¼
		Little Snake (LS)
Moffat (MOFF)	LS_MOFF_SM_016	T. 7 N., R. 93 W., sec. 36 (all)
Routt (ROUT)	LS_ROUT_SM_017	T. 8 N., R. 88 W., sec. 34, Lot 12, Lot 13, Lot 14, Lot 15
	LS_ROUT_SM_018	T. 7 N., R. 88 W., sec. 2, SE¼NW¼
	LS_ROUT_MO_019	T. 7 N., R. 88 W., sec. 1, SW¼NW¼, W½SW¼, SE¼SW¼; sec. 1, those portions of SE¼NW¼, NE¼SW¼, NW¼SE¼, and SW¼SE¼ that lie west of Routt County Road 80A; sec. 2, S½NE¼, SE¼; sec. 10, NE¼, NW¼; sec. 11, N½, SE¼; sec. 12, portions of NW¼ and SW¼ that lie west of the county road
	LS_ROUT_MO_020	T. 5 N., R. 88 W., sec. 12, NW¼, SW¼
	LS_ROUT_SM_021	T. 8 N., R. 85 W., sec. 16, Lot 4, Lot 5
	LS_ROUT_SM_022	T. 7 N., R. 85 W., sec. 17, W½NE¼
	LS_ROUT_SM_023	T. 6 N., R. 86 W., sec. 33, SW¼SW¼
	LS_ROUT_SM_024	T. 6 N., R. 84 W., sec. 27, SE¼SE¼
		Royal Gorge (RG)
Bent (BENT)	RG_BENT_MO_057	T. 21 S., R. 51 W., sec. 35, NE¼SW¼
	RG_BENT_MO_058	T. 22 S., R. 52 W., sec. 15, SW¼NE¼, NW¼SE¼, NW¼SW¼

Table 1–1. Legal descriptions of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado, by BLM field office.—Continued

[T., township; R., range; sec., section; N., N, north; S., S, south; E., E, east; W., W, west; NE, northeast; NW, northwest; SE, southeast; SW, southwest; PM prime meridian; MS mineral survey]

County	Indemnity unit code	Legal description
		Royal Gorge (RG)—Continued
Chaffee (CHAF)	RG_CHAF_MO_067	T. 15 S., R. 78 W., sec. 17, SW¼NW¼; sec. 18, N½SE¼, SW¼SE¼. [includes geothermal].
	RG_CHAF_SM_068	(New Mexico PM) T. 50 N., R. 8 E., sec. 7, NE¼NE¼
Custer (CUST)	RG_CUST_SM_025	T. 22 S., R. 72 W., sec. 4, SW¼NW¼, W½SW¼, SE¼SW¼, SW¼SE¼, NE¼SE¼, Lot 41, Lot 42, Lot 47; sec. 5, S½NE¼, SE¼NW¼, E½SW¼, NW¼SW¼, SE¼ [where BLM owns surface minerals]
	RG_CUST_SM_026	T. 22 S., R. 72 W., sec. 8, SE¼SE¼; sec. 9, W½; sec. 16, Lot 20, Lots 23 thru36, Lot 38; sec. 17, NW¼NE¼ [where BLM owns surface minerals]
	RG_CUST_SM_027	T. 22 S., R. 72 W., sec. 12, SE¼SE¼, Lot 3
	RG_CUST_SM_028	T. 22 S., R. 72 W., sec. 22, N½NE¼
	RG_CUST_SM_029	T. 22 S., R. 72 W., sec. 26, SE¼SW¼
	RG_CUST_SM_030	T. 22 S., R. 72 W., sec. 28, N½SW¼, SE¼SW¼, W½SE¼, SE¼SE¼
	RG_CUST_SM_031	T. 22 S., R. 71 W., sec. 5, Lot 20 thru Lot 23; sec. 6, Lot 13; sec. 8, NW¼NW¼; sec. 17, Lot 24
El Paso (ELPA)	RG_ELPA_SM_037	T. 16 S., R. 62 W., sec. 24, NW¼NW¼
	RG_ELPA_SM_038	T. 17 S., R. 62 W., sec. 1, SE¼NE¼, Lot 1
	RG_ELPA_SM_039	T. 17 S., R. 62 W., sec. 9, SE¼SE¼
Huerfano (HUER)	RG_HUER_MO_032	T. 28 S., R. 69 W., sec. 17, SE¼SE¼; sec. 20, NE¼, NE¼NW¼; sec. 21, W½NW¼, NE¼, SE¼NW¼, NE¼SE¼; sec. 22, W½SW¼, SE¼SW¼, SW¼SE¼; sec. 27, NW¼NE¼, NE¼NW¼
	RG_HUER_SM_033	T. 29 S., R. 69 W., sec. 31, NE¼NW¼, NE¼NE¼
	RG_HUER_SM_034	T. 29 S., R. 69 W., sec. 31, E½SW¼, SE¼, Lot 3, Lot 4; sec. 32, SW¼NW¼, W½SW¼, SE¼SW¼
	RG_HUER_SM_035	T. 29 S., R. 69 W., sec. 32, SE¼SE¼
	RG_HUER_SM_036	T. 29 S., R. 70 W., sec. 35, Lot 1
Kiowa (KIOW)	RG_KIOW_MO_050	T. 17 S., R. 48 W., sec. 18, NW¼NE¼
	RG_KIOW_SM_051	T. 19 S., R. 45 W., sec. 10, S½NE¼; sec. 11, SW¼; sec. 14, NE¼, NW¼, SE¼; sec. 15, NE¼
	RG_KIOW_SM_052	T. 20 S., R. 47 W., sec. 4, S½NW¼, SW¼, W½SE¼; sec. 5, S½NW¼, S½NE¼, SW¼, SE¼, Lot 1 thru Lot 4
	RG_KIOW_SM_053	T. 20 S., R. 47 W., sec. 8, NE¼NE¼, W½NE¼, SE¼NE¼, NW¼, NE¼SW¼, NW¼SE¼; sec. 9, NE¼, NW¼, N½SW¼, SE¼, SE¼SW¼; sec. 10, SW¼, SW¼SE¼; sec. 15, NW¼NE¼
	RG_KIOW_SM_054	T. 20 S., R. 47 W., sec. 22, SE¼NE¼, E½SE¼; sec. 23, S½NW¼, SW¼; sec. 26, W½NE¼, NW¼, N½SW¼, NW¼SE¼; sec. 27, NE¼NE¼
	RG_KIOW_SM_055	T. 20 S., R. 48 W., sec. 10, W½SW¼; sec. 15, W½NW¼, NW¼SW¼
	RG_KIOW_SM_056	T. 20 S., R. 48 W., sec. 13, S½NW¼, SW¼, W½SE¼; sec. 14, SE¼SW¼, SE¼; sec. 22, E½SE¼; sec. 23 (all); sec. 24, NW¼NE¼, NW¼, N½SW¼, SW¼SW¼; sec. 26, NE¼, NW¼, W½SW¼; sec. 27, E½NE¼
Park (PARK)	RG_PARK_SM_059	T. 11 S., R. 74 W., sec. 20, NE¼; sec. 21, NW¼, SW¼
	RG_PARK_SM_060	T. 12 S., R. 75 W., sec. 17, SW¼; sec. 18, E½NW¼, E½SW¼, SE¼, Lot 1 thru Lot 4; sec. 19, N½NE¼, SW¼NE¼, E½NW¼, Lot 1, Lot 2
	RG_PARK_SM_061	T. 12 S., R. 76 W., sec. 13, E½SE¼; sec. 24, NE¼
	RG_PARK_SM_062	T. 13 S., R. 76 W., sec. 4, SW¼NW¼, NW¼SW¼, Lot thru Lot 4; sec. 5, S½NE¼, S½NW¼, SW¼, SE¼, Lot 1 thru 4

Table 1–1. Legal descriptions of indemnity units in Colorado identified as suitable for transfer of ownership from the Bureau of Land Management (BLM) to the State of Colorado, by BLM field office.—Continued

[T., township; R., range; sec., section; N., N, north; S., S, south; E., E, east; W., W, west; NE, northeast; NW, northwest; SE, southeast; SW, southwest; PM prime meridian; MS mineral survey]

County	Indemnity unit code	Legal description
		Royal Gorge (RG)—Continued
Park (PARK)	RG_PARK_SM_063	T. 13 S., R. 76 W., sec. 6, E½ SW¼, Lot 6, Lot 7
	RG_PARK_SM_064	T. 12 S., R. 77 W., sec. 23, N½SW¼, N½SE¼
	RG_PARK_SM_065	T. 12 S., R. 77 W., sec. 25, S½SE¼
	RG_PARK_SM_066	T. 12 S., R. 77 W., sec. 34, NW¼SW¼
Pueblo (PUEB)	RG_PUEB_SM_040	T. 18 S., R. 61 W., sec. 8, SE¼SE¼
	RG_PUEB_SM_041	T. 18 S., R. 61 W., sec. 19, E½SW¼, SE¼, Lot 3, Lot 4
	RG_PUEB_SM_042	T. 18 S., R. 61 W., sec. 30, SE¼NW¼, E½SW¼, W½SE¼, Lot 2 thru Lot 4
	RG_PUEB_SM_043	T. 18 S., R. 61 W., sec. 32 (all)
	RG_PUEB_SM_044	T. 19 S., R. 61 W., sec. 6, E½SW¼, SE¼, S½NE¼, SE¼NW¼, Lot 1thru 7; sec. 7, E½NE¼, E½SE¼; Sec, 8, W½NW¼, W½SW¼
	RG_PUEB_SM_045	T. 19 S., R. 61 W., sec. 18, NE¼, SE¼, E½NW¼, E½SW¼, Lot 1thru Lot 4; sec. 19, NE¼, E½NW¼, E½SW¼, Lot 1 thru 4; sec. 20 (all)
	RG_PUEB_SM_046	T. 19 S., R. 61 W., sec. 28, NE¼, SE¼; sec. 29, NW¼, SW¼; sec. 32, NE¼, SE¼; sec. 33 (all)
	RG_PUEB_SM_047	T. 20 S., R. 61 W., sec. 4, S½NE¼, S½NW¼, SW¼, SE¼, Lot 1thru 4; sec. 5, S½NE¼, SE¼, Lot 1, Lot 2; sec. 9, NE¼, SE¼
	RG_PUEB_SM_048	T. 20 S., R. 61 W., sec. 7, SE¼SW¼, Lot 2, Lot 3
	RG_PUEB_SM_049	T. 20 S., R. 61 W., sec. 18, SW¼SE¼
Weld (WELD)	RG_WELD_MO_069	T. 12 N., R. 56 W., sec. 28, E½
	RG_WELD_MO_070	T. 9 N., R. 56 W., sec. 24, SW¼
	RG_WELD_MO_071	T. 5 N., R. 61 W., sec. 33, SW¼
	RG_WELD_MO_072	T. 11 N., R. 59 W., sec. 15, NE¼
	RG_WELD_MO_073	T. 3 N., R. 62 W., sec. 1, SE¼
		Tres Rios (TR)
Dolores (DOLO)	TR_DOLO_SM_074	T. 42 N., R. 13 W., sec. 30, NE¼NE¼
	TR_DOLO_SM_075	T. 40 N., R. 15 W., sec. 1, Lot 1thru 4
	TR_DOLO_SM_076	T. 40 N., R. 15 W., sec. 3, Lot 3, Lot 4
	TR_DOLO_SM_077	T. 40 N., R. 15 W., sec. 4, Lot 1thru 4
	TR_DOLO_SM_078	T. 40 N., R. 15 W., sec. 10, N½NE¼, E½NW¼
	TR_DOLO_SM_079	T. 40 N., R. 15 W., sec. 11, NE¼, NW¼, N½SW¼, SW¼SW¼
	TR_DOLO_SM_080	T. 40 N., R. 14 W., sec. 6, NE¼SW¼, Lot 13
	TR_DOLO_SM_081	T. 41 N., R. 14 W., sec. 28, S½SW¼
	TR_DOLO_SM_082	T. 41 N., R. 14 W., sec. 29, SW¼, NE¼SE¼, S½SE¼
	TR_DOLO_SM_083	T. 41 N., R. 14 W., sec. 30, N½SE¼
	TR_DOLO_SM_084	T. 41 N., R. 14 W., sec. 31, N½SE¼
	TR_DOLO_SM_085	T. 41 N., R. 14 W., sec. 32, N½NW¼, SW¼NW¼
		Uncompahgre (UN)
Ouray (OURA)	UN_OURA_SM_086	T. 44 N., R. 8 W., sec. 11, Lots 12 through 14, excluding M.S. No. 9195
	UN_OURA_SM_087	T. 44 N., R. 8 W., sec. 13, Lot 17, Lot 28, Lot 30, Lot 31
	UN_OURA_SM_088	T. 44 N., R. 8 W., sec. 14, E½SE¼
San Miguel (SANM)	UN_SANM_SM_089	T. 43 N., R. 14 W., sec. 2, S½NE¼, Lot 1, Lot 2

Associated Data Releases

Datasets summarized for Colorado (Carr and others, 2018) and for indemnity units (Burris and others, 2018) and methodological details for all data summaries are provided in U.S. Geological Survey data releases (table 1–2).

Methods

Data Sources for Colorado Summaries

See table 1–3 for data sources used to map ecological communities, soils, geology, and development in Colorado.

Ecological Communities

We selected LANDFIRE as the primary source dataset for mapping ecological communities (Carr and others, 2018). In areas of broad-scale discrepancies among LANDFIRE and National Gap Analysis Project (U.S. Geological Survey 2016a), ancillary datasets were used to evaluate and, if needed, to modify LANDFIRE Existing Vegetation Types (table 1–3) (Carr and others, 2018). Additional methodological details are provided in Carr and others (2018).

Salinity and Selenium

Salinity and selenium were summarized using the datasets listed in table 1–3. Indemnity units with electrical conduction of soils greater than or equal to 8 decisiemens per meter are considered to have potential elevated salinity levels (table 1–4). Potential for selenium was based on the presence of deep-seated plutonic rocks (table 1–5).

Terrestrial Development Index

To assess development levels in each IU, we used the total surface footprint from development (agricultural croplands, urban areas, roads, railroads, and energy and minerals) (Carr and others, 2017). We also quantified the broad-scale effects of development by using the terrestrial development index (TDI) for two analysis window sizes (1-kilometer [km] radius and 5-km radius), as described in Carr and others (2017). We conducted a preliminary analysis and found that 1-km and 5-km radii were most efficient at capturing spatial patterning of the development footprint in Colorado. The TDI for each analysis scale is a 30×30-meter raster dataset, with scores ranging from 0 to 100 percent. For visualization and analysis purposes, we divided the TDI scores into seven classes (Carr and others, 2018).

Access Limitations on Current Use of BLM Lands Open for Hunting and Recreation

All BLM lands are open for public recreation including hunting. Some isolated parcels, however, may not be readily accessible to the public for recreation because they are surrounded by non-Federal lands and are not served by public roads. IUs were assumed to be accessible if they were (1) surrounded by Federal lands and (or) accessible by primary or secondary roads or (2) adjacent to State lands that permitted hunting and (or) recreation. IUs were assumed to have potential access limitations if they were not accessible by primary or secondary roads and were surrounded by State lands that did not permit hunting and (or) recreation and by private lands (table 4).

Table 1–2. U.S. Geological Survey data releases and associated datasets used to create tables and figures in this report.

Dataset format	Dataset name	Table or figure
	Colorado (Carr and others, 2018)	
Raster	Ecological communities	Table 3; figures 3 to 10
	Soil salinity using electrical conductance	Figure 11
	Terrestrial development index using 1-kilometer moving window	Figures 12, 14
	Terrestrial development index using 5-kilometer moving window	Figures 13, 14
	Indemnity units (Burris and others, 2018)	
Geospatial	Indemnity unit locations	Tables 1−1 and 1−7; figure 1
	Soil salinity using electrical conductance	Table 1−4
Comma-separated values	Land cover types	Table 3
	Terrestrial development	Figure 14
	Potential species of management concern	Tables 6 to 9, 1–7 to 1–8

Table 1–3. Data sources used to map ecological communities, soils, and development in Colorado. Variables and data types for each component are provided.

[TIGER, Topologically Integrated Geographic Encoding and Referencing]

Component	Data type	Data sources
Terrestrial and aquatic communities	Ecological communities	LANDFIRE (2016b), National Gap Analysis Project (U.S. Geological Survey, 2016a), Reese and others (2017)
	Playa wetlands	Playa Lakes and Rainwater Basin Joint Ventures (2016)
Soils	Salinity	SSURGO (Natural Resources Conservation Service, 2012)
	Selenium	Stoeser and others (2005)
Development	Estimated surface disturbance footprint from development	Reese and others (2017)
Accessibility for hunting and recreation	Roads	TIGER (U.S. Census Bureau, 2016), World Imagery (Esri, 2017)
	Land ownership or jurisdiction and land use	Colorado Hunting Atlas (Colorado Parks and Wildlife, 2017b), Protected Areas Database of the United States (U.S. Geological Survey, 2016b), 2017 Colorado Recreation Lands (Colorado Parks and Wildlife, 2017a)

Table 1–4. Indemnity units with potential for high soil salinity levels based on electrical conductance greater than or equal to 8 decisiemens per meter.

[Multiple soil components can be present within indemnity units.]

Indemnity unit[1]	Soil components present	Electrical conductance range (decisiemens per meter)[2]
RG_KIOW_SM_053	Bijou, playas, fluvaquents	0–8
RG_KIOW_SM_054	Wilid, fluvaquents, Fort Collins, water	0–8

[1]Soils data were lacking for indemnity units UN_OURA_SM_086 and UN_OURA_SM_087. Portions of some indemnity units were based on partial coverage of soil components (Burris and others, 2018).

[2]Electrical conductance from SSURGO (Natural Resources Conservation Service, 2012).

Table 1–5. Indemnity units with potential for selenium based on geology.

Indemnity unit[1]	Geological description
KR_GRAN_SM_014	Cretaceous shale; Tertiary plutonic rock[2] (phaneritic)
RG_CUST_SM_031	Early Proterozoic felsic gneiss-mafic gneiss; Tertiary quartz latite; Tertiary plutonic rock[2] (phaneritic)

[1]Geology data were lacking for one indemnity unit, RG_CHAF_GO_067.

[2]Deep-seated plutonic rocks potentially contain elevated selenium concentrations.

To determine surrounding land ownership for all parcels, we used the Protected Area Database of the United States (PAD-US) (U.S. Geological Survey, 2016b) and the Colorado Parks and Wildlife Hunting Atlas (Colorado Parks and Wildlife, 2017b). Permitted hunting and recreation use of adjacent State lands was determined using Colorado Parks and Wildlife (2017a). We used primary and secondary roads to determine the presence of public roads providing access to IUs (U.S. Census Bureau, 2016). We evaluated access limitations for hunting and recreation for IUs by visually comparing all data layers in ArcGIS. We confirmed the presence or absence of roads using aerial imagery (Esri, 2017). Roads lacking a name or county designation and four-wheel drive roads were assumed to be inaccessible.

Current and Future Land Uses of Indemnity Units

See table 1–6 for a summary of land uses for each indemnity unit.

Species of Management Concern

We compiled occurrence, potential habitat, and overall range datasets for all 179 species or subspecies of management concern (tables 1–7 and 1–8) (Burris and others, 2018). Data sources and methodological details are provided in Burris and others (2018). See table 1–7 for the status of the 72 species with documented occurrences or potential habitat on indemnity units. The number of species of management concern by indemnity unit and status is summarized in table 1–8.

Table 1–6. Summary of current, pending, and future land uses for each indemnity unit, by Bureau of Land Management field office.

[Land use codes: A, Currently allowed, but surrounding land ownership may limit public access for recreation or hunting; C, Current use as determined by the Bureau of Land Management Colorado; F, Future land use as determined by the Colorado Land Board (no information on future use was available for oil and gas or for minerals; rights of way, oil and gas leases, active mining claims, and leases will transfer with conveyance to the State of Colorado); P, Pending uses currently under review, as determined by the Bureau of Land Management Colorado; T, Current use would transfer]

Indemnity unit code[1]	Land use or management status								
	Grazing allotment	Recreation	Hunting	Right of way	Oil and gas lease	Active mining claim	Mineral materials site	State Wildlife Area	Consolidate a split estate
Colorado River Valley (CR)									
CR_EAGL_SM_007	C F	C	C	C T P					
CR_EAGL_SM_008	C F	A	A	C T					
CR_GARF_SM_001	C F	C	C F	C T	C T				
CR_GARF_SM_002	C F	A	A F						
CR_GARF_SM_003	C F	C	C	C T					
CR_GARF_SM_004	C F	A	A	C T					
CR_GARF_SM_005	F	A	A	C T					
CR_GARF_SM_006	F	C	C						
Kremmling (KR)									
KR_GRAN_SM_012	C F	C	C	C T	C T				
KR_GRAN_SM_013	C F	C	C F						
KR_GRAN_SM_014	C F	A	C		C T				
KR_GRAN_SM_015	C F	A	C	C T					
KR_JACK_MO_011	C	A	A						F
KR_JACK_SM_009	C	A F	C F		C T P				
KR_JACK_SM_010	C	A F	CF		C T				

Table 1–6. Summary of current, pending, and future land uses for each indemnity unit, by Bureau of Land Management field office.—Continued

[Land use codes: A, Currently allowed, but surrounding land ownership may limit public access for recreation or hunting; C, Current use as determined by the Bureau of Land Management Colorado; F, Future land use as determined by the Colorado Land Board (no information on future use was available for oil and gas or for minerals; rights of way, oil and gas leases, active mining claims, and leases will transfer with conveyance to the State of Colorado); P, Pending uses currently under review, as determined by the Bureau of Land Management Colorado; T, Current use would transfer]

Indemnity unit code[1]	Land use or management status								
	Grazing allotment	Recreation	Hunting	Right of way	Oil and gas lease	Active mining claim	Mineral materials site	State Wildlife Area	Consolidate a split estate
Little Snake (LS)									
LS_MOFF_SM_016	C F	A	A						
LS_ROUT_MO_019	C	A	C						F
LS_ROUT_MO_020	C F	A	C F	C T	C T				F
LS_ROUT_SM_017	C F	C	C F						
LS_ROUT_SM_018	C F	C	C F						
LS_ROUT_SM_021	F	A	C						
LS_ROUT_SM_022	C F	A	C						
LS_ROUT_SM_023	C F	A	C						
LS_ROUT_SM_024	F	C	C						
Royal Gorge (RG)									
RG_BENT_MO_057	C	A	C					F	F
RG_BENT_MO_058		C	C						F
RG_CHAF_MO_067	F	C	C F	C T					F
RG_CHAF_SM_068	C F	A	A					F	
RG_CUST_SM_025	C F	A	C	C T		C T			
RG_CUST_SM_026	C F	C	C	C T P		C T	C T		
RG_CUST_SM_027	F	C	C						
RG_CUST_SM_028	C F	A	C	C T					
RG_CUST_SM_029	C F	A	A						
RG_CUST_SM_030	C F	C	C	C T					
RG_CUST_SM_031	C F	C	C	C T P					
RG_ELPA_SM_037	F	A	A						
RG_ELPA_SM_038	F	A	A						
RG_ELPA_SM_039	F	A	A						
RG_HUER_MO_032	C	A	A		C T				F
RG_HUER_SM_033	C F	A	A F	C T					
RG_HUER_SM_034	C F	A	A F	C T					
RG_HUER_SM_035	F	A	A F						
RG_HUER_SM_036	F	A	A F						
RG_KIOW_MO_050		C	C						F
RG_KIOW_SM_051	C F	C	C	C T	C T				
RG_KIOW_SM_052		A	A	C T	P			F	
RG_KIOW_SM_053		A	A	C T	C T			F	

Table 1–6. Summary of current, pending, and future land uses for each indemnity unit, by Bureau of Land Management field office. —Continued

[Land use codes: A, Currently allowed, but surrounding land ownership may limit public access for recreation or hunting; C, Current use as determined by the Bureau of Land Management Colorado; F, Future land use as determined by the Colorado Land Board (no information on future use was available for oil and gas or for minerals; rights of way, oil and gas leases, active mining claims, and leases will transfer with conveyance to the State of Colorado); P, Pending uses currently under review, as determined by the Bureau of Land Management Colorado; T, Current use would transfer]

Indemnity unit code[1]	Land use or management status								
	Grazing allotment	Recreation	Hunting	Right of way	Oil and gas lease	Active mining claim	Mineral materials site	State Wildlife Area	Consolidate a split estate
Royal Gorge (RG)—Continued									
RG_KIOW_SM_054		C	C	C T	C T P			F	
RG_KIOW_SM_055		A	C	C T				F	
RG_KIOW_SM_056		C	C	C T	C T			F	
RG_PARK_SM_059		A	A		C T				
RG_PARK_SM_060	C F	A	A			C T			
RG_PARK_SM_061	C F	A	A						
RG_PARK_SM_062	C F	A	A	C T					
RG_PARK_SM_063	C F	C	C						
RG_PARK_SM_064	F	C	C						
RG_PARK_SM_065	C F	A	A						
RG_PARK_SM_066	F	A	A						
RG_PUEB_SM_040	F	A	A						
RG_PUEB_SM_041	C F	A	A						
RG_PUEB_SM_042	C F	C	C						
RG_PUEB_SM_043	C F	C	C	C T					
RG_PUEB_SM_044	C F	A	A	C T					
RG_PUEB_SM_045	C F	C	C	C T					
RG_PUEB_SM_046	C F	A	C	C T					
RG_PUEB_SM_047	C F	A	C						
RG_PUEB_SM_048	C F	A	C	C T					
RG_PUEB_SM_049	C F	A	C						
RG_WELD_MO_069		C	C		C T				F
RG_WELD_MO_070		A	A		C T				F
RG_WELD_MO_071		A	A		C T				F
RG_WELD_MO_072		C	C		C T				F
RG_WELD_MO_073		A	A		C T				F
Tres Rios (TR)									
TR_DOLO_SM_074	C	C F	C F	C T				F	
TR_DOLO_SM_075	C F	A	C F						
TR_DOLO_SM_076	F	A	C F						
TR_DOLO_SM_077	F	C	C F						
TR_DOLO_SM_078	C F	A	C F						
TR_DOLO_SM_079	C F	A	C F						

Table 1–6. Summary of current, pending, and future land uses for each indemnity unit, by Bureau of Land Management field office. —Continued

[Land use codes: A, Currently allowed, but surrounding land ownership may limit public access for recreation or hunting; C, Current use as determined by the Bureau of Land Management Colorado; F, Future land use as determined by the Colorado Land Board (no information on future use was available for oil and gas or for minerals; rights of way, oil and gas leases, active mining claims, and leases will transfer with conveyance to the State of Colorado); P, Pending uses currently under review, as determined by the Bureau of Land Management Colorado; T, Current use would transfer]

Indemnity unit code[1]	Land use or management status								
	Grazing allotment	Recreation	Hunting	Right of way	Oil and gas lease	Active mining claim	Mineral materials site	State Wildlife Area	Consolidate a split estate
Tres Rios (TR)—Continued									
TR_DOLO_SM_080	C F	A	C F						
TR_DOLO_SM_081	C F	A	C F						
TR_DOLO_SM_082	C F	A	C F						
TR_DOLO_SM_083	C F	A	C F						
TR_DOLO_SM_084	C F	A	C F						
TR_DOLO_SM_085	C F	A	C F						
Uncompahgre (UN)									
UN_OURA_SM_086	C	C F	C F	C T					
UN_OURA_SM_087	C	C F	C F	C T					
UN_OURA_SM_088	C	C F	C F	C T					
UN_SANM_SM_089	C	A	C	C T					

[1]Indemnity unit code combines 2 letters for field office, 4 for county name, and 2 for kind of estate (SM, surface and mineral; MO, mineral only) followed by a three-digit unique numeric identifier.

Table 1–7. The status of 72 species that have documented occurrences and (or) potential habitat within indemnity units, by taxa.

[The full list of 179 species of management concern evaluated are provided in Burris and others (2018). BLM Colo., Bureau of Land Management Colorado; FWS, U.S. Fish and Wildlife Service; BCR, Bird Conservation Region; CPW, Colorado Parks and Wildlife; –, not applicable]

Common name	Scientific name[1]	Status			
		Federal	BLM Colo.	FWS—BCR[2]	CPW
	Insects				
Great Basin silverspot	*Speyeria nokomis nokomis*	–	Sensitive	–	–
	Amphibians				
Boreal toad	*Anaxyrus boreas boreas*	–	Sensitive	–	–
Northern cricket frog	*Acris crepitans*	–	Sensitive	–	–
Northern leopard frog	*Lithobates pipiens*	–	Sensitive	–	–
	Reptiles				
Massasauga	*Sistrurus catenatus*	–	Sensitive	–	–
Midget faded rattlesnake	*Crotalus oreganus concolor*	–	Sensitive	–	–
	Birds				
American bittern	*Botaurus lentiginosus*	–	–	16	–
American peregrine falcon	*Falco peregrinus anatum*	–	Sensitive	10, 16	–
American white pelican	*Pelecanus erythrorhynchos*	–	Sensitive	–	–
Bald eagle	*Haliaeetus leucocephalus*	–	Sensitive	10, 16, 18	–
Bell's vireo	*Vireo bellii*	–	–	18	–
Black rosy-finch	*Leucosticte atrata*	–	–	10, 16	–
Black swift	*Cypseloides niger*	–	Sensitive	10	–
Brewer's sparrow	*Spizella breweri*	–	Sensitive	10, 16	–
Brown-capped rosy-finch	*Leucosticte australis*	–	–	16	–
Burrowing owl	*Athene cunicularia*	–	Sensitive	16, 18	–
Cassin's finch	*Haemorhous cassinii*	–	–	10, 16	–
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	–	Sensitive	–	–
Ferruginous hawk	*Buteo regalis*	–	Sensitive	10, 16	–
Flammulated owl	*Otus flammeolus*	–	–	10, 16	–
Golden eagle	*Aquila chrysaetos*	–	Sensitive	16, 18	–
Grace's warbler	*Setophaga graciae*	–	–	16	–
Grasshopper sparrow	*Ammodramus savannarum*	–	–	16	–
Gray vireo	*Vireo vicinior*	–	–	16	–
Greater sage-grouse	*Centrocercus urophasianus*	–	Sensitive	–	–
Gunnison sage-grouse	*Centrocercus minimus*	Threatened	–	16	–
Interior least tern	*Sternula antillarum athalassos*	Endangered	–	–	–
Juniper titmouse	*Baeolophus ridgwayi*	–	–	16	–
Lark bunting	*Calamospiza melanocorys*	–	–	18	–
Lesser prairie-chicken	*Tympanuchus pallidicinctus*	–	–	18	–
Lewis's woodpecker	*Melanerpes lewis*	–	–	10, 16, 18	–
Loggerhead shrike	*Lanius ludovicianus*	–	–	10	–
Long-billed curlew	*Numenius americanus*	–	Sensitive	10, 16, 18	–
McCown's longspur	*Rhynchophanes mccownii*	–	–	10, 18	–
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	–	–	–
Mountain plover	*Charadrius montanus*	–	Sensitive	16, 18	–
Northern goshawk	*Accipiter gentilis*	–	Sensitive	–	–
Olive-sided flycatcher	*Contopus cooperi*	–	–	10	–
Pinyon jay	*Gymnorhinus cyanocephalus*	–	–	16	–
Piping plover	*Charadrius melodus*	Threatened	–	–	–
Prairie falcon	*Falco mexicanus*	–	–	16, 18	–
Sage thrasher	*Oreoscoptes montanus*	–	–	10	–

Table 1–7. The status of 72 species that have documented occurrences and (or) potential habitat within indemnity units, by taxa. —Continued

[The full list of 179 species of management concern evaluated are provided in Burris and others (2018). BLM Colo., Bureau of Land Management Colorado; FWS, U.S. Fish and Wildlife Service; BCR, Bird Conservation Region; CPW, Colorado Parks and Wildlife; –, not applicable]

Common name	Scientific name[1]	Status			
		Federal	BLM Colo.	FWS—BCR[2]	CPW
Birds—Continued					
Sagebrush sparrow	*Artemisiospiza nevadensis*	–	–	10	–
Snowy plover	*Charadrius nivosus*	–	Sensitive	16, 18	–
Swainson's hawk	*Buteo swainsoni*	–	–	10	–
Upland sandpiper	*Bartramia longicauda*	–	–	10, 18	–
Veery	*Catharus fuscescens*	–	–	16	–
White-faced ibis	*Plegadis chihi*	–	Sensitive	–	–
Williamson's sapsucker	*Sphyrapicus thyroideus*	–	–	10	–
Mammals					
Allen's big-eared bat	*Idionycteris phyllotis*	–	Sensitive	–	–
Black bear	*Ursus americanus*	–	–	–	Big game
Black-footed ferret	*Mustela nigripes*	Endangered[3]	–	–	–
Black-tailed prairie dog	*Cynomys ludovicianus*	–	Sensitive	–	–
Canada lynx	*Lynx canadensis*	Threatened[4]	–	–	–
Elk	*Cervus elaphus canadensis*	–	–	–	Big game
Fringed myotis	*Myotis thysanodes*	–	Sensitive	–	–
Gunnison's prairie dog	*Cynomys gunnisoni*	–	Sensitive	–	–
Moose	*Alces alces*	–	–	–	Big game
Mountain lion	*Puma concolor*	–	–	–	Big game
Mule deer	*Odocoileus hemionus*	–	–	–	Big game
Pronghorn	*Antilocapra americana*	–	–	–	Big game
Rocky Mountain bighorn sheep	*Ovis canadensis canadensis*	–	Sensitive	–	Big game
Spotted bat	*Euderma maculatum*	–	Sensitive	–	–
Swift fox	*Vulpes velox*	–	Sensitive	–	–
Townsend's big-eared bat	*Corynorhinus townsendii*	–	Sensitive	–	–
White-tailed deer	*Odocoileus virginianus*	–	–	–	Big game
White-tailed prairie dog	*Cynomys leucurus*	–	Sensitive	–	–
Plants					
Few-flower ragwort	*Packera pauciflora*	–	Sensitive	–	–
Fragile rockbrake	*Cryptogramma stelleri*	–	Sensitive	–	–
Hairy Townsend daisy	*Townsendia strigosa*	–	Sensitive	–	–
Harrington's beardtongue	*Penstemon harringtonii*	–	Sensitive	–	–
Pale blue-eyed grass	*Sisyrinchium pallidum*	–	Sensitive	–	–

[1]All scientific names are taken from the Integrated Taxonomic Information System (ITIS; https://itis.gov). Some common names are not provided by ITIS (Great Basin silverspot, Columbian sharp-tailed grouse, interior least tern, Mexican spotted owl, elk), so they are taken from related legal documentation or local usage. The common name given in ITIS for *Packera pauciflora* is alpine groundsel, but few-flower ragwort is used to correspond with related legal documentation and local usage.

[2]Bird Conservation Regions in Colorado: 10, Northern Rockies; 16, Southern Rockies/Colorado Plateau; 18, Shortgrass Prairie (U.S. Fish and Wildlife Service, 2008).

[3]The black-footed ferret in Colorado is classified as an experimental population, nonessential (U.S. Fish and Wildlife Service, 2013d).

[4]The Canada lynx is listed as federally threatened, but this listing is under review by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 2018).

Table 1–8. Number of species of management concern that have documented occurrences and (or) potential habitat for each indemnity unit and status.

[BLM Colo., Bureau of Land Management Colorado; FWS, U.S. Fish and Wildlife Service; CPW, Colorado Parks and Wildlife]

Indemnity unit	Federally threatened or endangered	BLM Colo.—sensitive	FWS—Birds of Conservation Concern	CPW—big game	Total
Colorado River Valley (CR)					
CR_EAGL_SM_007	1	12	12	3	28
CR_EAGL_SM_008	1	11	12	4	28
CR_GARF_SM_001	0	13	15	2	30
CR_GARF_SM_002	0	14	14	3	31
CR_GARF_SM_003	0	12	13	3	28
CR_GARF_SM_004	0	12	12	4	28
CR_GARF_SM_005	0	11	13	4	28
CR_GARF_SM_006	0	11	11	4	26
Kremmling (KR)					
KR_GRAN_SM_012	0	11	12	3	26
KR_GRAN_SM_013	1	8	10	4	23
KR_GRAN_SM_014	1	8	11	5	25
KR_GRAN_SM_015	1	11	13	5	30
KR_JACK_MO_011	0	9	9	3	21
KR_JACK_SM_009	1	9	11	5	26
KR_JACK_SM_010	1	12	11	6	30
Little Snake (LS)					
LS_MOFF_SM_016	0	15	11	4	30
LS_ROUT_MO_019	0	12	10	3	25
LS_ROUT_MO_020	0	11	10	4	25
LS_ROUT_SM_017	0	12	10	3	25
LS_ROUT_SM_018	0	12	7	3	22
LS_ROUT_SM_021	1	10	11	5	27
LS_ROUT_SM_022	0	12	8	3	23
LS_ROUT_SM_023	0	12	7	3	22
LS_ROUT_SM_024	1	7	11	5	24
Royal Gorge (RG)					
RG_BENT_MO_057	1	9	6	1	17
RG_BENT_MO_058	1	10	6	1	18
RG_CHAF_MO_067	1	10	12	6	29
RG_CHAF_SM_068	0	8	12	4	24
RG_CUST_SM_025	0	13	7	4	24
RG_CUST_SM_026	1	14	12	5	32
RG_CUST_SM_027	0	9	5	4	18
RG_CUST_SM_028	0	5	5	3	13
RG_CUST_SM_029	0	5	5	2	12
RG_CUST_SM_030	0	9	7	2	18
RG_CUST_SM_031	1	10	12	4	27
RG_ELPA_SM_037	0	7	4	1	12

Table 1–8. Number of species of management concern that have documented occurrences and (or) potential habitat for each indemnity unit and status.—Continued

[BLM Colo., Bureau of Land Management Colorado; FWS, U.S. Fish and Wildlife Service; CPW, Colorado Parks and Wildlife; –, not applicable]

Indemnity unit	Federally threatened or endangered	BLM Colo.—sensitive	FWS—Birds of Conservation Concern	CPW—big game	Total
Royal Gorge (RG)—Continued					
RG_ELPA_SM_038	0	8	5	1	14
RG_ELPA_SM_039	0	9	6	1	16
RG_HUER_MO_032	1	13	13	4	31
RG_HUER_SM_033	1	7	11	4	23
RG_HUER_SM_034	1	7	11	4	23
RG_HUER_SM_035	1	7	12	4	24
RG_HUER_SM_036	1	4	8	4	17
RG_KIOW_MO_050	0	8	7	0	15
RG_KIOW_SM_051	0	11	8	0	19
RG_KIOW_SM_052	2	17	7	2	28
RG_KIOW_SM_053	2	13	6	2	23
RG_KIOW_SM_054	2	16	8	2	28
RG_KIOW_SM_055	2	12	5	2	21
RG_KIOW_SM_056	2	17	7	2	28
RG_PARK_SM_059	0	5	5	3	13
RG_PARK_SM_060	0	11	10	3	24
RG_PARK_SM_061	0	10	7	2	19
RG_PARK_SM_062	1	9	5	2	17
RG_PARK_SM_063	1	10	11	1	23
RG_PARK_SM_064	1	11	13	4	29
RG_PARK_SM_065	0	12	12	2	26
RG_PARK_SM_066	1	10	11	3	25
RG_PUEB_SM_040	1	9	6	1	17
RG_PUEB_SM_041	1	9	5	1	16
RG_PUEB_SM_042	1	8	4	1	14
RG_PUEB_SM_043	1	9	5	1	16
RG_PUEB_SM_044	1	9	5	1	16
RG_PUEB_SM_045	1	9	6	1	17
RG_PUEB_SM_046	1	9	6	1	17
RG_PUEB_SM_047	1	9	6	1	17
RG_PUEB_SM_048	1	11	8	1	21
RG_PUEB_SM_049	1	9	6	1	17
RG_WELD_MO_069	0	8	8	3	19
RG_WELD_MO_070	0	7	8	1	16
RG_WELD_MO_071	0	8	7	2	17
RG_WELD_MO_072	0	9	8	3	20
RG_WELD_MO_073	0	9	7	2	18

Table 1–8. Number of species of management concern that have documented occurrences and (or) potential habitat for each indemnity unit and status.—Continued

[BLM Colo., Bureau of Land Management Colorado; FWS, U.S. Fish and Wildlife Service; CPW, Colorado Parks and Wildlife; –, not applicable]

Indemnity unit	Federally threatened or endangered	BLM Colo.—sensitive	FWS—Birds of Conservation Concern	CPW—big game	Total
Tres Rios (TR)					
TR_DOLO_SM_074	0	12	13	4	29
TR_DOLO_SM_075	1	12	13	4	30
TR_DOLO_SM_076	1	12	16	4	33
TR_DOLO_SM_077	1	11	15	4	31
TR_DOLO_SM_078	1	12	14	4	31
TR_DOLO_SM_079	1	12	14	4	31
TR_DOLO_SM_080	0	11	15	4	30
TR_DOLO_SM_081	0	11	14	4	29
TR_DOLO_SM_082	1	12	14	4	31
TR_DOLO_SM_083	1	12	14	4	31
TR_DOLO_SM_084	1	13	14	4	32
TR_DOLO_SM_085	0	11	14	4	29
Uncompahgre (UN)					
UN_OURA_SM_086	1	14	12	3	30
UN_OURA_SM_087	1	17	12	4	34
UN_OURA_SM_088	1	17	12	4	34
UN_SANM_SM_089	2	13	14	3	32

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