Billing Code 4333–15

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket Nos. FWS–R8–ES–2018–0106 and FWS–R8–ES–2018–0107; FF09E21000 FXES11110900000 201]

RINs 1018–BD87 and 1018–BD88

Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rules to List the Bi-State Distinct Population Segment of Greater Sage-Grouse with Section 4(d) Rule and to Designate Critical Habitat

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; withdrawal.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), withdraw the proposed rule to list the Bi-State distinct population segment (DPS) of greater sage-grouse (*Centrocercus urophasianus*) in California and Nevada as threatened under the Endangered Species Act of 1973, as amended (Act). We concurrently withdraw the proposed rule under section 4(d) of the Act and the proposed rule to designate critical habitat for the DPS. These withdrawals are based on our conclusion that the threats to the DPS as identified in the proposed listing rule no longer are as significant as believed at the time of publication of the 2013 proposed rule. We find the best scientific and commercial data available indicate that the threats to the DPS and its habitat, given current and future conservation efforts, are reduced to the point that the DPS does not

meet the Act's definition of an "endangered species" or of a "threatened species."

DATES: The U.S. Fish and Wildlife Service is withdrawing proposed rules published on October 28, 2013 (78 FR 64328 and 64358) as of [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: Relevant documents are available on the Internet at either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107 on *http://www.regulations.gov*. Relevant documents used in the preparation of this withdrawal are also available for public inspection, by appointment, during normal business hours at the Reno Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT**).

FOR FURTHER INFORMATION CONTACT: Lee Ann Carranza, Deputy Field Supervisor, Reno Fish and Wildlife Office, 1340 Financial Boulevard, Suite 234, Reno, NV 89502; telephone 775–861–6300. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800–877–8339.

SUPPLEMENTARY INFORMATION

Executive Summary

Why we need to publish this document. Under the Act, a species may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. We issued a proposed rule to list a distinct population segment (DPS) of greater sage-grouse in California and Nevada (known as the Bi-State DPS) in 2013. However, this document withdraws that proposed rule because we now determine that threats identified in the proposed rule have been reduced such that listing is not necessary for this DPS. Accordingly, we also withdraw the proposed rule under section 4(d) of the

Act and the proposed critical habitat designation.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that threats have been reduced such that listing is not necessary for the Bi-State DPS of greater sage-grouse.

Peer review. In accordance with our joint policy on peer review published in the *Federal Register* on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of five appropriate specialists regarding the species report. We received responses from three specialists, which informed this finding. The purpose of peer review is to ensure that our listing determinations, critical habitat designations, and 4(d) rules are based on scientifically sound data, assumptions, and analyses. The peer reviewers have expertise in the biology, habitat, and threats to the greater sage-grouse.

Acronyms and Abbreviations Used in This Document

We use many acronyms and abbreviations throughout this document. To assist the reader, we provide a list of these here for easy reference:

ac = acres

Act or ESA = Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)

BLM = Bureau of Land Management

BSAP = Bi-State Action Plan

BSLPG = Bi-State Local Planning Group

BSLSP = Bi-State Lek Surveillance Program

CDFW = California Department of Fish and Wildlife (formerly California Department of Fish and Game (CDFG))

CFR = Code of Federal Regulations

COT = Conservation Objectives Team

CPT = conservation planning tool

CRI = credible intervals

DPS = distinct population segment

EOC = Executive Oversight Committee

FR = *Federal Register*

ha = hectares

HTNF = Humboldt-Toiyabe National Forest

IPM = integrated population model

LADWP = Los Angeles Department of Water and Power

LRMP = land resource management plan

NDOW = Nevada Department of Wildlife

NEPA = National Environmental Policy Act (42 U.S.C. 4321 et seq.)

NFMA = National Forest Management Act (16 U.S.C. 1600 et seq.)

NRCS = Natural Resources Conservation Service

OHV = off-highway vehicle

PECE = Policy for Evaluation of Conservation Efforts When Making Listing Decisions

PEIS = Programmatic Environmental Impact Statement

PMU = population management unit

RHA = rangeland health assessment

RMP = resource management plan

Service = U.S. Fish and Wildlife Service

TAC = Technical Advisory Committee

USDA = U.S. Department of Agriculture

USFS = U.S. Forest Service

USGS = U.S. Geological Survey

WAFWA = Western Association of Fish and Wildlife Agencies

WNv = West Nile virus

Previous Federal Actions

The Bi-State DPS of the greater sage-grouse has a long and complex rulemaking history. Here, we will discuss only the major Federal actions related to the species. For a detailed description of previous Federal actions, please refer to the previous withdrawal of the proposed listing rule, published on April 23, 2015 (80 FR 22828), and the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE) analysis we prepared as a supporting document for this determination (Service 2019, pp. 1–6).

On October 28, 2013, we published a proposed rule to list the Bi-State DPS as a threatened species with a 4(d) rule (78 FR 64358). On that same day, we published a proposed rule to designate critical habitat for the Bi-State DPS (78 FR 64328).

On April 23, 2015, we withdrew the proposed listing rule, the proposed 4(d) rule, and the proposed critical habitat rule (80 FR 22828). This withdrawal was based on our

conclusion that the threats to the DPS as identified in the proposed listing rule were no longer as significant as believed at the time of publication of the proposed rule. We found that the best scientific and commercial data available indicated that the threats to the DPS and its habitat, given current and future conservation efforts as analyzed under PECE, were reduced to the point that the DPS did not meet the Act's definition of an "endangered species" or of a "threatened species."

On March 9, 2016, Desert Survivors, the Center for Biological Diversity, WildEarth Guardians, and Western Watershed Project filed suit in the U.S. District Court for the Northern District of California. The suit challenged the withdrawal of the proposal to list the Bi-State DPS. On May 5, 2018, the court issued a decision. The April 23, 2015, withdrawal was vacated and remanded to the Service for further consideration. The court's action reinstated the prior proposed rules to list and to designate critical habitat for the Bi-State DPS, thereby returning the process to the proposed rule stage, and the status of the Bi-State DPS effectively reverted to that of a species proposed for listing for the purposes of consultation under section 7 of the Act. The court's action also reinstated the proposed 4(d) rule and the proposed critical habitat designation for the Bi-State DPS.

On April 12, 2019, we published in the *Federal Register* (84 FR 14909) a document that announced that the proposed rules were reinstated and the public comment periods were reopened for 60 days and that we would publish a final listing determination on or before October 1, 2019.

On October 1, 2019, we announced a 6-month extension of the final listing determination to April 1, 2020 (84 FR 52058). We took that action based on substantial disagreement regarding the sufficiency and accuracy of the available data relevant to the

proposed listing, which made it necessary to solicit additional information. That document reopened the public comment period on the proposed listing and critical habitat rules for an additional 30 days.

Supporting Documents

We prepared a species report for the Bi-State DPS (Service 2020, entire). The species report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. The Service sent the species report to five independent peer reviewers and received three responses. The Service also sent the species report to all pertinent Federal, Tribal, and State partners, including scientists with expertise in sage-grouse and sage-brush habitat in the Bi-State area. We received reviews from six partners (Humboldt-Toiyabe National Forest (HTNB), Inyo National Forest, two Bureau of Land Management (BLM) offices: Bishop and Carson City, the California Department of Fish and Wildlife (CDFW), and the Nevada Department of Wildlife (NDOW)). These comments have been incorporated into the species report and informed this document.

Summary of Changes from the Proposed Rule

Based upon our review of the public comments, Federal and State agency comments, peer review comments, issues addressed at the public hearings, and any new relevant information that became available since the publication of the proposal and including new relevant information that has become available since the prior withdrawal decision, we reevaluated our proposed listing rule and made changes as appropriate in this withdrawal. Other than minor clarifications and incorporation of additional

information on the species' biology and populations, this determination differs from the proposal in the following ways:

(1) *A different status determination.* Based on our analyses of the potential threats to the species, and our consideration of partially completed, ongoing and future conservation efforts (as outlined below in **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**), we have determined that the Bi-State DPS should not be listed as a threatened species. Specifically, we have determined that conservation efforts (as outlined in the Bi-State Action Plan (BSAP), Agency commitment letters, and our detailed PECE analysis (all of which are available at either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107 on *http://www.regulations.gov* as well as the Technical Advisory Committee (TAC) comprehensive project database)) will continue to be implemented because (to date) we have a documented track record of active participation and implementation by the signatory agencies and commitments to continue implementation into the future.

Conservation measures, such as (but not limited to) pinyon-juniper removal, establishment of conservation easements for critical brood-rearing habitat, cheatgrass (*Bromus tectorum)* removal, permanent and seasonal closure of roads near leks, removal and marking of fencing, and restoration of riparian/meadow habitat have been occurring over the past decade, are currently occurring, and have been prioritized and placed on the agencies' implementation schedules for future implementation. Agencies have committed to remain participants in the BSAP and to continue conservation of the DPS and its habitat. Additionally, the BSAP has sufficient methods for determining the type and location of the most beneficial conservation actions to be implemented, including

continued development of new population and threats information in the future that will guide conservation efforts. As a result of these actions, this document withdraws the proposed rules as published on October 28, 2013 (78 FR 64328; 78 FR 64358).

We have also updated our Significant Portion of the Range analysis based on a recent court finding regarding the policy.

(2) *Addition of PECE analysis.* This document includes the **Policy for Evaluation of Conservation Efforts When Making Listing Decisions** section, which includes some information presented in the **Available Conservation Measures** section of the proposed listing rule.

(3) *Population impacts.* This document includes a discussion of the impacts of small population size and population isolation on the Bi-State DPS.

(4) *New information.* Following publication of the proposed listing rule, we received new information pertinent to this rulemaking action. Some of the information was in response to our request for scientific peer review of the proposed listing rule, while other information was a result of new literature now available, or updated regulations. We incorporated all new information into the Species Report (Service 2020, entire), which is available on the Internet at *http://www.regulations.gov* under either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107, as well as within this document where appropriate. New information includes (but is not limited to):

- A variety of biological or habitat clarifications, such as hen movement distances, nesting success, and invasive plant species influence on sagebrush-habitat dynamics.

- Updated trend and population analyses. Multiple new papers examining the population dynamics and trends of the Bi-State DPS (Coates et al. 2014, entire; Coates et al. 2018, entire; Mathews et al. 2018, entire; Coates et al. 2020, entire). These studies are incorporated into the Species Report and discussed throughout this document.
- Two genetic evaluations, one of which concluded there are three or four unique genetic clusters within the Bi-State area (Oyler-McCance et al. 2014, p. 8), and a second that concluded there were five unique genetic clusters (Tebbenkamp 2014, p. 18). Tebbenkamp (2014) did not evaluate the Pine Nut population; thus, six populations may have been identified by Tebbenkamp (2014) had the Pine Nut population data been available.
- New information on the effectiveness of pinyon-juniper removal has become available in recent years (Prochazka et al. 2017, entire; Severson et al. 2017, entire; Sandford et al. 2017, entire; Coates et al. 2017b, entire; Olsen 2019, entire). These studies are incorporated into the Species Report and discussed throughout this document.

(5) *New ESA factor D analysis.* In the 2013 proposed listing rule, we analyzed the adequacy of existing regulatory mechanisms in a separate section. Here, we evaluate the effects of existing regulatory mechanisms within each threat analysis, rather than evaluating regulatory mechanisms in a separate section, so that it is clear how the existing regulatory mechanisms relate to the stressor being analyzed.

(6) *Significant portion of the range (SPR) analysis*. Since 2013, we have a new policy regarding the Service's interpretation of the phrase "significant portion of the

range" (79 FR 37578; July 1, 2014). We also have new guidance regarding application of that policy (Service 2017, entire), which was published subsequent to the 2015 withdrawal of the proposed rule. Additionally, certain parts of the policy have been invalidated by court orders. We have completed our SPR analysis for the Bi-State DPS in accordance with the 2014 policy and the 2017 guidance as further refined by applicable court decisions.

Background

In our 12-month findings on petitions to list three entities of sage-grouse (75 FR 13910, March 23, 2010), we found that the Bi-State population of greater sage-grouse in California and Nevada meets our criteria to qualify as a DPS of the greater sage-grouse under Service policy (61 FR 4722, February 7, 1996). We reaffirmed this finding in the October 28, 2013, proposed listing rule (78 FR 64358) and do so again in this document. This determination is based principally on genetic information (Benedict et al. 2003, p. 308; Oyler-McCance et al. 2005, p. 1307), where the DPS was found to be both markedly separated and significant to the remainder of the greater sage-grouse taxon. The Bi-State DPS defines the far southwestern limit of the species' range along the border of eastern California and western Nevada (Stiver et al. 2006, pp. 1–11; 71 FR 76058, December 19, 2006).

Although the Bi-State DPS is a genetically unique and markedly separate population, the DPS has similar life-history and habitat requirements to the greater sage-grouse throughout the rest of its range. In the October 28, 2013, proposed listing rule (78 FR 64358), the species report, and this document, we use information specific to the Bi-State DPS where available but still apply scientific management principles for greater

sage-grouse that are relevant to the Bi-State DPS's management needs and strategies. This practice is followed by the wildlife and land management agencies that have responsibility for management of both the DPS and its habitat.

A detailed discussion of the Bi-State DPS's description, taxonomy, habitat (sagebrush ecosystem), seasonal habitat selection, life-history characteristics, home range, life expectancy and survival rates, historical and current range distribution, population estimates and lek (sage-grouse breeding complex) counts, population trends, and land ownership information is available in the species report (Service 2020, entire). The species report represents a compilation of the best scientific and commercial data available concerning the status of the Bi-State DPS, including the past, present, and future threats to this DPS. The species report and other materials relating to this final agency action can be found at *http://www.regulations.gov* under either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107.

Habitat and Life History

Sage-grouse depend on a variety of shrub and shrub-steppe vegetation communities throughout their life cycle (Schroeder et al. 2004, p. 364). Sagebrush is the most widespread vegetation in the intermountain lowlands of the western United States and is considered one of the most imperiled ecosystems in North America (West and Young 2000, p. 259; Knick et al. 2003, p. 612; Miller et al. 2011, p. 147). Most species of sagebrush are killed by fire; historical fire-return intervals are estimated to be as long as 350 years (West 1983, p. 341; Miller and Eddleman 2000, p. 17; West and Young 2000, p. 259; Baker 2011, pp. 191–192). Natural sagebrush recolonization in burned areas depends on the presence of adjacent live plants for a seed source or on the seed bank, if

present, and requires from decades to over a century for full recovery (Miller and Eddleman 2000, p. 17; Baker 2011, pp. 194–195).

Sage-grouse require large, interconnected expanses of sagebrush with healthy, native understories, in part to accommodate their seasonal shifts in habitat selection within the sagebrush ecosystem (Service 2020, p. 11). Sage-grouse exhibit strong site fidelity (loyalty to a particular area) to migration corridors and seasonal habitats, including breeding, nesting, brood-rearing, and wintering areas; they exhibit this fidelity even when a particular area may no longer be of value, limiting the species' adaptability to habitat changes (Service 2020, p. 11). However, recent research has suggested that this high degree of site fidelity may be more flexible than has traditionally been considered, at least with respect to certain restoration actions (e.g., tree removal; Sandford et al. 2017, p. 64; Severson et al. 2017, p. 55).

During the spring breeding season, male sage-grouse gather to perform courtship displays at leks or traditional strutting grounds. Areas of bare soil, short-grass steppe, windswept ridges, exposed knolls, or other relatively open sites typically serve as leks (Patterson 1952, p. 83; Connelly et al. 2004, p. 3-7 and references therein). The proximity, configuration, and abundance of nesting habitat are key factors influencing lek location (Connelly et al. 1981, pp. 153–154; Connelly et al. 2000a, p. 970). Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat (Connelly et al. 2000a, p. 970); therefore, lek habitat availability is not considered a limiting factor for sage-grouse (Schroeder et al. 1999, p. 4). Leks range in size from less than 0.04 ha (0.1 ac) to over 36 ha (90 ac) (Connelly et al. 2004, p. 4-3) and can host from a few to hundreds of males (Johnsgard 2002, p. 112).

The distances sage-grouse move between seasonal habitats are highly variable across the occupied range (Connelly et al. 1988, pp. 119–121). Migration can occur between distinct winter, breeding, and summer areas or the seasonal-use areas may be variously integrated (e.g., winter and breeding areas may be the same and brood-rearing sites are disjunct). Information available regarding seasonal migrations and migratory corridors for sage-grouse in the Bi-State area is variable. Some local breeding complexes (a general aggregation of birds associated with a particular lek or collection of leks in relatively close proximity to one another) remain fairly resident throughout the year while others demonstrate a more itinerant nature (Casazza et al. 2009, p. 8).

Still, all sage-grouse gradually move from sagebrush uplands to more mesic areas (moist areas such as upland meadows) during the late brood-rearing/summer period (3 weeks post-hatch) in response to summer desiccation of herbaceous vegetation (Connelly et al. 2000a, p. 971; Atamian et al. 2010, p. 1538; Connelly et al. 2011b, pp. 76–77 and references therein; Pratt et al. 2017, p. 635). Brood-rearing foraging habitats with increased perennial forb cover and plant species richness, greater meadow to sagebrush edge (ratio of perimeter to area), and a greater distance from woodlands provide for an increased probability of successful recruitment (Casazza et al. 2011, pp. 162–163). Sage-grouse will use free water, although they do not require it since they obtain water from their food. However, natural water bodies and reservoirs provide mesic areas often rich in succulent forb and insect food sources, thereby attracting sage-grouse hens with broods (Connelly et al. 2004, p. 4-12).

Non-migratory sage-grouse populations have been described as those with seasonal movements of less than 10 km (6.2 mi; Connelly et al. 2000a, pp. 968–969),

while birds in migratory populations may travel well over 100 km (62 mi) (Tack et al. 2012, p. 65). Despite the documentation of extensive seasonal movements in this species, dispersal (permanent rather than seasonal movement) abilities of sage-grouse to other areas are assumed to be low (Fedy et al. 2012, p. 1066; Tack et al. 2012, p. 65; Davis et al. 2014, p. 716). Sage-grouse dispersal is overall poorly understood and appears sporadic, if not rare (Service 2020, p. 12).

Range and Population Estimates

The Bi-State DPS of greater sage-grouse historically occurred throughout most of Mono, eastern Alpine, and northern Inyo Counties, California (Hall et al. 2008, p. 97), and portions of Carson City, Douglas, Esmeralda, Lyon, Mineral, and perhaps Storey County in Nevada (Gullion and Christensen 1957, pp. 131–132; Espinosa 2019, pers. comm.). The current range of the DPS in California is presumed to be reduced from the historical range (Leach and Hensley 1954, p. 386; Hall 1995, p. 54; Schroeder et al. 2004, pp. 368–369), but the extent of range loss is not well understood.

Current management of the Bi-State DPS employs Population Management Units (PMUs) for Nevada and California as tools for defining and monitoring sage-grouse distribution. The PMU boundaries represent generalized populations or local breeding complexes and were delineated based on aggregations of leks, known seasonal habitats, and telemetry data. Six PMUs were designated for the Bi-State DPS (from north to south): Pine Nut, Desert Creek-Fales, Bodie, Mount Grant, South Mono, and White Mountains (Figure 1; Table 1). These six PMUs represent a combined total of approximately 50 active leks (see Table 1 below; Service 2020, pp. 21–33). Leks are considered either active (e.g., two or more strutting males during at least 2 years in a 5-

year period), inactive (e.g., surveyed three or more times during one breeding season with no birds detected and no sign (e.g., droppings) observed), historical (e.g., no strutting activity for 20 years and have been checked according to State protocol at least intermittently), or unknown/pending (e.g., sign was observed, and one or no strutting males observed, or a lek that had activity the prior year but was not surveyed or surveyed under unsuitable conditions during the current year and reported one or no strutting males).

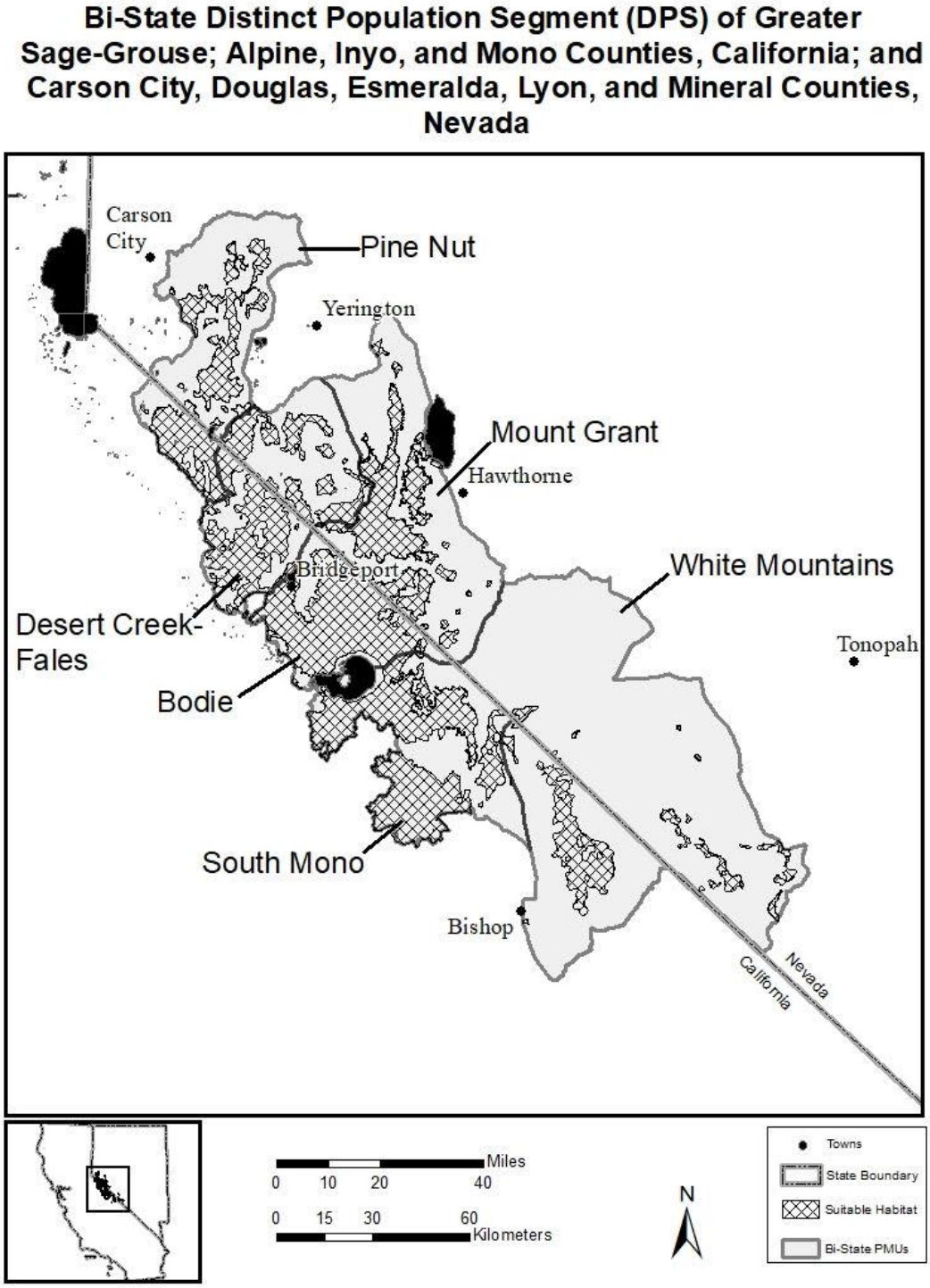

Figure 1. Population management units of the Bi-State DPS of the greater sage-grouse. The solid line shows the border of the management unit as defined by managing agencies, and the hatched line is suitable habitat within the units.

Table 1. Bi-State DPS PMUs, PMU size, estimated suitable sage-grouse habitat, average number of leks, average number of active leks, and range of maximum males on leks within each PMU (2003–2018). Number pairs in parentheses are lower and upper limits of the 95 percent credible interval. Area values for "Total Size" and "Estimated Suitable Habitat" may not sum due to rounding.

PMU	Total size in hectares (acres) *	Estimated suitable habitat in hectares (acres) **	Average number of leks ***	Average number of active leks ***†	Range in maximum male counts ****
Pine Nut	232,440 (574,372)	77,848 (192,367)	7.3 (2.0, 9.0)	1.8 (0.3, 4.7)	0–67
Desert Creek-Fales††	229,858 (567,992)	105,281 (260,155)	12.8 (8.3, 15.0)	6.8 (5.0, 9.7)	61–220
Mount Grant††	282,907 (699,079)	45,786 (113,139)	9.6 (5.0, 11.0)	4.4 (1.3, 7.0)	12–220
Bodie††	141,490 (349,630)	105,698 (261,187)	17.3 (12.3, 20.0)	13.1 (9.7, 16.7)	137–512
South Mono	234,508 (579,482)	138,123 (341,311)	15.6 (12.3, 19)	13.3 (11.0, 16.7)	172–418
White Mountains	709,768 (1,753,875)	53,452 (132,083)	2+(not available)	2+(not available)	Not available
Total (all PMUs combined)	1,830,972 (4,524,430	526,188 (1,300,238)	64.6 (41.9, 76.0)	41.4 (29.3, 56.8)	427–1,409

* BSLPG (2004, pp. 11, 32, 63, 102, 127, 153).
** Bi-State TAC (2012, unpublished data); BLM (2014, unpublished data).
*** Derived from Mathews et al. 2018, Table 6 and Figure 17.
**** Derived from NDOW and CDFW lek databases. Low and high counts occurred in 2008 and 2012, respectively. However, there was variation in annual peak male counts across PMUs; therefore, column does not sum to total.
† Active—two or more strutting males during at least 2 years in a 5-year period.
†† Part of the North Mono population segment in some early population analyses

Sage-grouse populations in the Bi-State area appear to be isolated to varying degrees from one another (Casazza et al. 2009, entire; Oyler-McCance and Casazza 2011, p. 10; Tebbenkamp 2012, p. 66; Oyler-McCance et al. 2014, p. 8; Tebbenkamp 2014, p.

18). Birds in the White Mountains PMU as well as those in the South Mono PMU are largely isolated from sage-grouse populations in the remainder of the Bi-State DPS (Casazza et al. 2009, pp. 34, 41; Oyler-McCance and Casazza 2011, p. 10; Tebbenkamp 2012, p. 66). Traditionally, the Pine Nut PMU was presumed isolated; however, recent data show birds are capable of moving south into the Sweetwater Mountains in the Desert Creek-Fales PMU and even further south into the Bodie PMU (USGS 2014b, entire). It is not apparent that birds leaving the Pine Nuts are returning. While adults are unlikely to switch breeding populations, it is likely that genetic material is transferred among these northern populations through the natural movements of young of the year birds, as long as there are established populations available in which to emigrate. However, fine-scale genetic differentiation among sage-grouse populations is at a relatively small geographic scope (approximately 10 km (6 mi)), suggesting dispersal among populations is highly restricted (Jahner et al. 2016, pp. 8–9).

Two independent genetic evaluations have concluded there are three or four (Oyler-McCance et al. (2014, p. 8) or five (Tebbenkamp 2014, p. 18) unique genetic clusters in the Bi-State area. The latter study did not evaluate the Pine Nut population (Pine Nut PMU), which has been found to be unique (Oyler-McCance et al. 2014, p. 8). Based on this information, we presume that there are likely three to six populations or groups of birds in the Bi-State area that largely operate demographically independent of one another.

Four separate statistical approaches to assessing the population trend of the Bi-State DPS have been conducted, with two of these approaches being repeated following additional years of data collection. The four approaches are: (1) Connelly et al. 2004; (2)

WAFWA 2008, (3) Garton et al. (2011 and 2015); and (4) U.S. Geological Survey (USGS) 2014, 2018, and 2019 (Coates et al. 2014, Coates et al. 2018, Mathews et al. 2018; Coates et al. 2020). In 2004, WAFWA conducted a partial population trend analysis for the Bi-State area (Connelly et al. 2004, chapter 6). The WAFWA recognizes four populations of sage-grouse in the Bi-State area, which represent the same overall extent delineated by the six PMUs described in the 2012 BSAP and this document. Two of the WAFWA populations (North Mono Lake and South Mono Lake) had sufficient data for trend analysis (Connelly et al. 2004, pp. 6-60 to 6-62). The North Mono Lake population encompasses the Bodie, Mount Grant, and Desert Creek-Fales PMUs, while the South Mono Lake population encompasses the South Mono PMU. The North Mono Lake population displayed a significant negative trend from 1965 to 2003, and the South Mono Lake population displayed a positive numerical trend, albeit not statistically significant, over this same period (Connelly et al. 2004, pp. 6-69 to 6-70). In 2008, WAFWA (2008, Appendix D) conducted a trend analysis on the same two populations identified above using a different statistical method for the periods from 1965 to 2007, 1965 to 1985, and 1986 to 2007. The trend for the North Mono Lake population, as measured by maximum male attendance at leks, was negative from 1965 to 2007 and 1965 to 1985, but variable from 1986 to 2007; results suggest an increasing trend beginning in about 2000. Results for the South Mono Lake population suggested a negative trend from 1965 to 2007, a stable trend from 1965 to 1985, and a variable trend from 1986 to 2007; these results also suggest a positive trend beginning around 2000.

In 2011, Garton et al. (2011, pp. 324–330) used a new approach to conduct a third trend analysis on the same populations used in the two previous WAFWA analyses. In

this study, the average number of males per lek in the North Mono Lake population declined by 35 percent and the average number of males per active lek declined by 41 percent from the 1965–1969 to 2000–2007 assessment periods (Garton et al. 2011, p. 324). Based on a reconstructed minimum population estimate for males from 1965 to 2007, the overall population showed irregular fluctuations between peaks in 1970 and 1987 of 520 to 670 males, with lows above 100 and no consistent long-term trend over the 40-year period. In the South Mono Lake population, the average number of males per lek increased by 218 percent from the 1965–1969 to 1985–1989 assessment periods but declined by 49 percent from the 1985–1989 to 2000–2007 assessment periods (Garton et al. 2011, p. 325). Based on reconstructed minimum male counts, the population showed no obvious trend through time with between 200 and 600 males attending leks. The average annual rate of change for both populations suggested that population growth has been, at times, both positive and negative over the past 40 years (Garton et al. 2011, pp. 324–330).

In 2015, the researcher updated this analysis by accumulating and analyzing several years of additional of data (Garton et al. 2015, entire). The updated estimates of population performance largely remained unchanged, while the outlook for persistence improved. For the North Mono Lake population, the estimated minimum number of males increased by 25 percent in 2013 as compared to 2007, while the probability of declining below a (researcher-defined) quasi-extinction threshold decreased (Garton et al. 2015, pp. 13–14). For the South Mono Lake population, the estimated minimum number of males decreased by six percent in 2013 as compared to 2007, although the probability of declining below the quasi-extinction threshold remained generally unchanged. For

both populations, the predicted population size in 30 and 100 years increased in 2013 as compared to 2007 (Garton et al. 2011, pp. 376–377; Garton et al. 2015, p. 45). This approach suggests both of these populations will remain relatively small, as they have historically. Modeled weighted probabilities of either population declining below an effective population sizes of 50 individuals in 30 and 100 years are generally low (approximately 8 percent in 30 years and 22 percent in 100 years for both populations; Garton et al. 2015, p. 14)..

In 2014, the USGS completed an analysis of population trends in the Bi-State area spanning the years 2003 to 2012 (Coates et al. 2014, entire). This analysis, termed an Integrated Population Model (IPM), integrates a variety of data such as lek counts and vital rates to inform an estimate of lambda (population growth) within the DPS. This analysis evaluated several populations in the Bi-State area including the Pine Nuts (Pine Nut PMU), Fales (California portion of the Desert Creek–Fales PMU), Desert Creek (Nevada Portion of the Desert Creek–Fales PMU), Bodie Hills (Bodie PMU), Parker Meadows (South Mono PMU), and Long Valley (South Mono PMU). It did not evaluate the populations in the Mount Grant or White Mountains PMUs due to data limitations. Results at that time suggested a stable trend in population growth across the entire Bi-State area between 2003 and 2012 (i.e., both increasing and decreasing at an equal rate; Coates et al. 2014, p. 19). However, the trend in population growth was variable among populations (Coates et al. 2014, pp. 14–15).

Since the 2013 proposed rule and the 2015 withdrawal of the proposed listing rule, this analysis has been updated, once using a 13-year dataset spanning the years 2003 through 2015, again using 15 years of data spanning the years 2003 through 2017, and

most recently using an approach that segmented the trends into three time intervals (Coates et al. 2018, entire; Mathews et al. 2018, entire; Coates et al. 2020, p. 8). The later approach was adopted to account for population cycling in sage-grouse; that is, regular periods of growth and decline naturally experienced by sage-grouse rangewide (Garton et al. 2011, p. 338). Indeed, it became apparent after analyzing the 13-year and 15-year datasets that the resulting estimates of population growth rates were being biased low due to an overrepresentation of down cycle years. To alleviate this bias, the latest trend analysis analyzes three time intervals that span one, two, and three cycles, with the start and stop points occurring in the troughs of a cycle. The three time intervals are 1995–2018, 2001–2018, and 2008–2018. Not all populations had sufficient historical data to evaluate all three time periods and thus analysis was constrained to one or two time periods depending on the population. The most recent analysis includes results from the Mount Grant and White Mountains PMUs, which were previously excluded due to insufficient data.

The results of the most recent iteration of the IPM suggests a general pattern of population cycling within an otherwise stable population across the Bi-State DPS with additional evidence that oscillations were influenced by drought conditions in recent years (Coates *et al*. 2018, pp. 250, 252; Coates et al. 2020, p. 27). Furthermore, variation among individual PMU trends was apparent. The credible intervals (CRIs) reported in this study represent the range of interannual variation in lambda; that is, while annual median population growth for the Bi-State DPS as a whole in the period 1995–2019 is 1.018 (or approximately a 2 percent annual increase), the CRI reported (0.737–1.418)

represents the variation in estimated lambda as it cycles from low to high over the study period, rather than the error in the median estimate for any given year.

As discussed above, this analysis estimated that, across the Bi-State as a whole, estimated median population growth was 1.018 (CRI = 0.737–1.418) from 1995 through 2018, 0.989 (CRI = 0.677–1.343) from 2001 through 2018, and 0.988 (CRI = 0.704–1.304) from 2008 through 2018 (Coates et al. 2020, Table 3). More specifically, over the past decade only the Bodie Hills and Parker Meadows population demonstrated an average annual positive growth (lambda = 1.061 and lambda = 1.048, respectively). The remaining populations including Mount Grant (lambda = 0.989), Fales, (lambda = 0.965), Pine Nut (lambda = 0.835), Desert Creek (lambda = 0.938), Long Valley (lambda=0.96), and the White Mountains (lambda = 0.85; Coates et al. 2020, Table 3) averaged slight negative growth, although in each case the 95 percent CRI overlapped 1. Additional analysis suggests that over the past 5 years performance of some individual leks in Long Valley, Fales, Bodie Hills, Mount Grant, and to a lesser extent Sagehen (a population in the South Mono PMU) have been trending (negatively) in a pattern that deviates from the Bi-State at large (Coates et al. 2020, Table 3). This analysis suggests that alternative factors (such as anthropogenic disturbance) and not climate or weather may be acting to influence these specific sites.

In general, these four approaches (with some being run more than once) suggest that the trend in population growth within the Bi-State has fluctuated over the past 40 years (both increased and decreased), but over the entire timeframe has remained relatively stable. It appears that some populations (Pine Nut, Mount Grant, Bodie and Desert Creek) display greater variation in population growth (both positive and negative)

and that trends among populations are variable (WAFWA 2008, Appendix D; Garton et al. 2011, p. 324, Coates et al. 2020, p. 34). Differences in population trends across the same time periods in the newest study (compared to previous studies) may be due to the fact that the previous studies did not correct for the effects of population cycling (Coates et al. 2020, p. 30).

Two studies forecasted the probability that some populations would become extirpated. Garton et al. (2015, p. 41) used their reconstructed male counts to forecast future probabilities of population persistence assuming that past conditions persist into the future (a potentially unrealistic assumption). They conclude that the probabilities of declining below a quasi-extinction threshold (as defined by less than 50 breeding adults per population) were approximately 8 and 22 percent over the next 30 and 100 years, respectively, for both the North Mono Lake and South Mono Lake populations. Furthermore, Garton et al. (2015, p. 41) indicate that long-term persistence (as defined by more than 500 breeding adults per population, a standard number for persistence studies) for both core populations has an estimated 100 percent probability of dropping below this 500-adult threshold in the next 30 years. However, the researchers acknowledge the cyclic nature of sage-grouse populations and note that these populations have already been both above and below this mark in previous years, which is part of that natural cycling. Furthermore, model projections suggest that, both over the near term (30 years) and the long term, the North Mono Lake and South Mono Lake populations have a relative high probability of maintaining between 50 and 500 breeding adults. Thus, in these two core populations immediate genetic concerns (e.g., inbreeding depression) are

not apparent, but concern over maintaining long-term genetic and demographic viability remains.

Coates et al. (2020, p. 41; Table 1) estimated 10-year extirpation probability based on the number of runs of the IPM where populations went to zero. Probabilities of extirpation ranged greatly for individual PMUs and populations within the PMUs, with highest extirpation probabilities in the Pine Nuts PMU (69.7 percent), the White Mountains PMU (75.1 percent), and the Sagehen and Parker Meadows populations of the South Mono PMU (74.8 and 64.3 percent, respectively) (Coates et al. 2020, Table 1). The Bi-State DPS as a whole has a 1.1 percent extirpation probability in the next 10 years, and the Desert-Creek Fales PMU (9.0 percent), the Bodie Hills PMU (2.4 percent), and the South Mono PMU as a whole (3.8 percent), as well as its largest population (Long Valley; 7.9 percent) all have low probabilities of extirpation (Coates et al. 2020, Table 1). Some of these extirpation probabilities are lower than those calculated by Garton et al. (2015), likely because of differences in methods. The two studies also used different data sets, with Garton et al. (2015) using reconstructed male counts, and Coates et al. (2020) using multiple data sources for the IPM, including demographic and lek count data.

Thus, even though some populations in this most recent model have high probabilities of extirpation over the next ten years, the DPS as a whole is likely to persist over this time period. These extinction probabilities are created from continuing and forecasting past trends into the future, and thus likely do not reflect the effects of conservation measures started or completed in recent years.

Finally, the most recent population study included a PMU distribution analysis to examine short-term changes in population distribution across the Bi-State DPS. This

analysis concluded that some parts of the Bi-State DPS are contracting, with the greatest contractions in acres of occupied habitat occurring in the Pine Nut, Fales, Sagehen, and White Mountains populations (Coates et al. 2020, p. 51–54). However, distributional area in the Bodie Hills is increasing (Coates et al. 2020, p. 54). As a whole, the Bi-State DPS showed some evidence of range contraction between 2008 and 2018, though the 95 percent CRI overlapped zero ((-0.07 [-0.19, 0.07]) (Coates et al. 2020, p. 51).

Following are brief accounts of each PMU.

(1) The Pine Nut PMU has the fewest sage-grouse (Median = 33; CRI = 0–73 individuals in 2018; Coates et al. 2020, p. 33) and the least number of active leks of the Bi-State PMUs. The population in the Pine Nut PMU has some level of connectivity with the Desert Creek-Fales PMU and potentially also with the Bodie and Mount Grant PMUs. The most significant impacts in this PMU are wildfire, invasive species, woodland encroachment, urbanization, and infrastructure.

Historically, a single lek in the northern portion of the Pine Nut Mountains (known as Mill Canyon Dry Lake) was the only known consistently active lek in this PMU. From 2000 through 2013, the average male attendance at the Mill Canyon Dry Lake lek was approximately 14 males (Bi-State TAC 2012, p. 17). Since 2013, activity on this lek has essentially ceased. An additional lek in the southern extent of the Pine Nut mountain range has periodically been reported but at this point is not considered active. Aerial surveys over the past few years typically detect birds in this area but actual strutting activity is uncertain. It is unclear if this southern lek has been abandoned, or if the original documentation just captured a rare event or simply misclassified random bird sightings for actual strutting activity. Over the past several years, two newly discovered

lek sites in the Buckskin Range appear to be the only reliably active strutting grounds in this PMU (NDOW 2018, unpublished data). Both lek sites are small with two to five males apiece. The most recent results from the IPM suggests population growth in this PMU has declined on average six percent annually over the past decade (2008–2018; Median $\lambda = 0.835$; CRI = 0.234–1.94; Coates et al. 2020, p. 41).

Ongoing conservation efforts in this PMU include an acquisition of land containing high priority targets identified in the 2012 BSAP, which will help limit the effects of urban and exurban development. This 5,870 ha (14,500 ac) acquisition by the Carson City BLM has been approved and is anticipated to finalize in the spring of 2020. Other completed, ongoing, or planned conservation actions in the Pine Nut PMU include pinyon-juniper removal, horse gathers, removal of nonnative invasive plants, fuel reduction treatments, road closure, and fence removal (Bi-State TAC 2019, entire).

(2) The Desert Creek-Fales PMU straddles the Nevada-California border and contains two populations, one in each State. This PMU includes two breeding complexes: Desert Creek (Nevada) and Fales (California). The populations in the Desert Creek-Fales PMU have some level of connectivity with the Pine Nut PMU and potentially also with the Bodie and Mount Grant PMUs. The most significant impacts in this PMU are wildfire, invasive species (specifically conifer encroachment), infrastructure, and urbanization.

The NDOW uses data from six active leks to evaluate the trend and to tally maximum male attendance in the Desert Creek breeding complex. The long-term average male attendance is approximately 17.7 males per lek (Bi-State TAC 2017, p. 8). This average is influenced by one of these leks becoming inactive, with no males counted

within the last 8 years. This lek might have moved locations, but this possibility remains unconfirmed. In 2012, a previously undocumented lek was discovered to the east of Nevada State Route 338 near Dalzell Canyon; 24 males were documented strutting on this lek. Over the last 7 years, this lek has remained active but counts have been small (<5). Three additional lek sites have also been discovered over the past 5 years. The most recent results from the IPM suggest population growth in this PMU has declined in the past decade. Estimated median population abundance in 2018 was 325 (CRI = 163–542; Coates et al. 2020, p. 34) individuals. Estimated median population growth from 2001 through 2018 was 0.939 (CRI = 0.348–1.499) and from 2008 through 2018 was 0.938 (CRI = 0.337–1.535; Coates et al. 2020, p. 34).

The Fales breeding complex is located in northern Mono County, California. It is composed of three active and three inactive leks. Two active leks are located near Sonora Junction, in proximity to the intersection of Highway 395 and California Highway 108, and one additional lek is located in the northeast corner of Mono County in the Sweetwater Mountains. No males have been documented on a previously occupied lek since possible activity in 2012 (CDFW 2014a, unpublished data; CDFW 2018, unpublished data). In 2018, peak male count on the two remaining leks was at a historic low of 16 males total. One of the two remaining leks may also potentially be affected by the recent Boot fire (2018) and the construction of a new outbuilding approximately 200 meters (218 yards) away. The most recent results from the IPM suggest population growth has been negative over the past decade, but evidence of decline is less robust than in other breeding areas, especially when considering the longer timeframes. Estimated median population abundance in 2018 was 121 (CRI = 54–208; Coates et al. 2020, p. 34)

individuals. Estimated median lambda from 1995–2018 was 0.999 (CRI = 0.59–1.641), from 2001–2018 was 0.984 (CRI = 0.539–1.525), and from 2008–2018 was 0.965 (CRI = 0.544–1.397; Coates et al. 2020, p. 34). Overall, the combined Desert Creek and Fales subpopulation has declined 4.5 percent annually over the past 18 years (Coates et al. 2020, Table 3).

Completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal, fence removal, road closures, livestock management (to reduce impacts to critical brood-rearing habitat), nonnative invasive plant removal, road closure, fence removal, and post-fire restoration (Bi-State TAC 2019, entire).

(3) The Mount Grant PMU is composed of three connected areas: two high-elevation areas associated with Aurora Peak and the Wassuk Range (centered on Mount Grant), and one low-elevation area called Ninemile Flat (located in the East Fork Walker River valley) between the two high-elevation areas. This PMU is also connected with the Bodie PMU (a portion of the sage-grouse population in each PMU moves seasonally to the other). Surveys in the Mount Grant PMU have been sporadic due to difficulty accessing several locations and survey data collection has been influenced by apparent confusion over lek names and potential vagaries in lek locations. Woodland succession, and potentially to a lesser extent historical and current mining activity, has most negatively influenced bird distribution within the Mount Grant PMU (Bi-State TAC 2012, pp. 36–37). More recently, recreational OHV use has become a more prevalent activity under consideration for its influence on birds (Service 2020, p. 27).

The largest known lek in the Mount Grant PMU is located near Aurora Peak along the Nevada-California border, and it is generally considered the eastern extension

of the Bodie PMU breeding complex. The high count of 94 males for this lek was recorded in 2006, with a low of 10 in 2013. Over the past 5 years, peak male counts have ranged between 14 and 41 individuals (NDOW 2018, unpublished data). Leks in the Wassuk Range have not been surveyed consistently due to lack of access, which requires aerial survey methods. In 2005 and 2006, a total of 19 and 33 males, respectively, were counted on five active leks in the Wassuk Range (NDOW 2009, unpublished data; Bi-State TAC 2012, p. 35). During 2012, on four leks surrounding Mount Grant, researchers counted a total of 139 birds (males and females) (BSLSP 2012, p. 13). In 2013, researchers counted 38 males on 3 leks, the largest of which contained 30 males, and over the past 4 years, total male counts have ranged between 8 and 35 across 3 to 5 leks, with the largest lek containing 23 males. However, these results are calculated from limited data due to access limitations and survey method. The most recent results from the IPM suggest population growth in this PMU has generally been stable over the past decade, largely mirroring the pattern across the Bi-State DPS overall. Estimated median population abundance in 2018 was 374 (CRI = 205–619; Coates et al. 2020, p. 34) individuals. Estimated median lambda from 2008 through 2018 was 0.989 (CRI = 0.551–1.536; Coates et al. 2020, p. 34).

Completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal, sagebrush restoration, horse gathers (roundup and removal of wild horses on public lands), road closures, and fence removal (Bi-State TAC 2019, entire).

(4) The Bodie PMU contains one population (Bodie Hills), which is one of the two core (largest) populations for the Bi-State DPS. Most of the PMU is located to the

east of Highway 395, but a small portion extends west of Highway 395 to the Sierra Nevada Mountains. Loss of historical sage-grouse range in the Bodie PMU has been most influenced by woodland succession (The Nature Conservancy 2009, entire; Bi-State TAC 2012, p. 30; USGS 2012, unpublished data). Significant stands of pinyon pine and to a lesser extent juniper occur at mid to low elevations on all flanks of the Bodie Hills as well as across the Sierra Nevada Mountains side of the PMU. Perennial water and meadow habitats in the Bodie PMU are generally privately owned and provide important sage-grouse habitat during the brood-rearing/summer season. While natural vegetation succession processes (woodland establishment)—in the absence of disturbance—have resulted in loss of sagebrush habitat that continues to fragment and isolate the population within this PMU, the extent of habitat loss and fragmentation attributable to land use change (urban development and agricultural conversion) appears minimal.

Approximately eight leks have been regularly surveyed in the Bodie PMU since the late 1980s with some locations being counted as far back as the 1950s. Additional active leks and numerous satellite leks (sites used sporadically in years of high sage-grouse abundance) have also been identified in the Bodie PMU. The majority of leks are located in the Bodie Hills east of Highway 395, but at least one long-term lek and several associated satellite leks occur west of the Highway. Since 1953, the long-term average total male attendance in the Bodie PMU is 192 (Bi-State TAC 2017, p. 11). The minimum count recorded was 64 males on 6 leks in 1998, and the maximum was 524 males on 14 leks in 2014.

The sage-grouse population in the Bodie PMU has no discernible long-term trend (Garton et al. 2011, p. 324; referred to as the Mono Lake population). The average

number of males per active lek declined by 41 percent between 1965 and 2007, but since 1991 the minimum number of males counted has been trending upward (Garton et al. 2011, p. 324). Recent survey years are encouraging because they demonstrate a substantial increase in the peaks associated with the population fluctuations. These increasing peaks, coupled with the general increase in the number of males counted since the early 1990s, suggests the Bodie PMU may be moving toward a cycle that oscillates at generally higher numbers as compared to the other PMUs. The most recent results from the IPM suggest growth in this population has remained stable, with evidence of increase. Estimated median population abundance in 2018 was 1,521 (CRI = 1,181–1,941; Coates et al. 2020, p. 34) individuals. Estimated median lambda from 1995 through 2018 was 1.07 (CRI = 0.76–1.758), from 2001 through 2018 was 1.029 (CRI = 0.74–1.457), and from 2008 through 2018 was 1.061 (CRI = 0.783–1.471; Coates et al. 2020, p. 34). Changes in population from 1995 through 2018 indicate that sage-grouse numbers as of 2018 were approximately four times higher compared to the low point 24 years ago (Coates et al. 2020, p. 34).

Completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal; conservation easements; fence modification and removal; road closure; post-fire rehabilitation; and sagebrush and brood-rearing habitat restoration (Bi-State TAC 2019, entire).

(5) The South Mono PMU comprises three generally discrete locations or breeding complexes: Long Valley, Parker Meadow, and Granite Mountain. In the South Mono PMU, sage-grouse were likely historically distributed in many of the same areas utilized today (BSLPG 2004, p. 162), although there has been an estimated reduction in

sagebrush extent of approximately 13 percent (USGS 2012, unpublished data) due to woodland succession. In addition, loss and fragmentation of habitat due to other causes (infrastructure, wildfire, and water development) has likely altered sage-grouse occurrence in certain locations such as the Mono Basin and Adobe Valley. In Long Valley, there may be specific locations where distribution has been reduced, but these areas appear limited in extent and confined to peripheral locations within the breeding complex. Changes in the sage-grouse population size in the Parker Meadow and Granite Mountain portions of the PMU are unclear, but likely greater. The Granite Mountain and Adobe Valley area (north of Highway 120) contains an expanse of sagebrush habitat and has been known to support birds during severe winters as well as historically (USFS 1966, p. 4; BSLPG 2004, p. 161). However, no consistent use of Adobe Valley is currently occurring, and use of the Granite Mountain area is limited. This inconsistent use is presumed to be caused by the general lack of water and meadow habitat in the area, which has likely decreased in the past century. To the east of Adobe Valley in the vicinity of Pizona Creek, a potential connectivity corridor exists between populations in the South Mono and White Mountains PMUs. However, the vegetation within this corridor has apparently changed due to woodland succession, and an aerial survey suggests that current vegetation is not suitable sage-grouse habitat (BSLSP 2012, p. 36).

Although surpassed by the Bodie PMU in 2012, traditionally the South Mono PMU has had the highest estimated population size as compared to the other PMUs within the range of the Bi-State DPS. The Long Valley breeding complex includes at least 10 to 12 consistently active leks and associated satellite sites located along the upper Owens River drainage and the Crowley Lake Basin. The Granite Mountain breeding

complex includes two inactive leks located in the Adobe Valley and two active leks located in the Sagehen Summit area. The Parker Meadow breeding complex includes one consistently active lek site located south of Parker Creek at the northwest end of the June Lake Loop Road. Both the Granite Mountain and Parker Meadow breeding complexes are small, with generally less than 10 strutting males per complex documented per year.

Long Valley represents the largest population in the South Mono PMU and, in conjunction with the Bodie PMU, these two PMUs represent the core populations of the Bi-State DPS. Sage-grouse have been counted in the Long Valley breeding complex since the early 1950s. Historical maximum male attendance counts occurred in 1962, 1963, 1986, and 2012 when 408, 405, 406, and 418 male were counted, respectively, on 6–7 leks (Bi-State TAC 2012, p. 44). The long-term average peak male attendance between 1953 and 2018 is approximately 200, counted on an average of 9 leks. The high count during this period was 418 males in 2012, and the low count was 130 males in 2019 (CDFW 2019, unpublished data). The population in Long Valley has demonstrated positive and negative growth rates over the past 40 years (Garton et al. 2011, p. 329), although fluctuations have been relatively tempered and the population trend appears generally stable based on these data. The most recent results from the IPM suggest growth in this population has declined on average approximately four percent annually over the past decade, with more evidence of decrease than increase and apparently deviating from the remainder of the DPS. Estimated median population abundance in 2018 was 818 (CRI = 614–1,053; Coates et al. 2020, p. 35) individuals. Estimated median lambda from 1995 through 2018 was 0.996 (CRI = 0.676–1.427), from 2001

through 2018 was 0.986 (CRI = 0.655–1.433), and from 2008 through 2018 was 0.96 (CRI = 0.68–1.361; Coates et al. 2020, p. 35).

Four leks are known to exist in the Granite Mountain breeding complex (Adobe, Gaspipe, Big Sand Flat, and Sagehen Summit). Estimated median population abundance in 2018 was 20 individuals (CRI = 0–75; Coates et al. 2020, Table 1). Estimated median lambda from 1995 through 2018 was 0.916 (CRI = 0.282–1.964), from 2001 through 2018 was 0.844 (CRI = 0.18–1.819), and from 2008 through 2018 was 0.834 (CRI = 0.222–1.658; Coates et al. 2020, Table 3). Sage-grouse have been known to occur in the Parker Meadow breeding complex area since the 1950s, although lek monitoring did not occur until 2002. One small lek is active, and on occasion, satellite sites have experienced strutting activity (CDFW 2012, unpublished data). Since 2002, a high count of 18 males occurred in 2018, and a low count of 3 males occurred in 2010 (Bi-State TAC 2012, p. 45; CDFW 2018, unpublished data). The most recent results from the IPM suggest growth in this population is generally stable. Estimated median population abundance in 2018 was 48 (CRI = 21–86; Coates et al. 2020, Table 1) individuals. Estimated median lambda from 2001 through 2018 was 0.968 (CRI = 0.254–0.7.16), and from 2008 through 2018 was 1.048 (CRI = 0.361–5.814; Coates et al. 2020, Table 3). While growth in this population has little influence on the South Mono PMU as a whole, Parker Meadows likely facilitated connectivity between the Bodie and South Mono PMUs historically and potentially still does so today.

In 2017, an experimental translocation program was initiated to bolster low numbers in the Parker Meadows population (Mathews et al. 2018, p. 7). Given its infancy, the efficacy of this program has not yet been determined. However, the recent

high male lek count in 2018 (which excluded translocated males) offers some optimism as translocations in 2017 improved reproductive success and ultimately recruitment in 2018.

Apart from the translocation, completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal, land acquisition, road closures, landfill removal, and fence modification and removal (Bi-State TAC 2019, entire).

(6) The White Mountains PMU is the southernmost PMU in the Bi-State DPS, encompassing the White Mountains along the border of Nevada and California. It extends from the Candelaria Hills and Truman Meadows areas in the north to California Highway 168 in the south and from California Highway 6 in the west to the Silver Peak Range, Nevada, in the east. Historical and current distributions of sage-grouse in the White Mountains are not well understood. The area is difficult to access and, due to elevation, heavy snow conditions are typical during the spring breeding season. In addition, the number, size, and activity of leks in the White Mountains are not well known due to infrequent and opportunistic surveys. Historical accounts in Esmeralda County, Nevada, suggest bird densities there have likely always been low.

Current impacts such as exurban development (e.g., Chiatovich Creek area (BSLSP 2012, p. 38)), grazing, recreation, and invasive species may be influencing portions of the population and are likely to increase in the future, but current impacts are considered minimal due to the remote locations of most known sage-grouse use areas. Potential future impacts from infrastructure (power lines, roads) and mineral developments could lead to fragmentation of the remote, contiguous nature of the habitat if conservation efforts were not conducted.

There are currently two active leks in the Nevada portion of the White Mountains PMU. Both were discovered in 2012 and are relatively small with between zero and nine males documented per lek per year (NDOW 2018, unpublished data). Since 2016, no males have been detected at one of these sites.

The most recent run of the IPM suggests more evidence of decline than increase, although this estimate is derived from fairly limited data. Estimated median population abundance in 2018 was 45 (CRI = 9–86; Coates et al. 2020, p. Table 1) individuals. Estimated median lambda from 2008 through 2018 was 0.85 (CRI = 0.343–1.957; Coates et al. 2020, p. Table 3).

Completed, ongoing, and planned conservation measures in this PMU include conservation easements and horse gathers (Bi-State TAC 2019, entire).

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term "threat" may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the

species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

Our proposed rule described "foreseeable future" as the extent to which we can reasonably rely on predictions about the future in making determinations about the future conservation status of the species. The Service since codified its understanding of foreseeable future in 50 CFR 424.11(d) (84 FR 45020). In those regulations, we explain the term "foreseeable future" extends only so far into the future as the Service can reasonably determine that both the future threats and the species' responses to those threats are likely. The Service will describe the foreseeable future on a case-by-case basis, using the best available data and taking into account considerations such as the species' life-history characteristics, threat-projection timeframes, and environmental variability. The Service need not identify the foreseeable future in terms of a specific period of time. These regulations did not significantly modify the Service's interpretation; rather they codified a framework that sets forth how the Service will determine what constitutes the foreseeable future based on our long-standing practice. Accordingly, though these regulations do not apply to this determination for the Bi-State DPS of greater sage-grouse because it was proposed prior to their effective date, they do not change the Service's assessment of foreseeable future for the Bi-State DPS of greater sage-grouse as contained in our proposed rule and in this determination.

Analytical Framework

The Species Report documents the results of our comprehensive biological status review for the species, including an assessment of the potential threats to the species. The Species Report does not represent a decision by the Service on whether the species should be proposed for listing as an endangered or threatened species under the Act. It does, however, provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the Species Report; the full report can be found at either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107 on *http://www.regulations.gov*.

In this determination, we used the three conservation biology principles of resiliency, redundancy, and representation to assess the viability of the Bi-State DPS (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we will consider the DPS' overall response to threats and the DPS' viability as a whole.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, the influence of those conditions on the species' overall viability, and the risks to that viability. Following are summary evaluations of 11 threats analyzed in the Species Report for the Bi-State DPS: urbanization and habitat conversion (Factor A); infrastructure (Factor A); mining (Factor A); grazing and rangeland management (Factor A); nonnative invasive plants and native woodland succession (Factor A); wildfires and altered fire regime (Factor A); climate change, including drought (Factor A); recreation (Factor E); disease (Factor C); predation (Factor C); and small population size and population isolation (Factor E). We also evaluate the inadequacy of existing regulatory mechanisms (Factor D) on the magnitude of threats. Please see the Species Report (Service 2020, pp. 39–136) for a more detailed discussion of each threat.

In the Species Report, we also considered four additional threats: renewable energy (Factor A), commercial and recreational hunting (Factor B); scientific and educational uses (Factor B); and contaminants (including pesticides) (Factor E). We concluded that though these threats are currently having some impact on individual sage-grouse and their habitat, their overall effect now and into the future is expected to be minimal. Therefore, we will not present summary analyses of those threats in this document but will consider them in our overall conclusions of impacts to the species. For full descriptions of all these threats and how they impact the species, please see the Species Report (Service 2020, pp. 63–124).

For the purposes of this assessment, we consider the foreseeable future to be the amount of time on which we can reasonably determine a likely threat's anticipated

trajectory and the anticipated response of the species to those threats. For some threats impacting the Bi-State DPS, we consider the time for which we can reliably project threats and the anticipated response to be 30 years. This time period represents our best professional judgment of the foreseeable future conditions related to climate change, native woodland succession, nonnative invasive plants, and wildfire cycles, as well as the Bi-State DPS population cycles, probability of population persistence analyzed and described by Garton et al. (2015, entire), and regeneration time of sagebrush habitat. For other threats and the anticipated species response, we can reliably project impacts and the species response for less than 30 years, such as infrastructure, urbanization and habitat conversion, grazing and rangeland management, recreation, disease, and predation.

Urbanization and Habitat Conversion

Urbanization and habitat conversion (Factor A) have both direct and indirect effects on sagebrush habitat. In this section, we will discuss direct impacts to sagebrush habitat and to sage grouse populations. Indirect effects (such as those associated with infrastructure, increases in invasive plant species, and increases in domestic animals and wildlife predator species) will be addressed in later sections.

Traditional land use in the Bi-State area was primarily farming and ranching operations. These operations can have both beneficial and detrimental effects on sage-grouse conservation. Continuing farming and ranching operations have limited development of exurban subdivisions in the Bi-State area, but they have also affected the extent of remaining sagebrush through conversion to alternate vegetation types (such as pasture grass) (Service 2020, p. 35). The extent of impacts from the conversion of habitat depends on the amount of sagebrush lost, the type of seasonal habitat affected, and the

arrangement of habitat lost (large blocks or small patches) (Knick et al. 2011, pp. 208–211).

While conversion of sagebrush vegetation communities to agricultural land continues to occur in the Bi-State area, the rate of this conversion remains difficult to quantify. Some reports state that conversion has lessened and that some of these lands are instead being sold and converted to low-density residential housing developments (Bi-State TAC 2012, pp. 18, 24, 41). Several studies have demonstrated that these increases in human population density could have strong effects on sage-grouse occupancy beyond the areas directly converted to human development. Sage-grouse extirpation was more likely in areas having a human population density of at least four people per 1 km^2 (10 people per 1 mi^2) (Aldridge et al. 2008, pp. 991–992). Increase in human populations from this moderate level did not infer a greater likelihood of extirpation, likely because much of the additional growth occurred in areas no longer suitable for sage-grouse (Aldridge et al. 2008, pp. 991–992). Additionally, human density is 26 times greater in extirpated sage-grouse areas than in the currently occupied range (Wisdom et al. 2011, p. 463). In modeling several measures of human population on greater sage-grouse persistence, including current population density, historical population density, and human population growth, the best predictor of sage-grouse extirpation was human population density in 1950 (Aldridge et al. 2008, p. 985). This finding suggests that human development has had long-term impacts on habitat suitability and sage-grouse persistence (Aldridge et al. 2008, pp. 991–992). Thus, even small increases in human population density can have a strong effect on sage-grouse populations.

Another indicator of human development pressure on sage-grouse can be inferred from existing sagebrush availability. To persist in an area, sage-grouse require a minimum of 25 percent sagebrush; a high probability of persistence required 65 percent sagebrush or more (Aldridge et al. 2008, p. 990; and Chambers et al. 2014, p. 12). When data were analyzed in 2014 across the Bi-State, no leks contained less than 25 percent sagebrush cover in the immediate area. However, 30 out of the 55 leks (55 percent) contained between 25 and 65 percent sagebrush cover, suggesting an intermediate probability of persistence (Chambers et al. 2014, p. 12). The remaining 25 leks (45 percent) contained greater than 65 percent sagebrush cover surrounding a lek site.

Historical and recent alterations, as well as ongoing conversion of sagebrush vegetation to support ranching operations and urban/exurban expansion, poses the greatest risk to persistence of sage-grouse in the Pine Nut, Desert Creek-Fales, and South Mono PMUs and to a lesser degree in the Bodie, and White Mountains PMUs (BSLPG 2004, pp. 24–169; Bi-State TAC 2012, pp. 18–46). Approximately 11 percent of suitable sage-grouse habitat in the Bi-State area occurs on private lands. In each PMU, sage-grouse home ranges include private lands that are critical to fulfilling annual habitat needs (Casazza 2009, p. 9), including a significant proportion of mesic areas (e.g., upland meadows) within the range of the Bi-State DPS needed by sage-grouse during the late brood-rearing period. Sage-grouse are known to display strong site fidelity to traditional seasonal habitats, and loss or degradation of specific sites (especially brood-rearing habitat) can have negative population impacts.

The majority of local agency land in the South Mono PMU is owned by the City of Los Angeles and managed by the Los Angeles Department of Water and Power

(LADWP). Many of these parcels are irrigated pasture, which provide important brood-rearing habitat to upwards 40 percent of the entire Bi-State DPS population. The LADWP is considering altering the extent to which these lands are irrigated. If realized, this potential additive stressor has the potential to negatively affect brood-rearing success (an influential demographic vital rate), given that the Long Valley population has demonstrated slightly negative population growth on average over the past 10 years. To address this concern, in 2019 LADWP provided a letter to the Service that reaffirms its prior commitment to allocate a sufficient amount of water to maintain sage-grouse habitat in Long Valley. Determining the amount of water needed to achieve this commitment will be informed by a collaborative, science-based approach (LADWP 2019, *in litt.*). The goal of LADWP's natural resource management is to employ Best Management Practices for land and water uses that maintain water supplies to the City of Los Angeles while protecting water quality, habitat, biodiversity, as well as species recognized under the ESA throughout the related watersheds. In 2014 (August 18, 2014), LADWP and their governing Board of Water and Power Commission approved a Conservation Strategy for the Bi-State DPS on their lands in Mono County, California. A component of this Strategy included commitments to maintain sage-grouse lekking, nesting, and brood rearing habitat. Consistent with this Strategy, LADWP has consistently managed the activities on their lands such as habitat restoration, livestock grazing, recreation, control of noxious and invasive weeds, fire suppression, infrastructure, and management of water in a manner that is compatible with the conservation of the Bi-State DPS. These past efforts and ongoing commitments will continue to provide benefits to conservation of the

species. The remainder of private lands in the South Mono PMU is rangeland, although potential for commercial, residential, or recreational development exists.

Ongoing efforts to develop fee acquisition of properties or enroll them into conservation easements may help ameliorate current and anticipated effects of urbanization and habitat conversion. We estimate that approximately 10,415 ha (25,737 ac) of private land, which may provide suitable habitat for sage-grouse in the Bi-State DPS, are currently enrolled in various easement programs. The easements are targeted primarily at development and water rights and vary in length from 30 years to in perpetuity; thus, they can ameliorate the threat of development but do not necessarily ensure that habitat remains suitable. The majority of these easement lands are located in the Bodie PMU, with the remainder of easements occurring in the Desert Creek-Fales, South Mono, Pine Nut, and White Mountains PMUs. Of the approximately 60,326 ha (149,071 ac) of private land that may provide suitable habitat for sage-grouse within the Bi-State area, approximately 17 percent is under easements. An additional approximate 9,045 ha (22,352 ac) of previously private land within the Bi-State DPS has been acquired by State and Federal agencies over the past decade. In total, approximately 19,460 ha (48,089 ac) of land, either through conservation easements or acquisitions, has been substantially protected from urbanization challenges. These acres represent approximately 31 percent of total private lands containing suitable sage-grouse habitat across the Bi-State area. In addition, approximately 7,280 ha (18,000 ac) of lands identified as important by the 2012 BSAP have funding obligated and are working through the easement development process, with many of these efforts anticipated to be completed in a few years. An effort to acquire approximately 5,867 ha (14,500 ac) of

additional lands in the Pine Nut PMU by the Carson City BLM has been approved but will likely not finalize until sometime in 2020. Combining the realized and reasonably anticipated efforts, approximately 57 percent of high-priority private lands in the Bi-State area will be protected.

Currently, 89 percent of the Bi-State DPS is Federal lands. On Federal lands, existing regulatory mechanisms protect sagebrush habitat from development. Approximately 54 percent of all lands within the sage-grouse Bi-State area is BLM-administered land; this includes approximately 1 million ha (2.5 million ac). The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*) is the primary Federal law governing most land uses on BLM lands, and directs development and implementation of resource management plans (RMPs) that direct management at a local level. The sage-grouse is designated as a sensitive species on BLM lands in the Bi-State area (Sell 2010, pers. comm.). The BLM's objectives for sensitive species is two-fold: (1) To conserve and recover ESA-listed species and the ecosystem on which they depend so that ESA protections are no longer needed, and (2) to initiate proactive conservation measures that reduce or eliminate threats to species to minimize the likelihood of and need for listing of these species under the ESA (BLM 2008, p. 3).

The USFS manages approximately 35 percent of the land in the Bi-State area or approximately 600,000 ha (1.5 million ac). Management of activities on national forest system lands is guided principally by the National Forest Management Act (NFMA). The NFMA specifies that the USFS must have a land resource management plan (LRMP) (16 U.S.C. 1600) to guide and set standards for natural resource management activities on each National Forest or National Grassland. The greater sage-grouse is designated as a

USFS Sensitive Species in the Intermountain (R4) and Pacific Southwest (R5) Regions, which includes the Humboldt-Toiyabe National Forest (Bridgeport and Carson Ranger Districts) and the Inyo National Forest in the Bi-State area. Designated sensitive species require special consideration during land use planning and activity implementation to ensure the viability of the species on USFS lands and to preclude any population declines that could lead to a Federal listing (USFS 2008, p. 21). In addition, sensitive species designations require analysis for any activity that could have an adverse impact to the species, including analysis of the significance of any adverse impacts on the species, its habitat, and overall population viability (USFS 2008, p. 21). The specific protection that sensitive species status confers to sage-grouse on USFS lands is largely dependent on LRMPs and site-specific project analysis and implementation.

These regulatory mechanisms prevent urban development on Federal lands. Through NFMA, LRMPs, Federal Land Policy and Management Act, RMPs, and the On-Shore Oil and Gas Leasing Reform Act (1987; implementing regulations at 36 CFR part 228, subpart E), land-managing agencies have the authority to manage, prevent, restrict, or attach protective measures to mineral extraction, wind development, and other energy permits on Federal lands. Thus, some habitat loss due to these developments may still occur on Federal land. Despite this, regulatory mechanisms in place are overall reducing the magnitude of threats associated with urbanization and habitat conversion.

Historical and recent conversion of sagebrush habitat on private lands for agriculture, housing, and associated infrastructure within the Bi-State area has likely negatively affected sage-grouse distribution and population extent in the Bi-State DPS, thus potentially influencing current and future recovery opportunities in the Bi-State area.

These alterations to habitat have been most pronounced in the Pine Nut and Desert Creek-Fales PMUs and to a lesser extent in the Bodie, South Mono, and White Mountains PMUs. Although only a subset of the 11 percent of suitable sage-grouse habitat that occurs on private lands could potentially be developed, conservation actions on adjacent public lands could be compromised due to the significant percentage of late brood-rearing habitat that occurs on the private lands. Furthermore, the influence of land development and habitat conversion on the population dynamics of sage-grouse is greater than a simple measure of spatial extent because of the indirect effects from the associated increases in human activity. These threats are not universal across the Bi-State area, but localized areas of impacts have been realized and additional future impacts are anticipated. Currently, approximately 31 percent of total private lands containing suitable sage-grouse habitat across the Bi-State area are enrolled under an easement program or have been acquired by Federal and State agencies, and this number will increase to 57 percent when combining additional efforts that are ongoing and reasonably likely to occur.

Urbanization was not considered a significant threat at the time of the 2013 proposed listing rule. Currently, the effects of urbanization are having a minimal impact on the resiliency of populations within the Bi-State DPS. Absent any protections or conservation measures, the magnitude of impacts could increase into the foreseeable future as unprotected private lands become further fragmented. However, due to protections associated with regulatory mechanisms, and in particular because of efforts to acquire important private lands associated with the BSAP, we conclude that the

magnitude of effects associated with this threat and its potential impacts on population resiliency should not increase to a detrimental level.

The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as urbanization and habitat loss. Because we have determined that the partially completed and future conservation measures/efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, above), we believe that urbanization and human disturbance is not a significant impact on the species within the foreseeable future.

Infrastructure

We characterize infrastructure as features that assist or are required for human development or an associated action. We focus on five infrastructure features that are apparent in the Bi-State area and that have been implicated in impacting sage-grouse: three linear features (roads, power lines, and fences) and two site-specific features (landfills and communication towers).

Infrastructure can have direct impacts on sage-grouse, such as mortality through collision with power lines or fences, or direct impacts on sagebrush, such as habitat fragmentation or habitat loss. Fragmentation of sagebrush habitat has been cited as a primary cause of the decline of sage-grouse populations because the species requires large expanses of contiguous sagebrush (Service 2020, p. 45). Estimating the impact of habitat fragmentation caused by infrastructure on sage-grouse is complicated by the nonrandom placement of these features and by time lags in species response to habitat changes (Garton et al. 2011, p. 371), particularly since these relatively long-lived birds

continue to return to altered breeding areas (leks, nesting areas, and early brood-rearing areas).

Roads are a linear feature on the landscape that can contribute to habitat loss and avoidance of areas close to roads, create barriers to migration corridors or seasonal habitats, and increase human disturbance in remote areas (Service 2020, p. 46). Additionally, roads can provide corridors for predators to move into previously unoccupied areas. For some mammalian and avian species (such as common ravens (*Corvus corax*)), dispersal along roads and other linear features like power lines has greatly increased their distribution (Forman and Alexander 1998, p. 212; Knight and Kawashima 1993, p. 268; Forman 2000, p. 33; Connelly et al. 2004, p. 12-3). Road networks also contribute to the spread of nonnative invasive plants via introduced road fill, vehicle transport, and road maintenance activities (Forman and Alexander 1998, p. 210; Forman 2000, p. 32; Gelbard and Belnap 2003, p. 426; Knick et al. 2003, p. 619; Connelly et al. 2004, p. 7-25). Direct mortality of sage-grouse from vehicle collisions does occur (Patterson 1952, p. 81; Wiechman and Reese 2008, p. 3), but mortalities are typically not monitored or recorded. Additionally, roads can have impacts on sage-grouse behavior. For example, roads within 7.5 km (4.7 mi) of leks negatively influence male lek attendance (Service 2020, pp. 46–47). The mechanism by which road presence reduces male lek attendance is not entirely clear, but chronic noise may contribute to these decreases. Male sage-grouse rely on acoustical signals to attract females to leks (Gibson and Bradbury 1985, p. 82; Gratson 1993, p. 692). Therefore, if noise interferes with mating displays, and thereby female attendance, younger males will not be drawn to the

lek and eventually leks could become inactive (Amstrup and Phillips 1977, p. 26; Braun 1986, pp. 229–230).

In general, locations associated with mineral development (Mount Grant PMU), recreational activity (Bodie and South Mono PMUs), and major travel corridors (Desert Creek-Fales PMU) have the most significant daily road traffic. Our analysis of the best available data in the Bi-State area documents that 54 out of 55 known active or pending leks are within 3 km (1.8 mi) or less of an existing minor road (such as dirt two-track roads). Furthermore, of the 55 known active or pending leks, 64 percent (n=35) are within 5 km (3.1 mi) of paved secondary highways (Service 2013c, unpublished data).

An extensive network of roads and trails currently occurs throughout the range of the Bi-State DPS. In the Bi-State area, all Federal lands have restrictions limiting off-road vehicular travel. In addition, road closures and rehabilitation of redundant roads by USFS and BLM are occurring to benefit Bi-State DPS conservation (Service 2020, p. 49). We anticipate limited additional road and trail development will occur within suitable and potentially suitable habitat in the Bi-State area based on recent land use plan amendments, USFS and BLM travel management plans, and our current understanding of travel management direction. However, because an extensive road and trail network already occurs throughout the Bi-State area and because roads are known to result in both direct and indirect impacts to sage-grouse, we anticipate some impacts to birds and leks in the future, although we are uncertain to what degree these potential impacts will affect populations in the Bi-State area.

Power lines can directly affect sage-grouse by posing collision and electrocution hazards (Braun 1998, pp. 145–146; Connelly et al. 2000a, p. 974). They can have indirect

effects by decreasing lek recruitment, increasing predator presence, facilitating the invasion of nonnative invasive annual plants by creating soil conditions favorable to their spread, potentially acting as a barrier to movement, and ultimately negatively affecting population performance (Service 2020, pp. 50–52). Due to the potential spread of invasive species and facilitation of predator occurrence as a result of power line construction, the indirect influence power lines can have on vegetation community dynamics and species occurrence often extends out further than the physical footprint (Knick et al. 2011, p. 219). Recent research has demonstrated that power lines are influencing sage-grouse behavior, demographic vital rates, and population growth rates due to associated impacts from raven abundance and predation (Gibson et al. 2018, p. 17).

Power lines occur in all Bi-State PMUs, but the extent of exposure varies by location. Based on available data (generally restricted to transmission lines), we estimate approximately 210 km (130 mi) of existing power lines are present across suitable habitat in the Bi-State. Overall, approximately 21 percent of 55 active and pending leks in the Bi-State area are within 2 km (1.2 mi) or less of existing transmission lines and approximately 38 percent of active and pending leks are within 5 km (3.1 mi) or less of existing transmission lines (Service 2013c, unpublished data). This suggests a potential loss, due to sage-grouse avoidance, of approximately 25,200 ha (62,270 ac) of otherwise suitable habitat (Gillan et al. 2013, p. 307). These transmission lines have the potential to further negatively influence over 250,000 ha (617,700 ac) or approximately 47 percent of suitable habitat, assuming their presence leads to the increased presence of ravens and other predators (Gibson et al. 2018, p. 17). Given that the predator community population

size likely fluctuates through time, the scale of this potential impact will likely vary. Therefore, we are uncertain to what degree these potential impacts will affect populations in the Bi-State area. Of ongoing concern, however, is the potential time lag in effects from construction of power lines, as ravens and other predators may not utilize those lines until several years after their construction.

We anticipate that while existing power lines will persist on the landscape in the future, new power lines will be limited to smaller distribution lines associated with expansion of urbanization on a portion of the private lands within and around the Bi-State area. Bi-State habitat is currently managed as a right-of-way avoidance area by Federal land managers, such that larger lines (>120 kilovolts) and associated facilities will not be authorized (outside of existing corridors; BLM 2016, p. 15; HTNF 2016, p. 13). In the Bodie PMU, one decommissioned power line has been removed (Bi-State TAC 2018).

Fences are used to delineate property boundaries and for livestock management (Braun 1998, p. 145; Connelly et al. 2000a, p. 974). The effects of fencing on sage-grouse include direct mortality through collisions, creation of predator perch sites, and habitat fragmentation (Service 2020, p. 55). Fences present a risk to sage-grouse in all Bi-State PMUs (BSLPG 2004, pp. 54, 80, 120, 124, 169) due to known fence collisions and their potential to degrade habitat quality.

Not all fences present the same direct mortality collision risk to sage-grouse. Collision risk factors include fencing design, landscape topography, and spatial relationship with seasonal habitats (Christiansen 2009, p. 2). Management methods can decrease the impact of fences on sage-grouse. Visual markers have been employed in some of the high-risk areas to make fences more readily seen by birds; this method does

appear to substantially reduce mortality due to collisions. Markers have been installed on a total of approximately 101 km (63 mi) of fence across the Bi-State DPS since 2012. Recent land use plan amendments encourage evaluation of existing fences with respect to sage-grouse conservation and discourage new installations that may negatively affect sage-grouse and its habitat (BLM 2016, pp. 12, 15; HTNF 2016, p. 14).

Data on the total extent (length and distribution) of existing fences and new fence construction projects are not available for the Bi-State area. However, based on data contained within the *Greater Sage-grouse Bi-State Distinct Population Segment Forest Plan Amendment* (USFS and BLM 2014, p. 99), there is likely on the order of 650 km (400 mi) of existing fences across the entire DPS. While we expect fencing to continue and possibly expand in the future within every PMU in the Bi-State area, efforts associated with conservation and regulatory mechanisms are currently ongoing (and expected to continue into the future) to ameliorate some of their impacts (Bi-State TAC 2012, p. 5; BLM 2016, pp. 12, 15; HTNF 2016, p. 14). While direct mortality through collision may be minimized by these approaches, indirect impacts caused by predation and other forms of habitat degradation may remain. The overall severity of these impacts to the Bi-State DPS throughout its range is not known, but based on the best available data the impacts are widespread but minor.

Millions of birds are killed annually in the United States through collisions with communication towers (including cellular towers) and their associated structures (e.g., guy wires, lights) (Shire et al. 2000, p. 5; Manville 2002, p. 10), although most documented mortalities are of migratory songbirds. In a comparison of sage-grouse locations in extirpated areas of their range (as determined by museum species and

historical observations) and currently occupied habitats, proximity to cellular towers had a strong correlation with likelihood of extirpation, and the distance to cellular towers was nearly twice as far from grouse locations in currently occupied habitats than extirpated areas (Wisdom et al. 2011, p. 463). However, there was no information as to whether the towers were a factor in the extirpation of those areas, or if their presence was linked to other threats in those areas (Wisdom et al. 2011, p. 467).

Within the range of the Bi-State DPS, approximately eight communication towers have been constructed in the past decade (Federal Communications Commission (FCC) 2018, unpublished data); each PMU has at least one such facility located within occupied sage-grouse habitat. These eight sites are likely an underrepresentation of the actual number of tower sites within the Bi-State area, as tower facilities shorter than 61 m (199 ft.) above ground level are not required to register with the FCC (FCC 2018, unpublished data). We are unable to determine if any sage-grouse mortalities have occurred as a result of collisions with registered or unregistered communication towers or their supporting structures, as most towers are not monitored, and those that are monitored lie outside the range of the species (Kerlinger 2000, p. 2; Shire et al. 2000 p. 19).

Based on regulatory mechanisms associated with existing land use plans as well as existing land designations (wilderness and wilderness study areas), which significantly restrict new communication site development, we do not expect many new facilities on federally managed land in the Bi-State area (BLM 1993, p. 18; BLM 2016, p. 13; HTNF 2016, pp. 42–43). However, we anticipate that existing communication towers will remain in place and potentially new communication towers will be added at existing tower sites. Typically, rights-of-way grants afforded these facilities are for 30 years, and

would likely be renewed indefinitely. It is also probable that new communication towers will be developed on non-federally managed lands along existing Federal Highways and State Routes. Thus, future communication tower placements will most likely affect the Desert Creek-Fales and South Mono PMUs, potentially affecting sage-grouse habitat in those locations.

Municipal solid waste landfills and associated roads contribute to increases in synanthropic predators (predator species adapted to conditions created or modified by people) (Knight et al. 1993, p. 470; Restani et al. 2001, p. 403; Webb et al. 2004, p. 523). One landfill exists in the Bi-State area. The Benton Crossing Landfill in Mono County is located north of Crowley Lake in Long Valley on a site leased from the LADWP. Common ravens and California gulls (*Larus californicus*) heavily use the landfill (Coates 2008, pers. comm.; USGS 2017, p. 17). Sage-grouse nest success in Long Valley (South Mono PMU) was lower than in other PMUs within the Bi-State area (Kolada et al. 2009b, p. 1344), which may be attributable to increased avian predators subsidized by landfill operations (Casazza 2008, pers. comm.; USGS 2017, p. 74; Coates et al.. 2018, p. 256). At this time, the future closing of the landfill appears probable, as LADWP has stated that they do not intend to renew the lease and Mono County has been funding planning studies for relocation, but any action on relocation is unlikely before the lease expires in 2023.

In the Bi-State area, linear infrastructure impacts each PMU both directly and indirectly to varying degrees. Existing roads, power lines, and fences may degrade sage-grouse habitat and contribute to direct mortality through collisions. In addition, roads, power lines, and fences influence sage-grouse use of otherwise suitable habitats adjacent

to current active areas, increase predators, and increase invasive plants. The impact caused by these indirect effects extends beyond the immediate timeframe associated with the infrastructure installation. Across the entire range of the greater sage-grouse, the mean distance to highways and transmission lines for extirpated populations was approximately 5 km (3.1 mi) or less (Wisdom et al. 2011, p. 463). In the Bi-State area, 64 percent of active or pending leks are within 5 km (3.1 mi) of highways, and approximately 38 percent are within this distance to existing transmission lines (Service 2013c, unpublished data). The similarity apparent between these Bi-State DPS lek locations and extirpated greater sage-grouse populations suggests that persistence may be influenced by their juxtaposition with these anthropogenic features.

The geographic extent, density, type, and frequency of linear infrastructure disturbance in the Bi-State area have changed over time. While new development of some of these features (highways) will likely not occur, other infrastructure features have the potential of increasing (secondary roads, power lines, fencing, and communication towers). Furthermore, while development of new highways is unlikely, road improvements are possible and traffic volume will likely increase, and in certain areas these actions may be more important than road development itself.

We concluded in the 2013 proposed listing rule that infrastructure impacts (particularly fencing, power lines, and roads) were a significant factor for proposing to list the DPS as a threatened species, and today, we affirm that impacts from infrastructure occur in various forms throughout the Bi-State DPS's range and are an ongoing threat impacting population resiliency across its range and degrading habitat both currently and into the future. This conclusion is based on a variety of range-wide impacts that are

currently occurring and expected to continue or increase in the future that result in habitat fragmentation; limitations for sage-grouse recovery actions due to an extensive road network, power lines, and fencing; and a variety of direct and indirect impacts such as direct loss of individuals from collisions or structures that promote increased potential for predation. Collectively, these threats may result in perturbations that influence both demographic vital rates of sage-grouse (e.g., reproductive success and adult sage-grouse survival) and habitat suitability in the Bi-State area.

Importantly, conservation efforts that address infrastructure impacts have continued to be implemented since publication of the proposed listing rule, including (but not limited to): removing power lines; implementing both permanent and seasonal road closures; removing racetrack fencing; and the likely relocation of the landfill in Long Valley. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), infrastructure-related impacts are significantly reduced.

The BSAP (Bi-State TAC 2012, entire) includes measures to counter negative effects from infrastructure. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, below), we believe that effects associated with infrastructure may no longer be considered a significant impact into the future.

Mining

Surface and subsurface mining for mineral resources (gold, silver, aggregate, and others) can result in direct loss of sagebrush habitat. Construction of mining

infrastructure can result in additional direct loss of habitat from establishment of structures, staging areas, roads, railroad tracks, and power lines. Sage-grouse and their nests could be directly affected by crushing or vehicle collision. Sage-grouse also can be impacted indirectly from an increase in human presence, land use practices, ground shock, noise, dust, reduced air quality, degradation of water quality and quantity, and changes in vegetation and topography (Moore and Mills 1977, entire). However, whereas theoretical effects are relatively clear and logical, information relating sage-grouse response to mineral developments is not extensive.

Mineral development is classified as leasable (fluid) minerals (in the Bi-State area, this is limited to geothermal resource), saleable minerals (sand and gravel pits), and locatable minerals (precious metals). Through existing regulatory mechanisms, Federal managers have discretion to condition or deny proponents of leasable or saleable mineral projects, and existing land use management plans have provisions that significantly restrict the likelihood of these developments (BLM 1993, p. 18; BLM 2016, pp. 12–13; HTNF 2016, pp. 19–21). Locatable minerals are administered under the General Mining Act of 1872. Federal land managers have very limited ability to prevent or preclude these activities from occurring.

Mineral extraction has a long history throughout the Bi-State area. Mining continues today to a limited extent in all PMUs and is expected to continue into the future. Although mining occurs year-round in the Bi-State DPS, direct loss of key seasonal habitats or population disturbances during critical seasonal periods are of greatest impact. Currently, the PMUs with the greatest exposure are Bodie, Mount Grant, Pine Nut, and to a lesser degree South Mono (BSLPG 2004, pp. 89, 137, 178). There are

currently several active Plans of Operations that overlap Bi-State sage-grouse habitat and thousands of active mining claims on Federal, State, and private lands. There is potential for additional mineral developments to occur in the Bi-State area in the future. While all PMUs have the potential for mineral development, based on current land designations and past activity, it appears the Pine Nut and Mount Grant PMUs are most likely to experience new activity (Service 2020, pp. 61–63). Currently operational mines are not within the core population areas of the Bi-State DPS, although existing inactive mining sites, exploration actions, and potential future developments could impact important lek complexes and population connectivity.

In general, potential exists for mining operations to expand both currently and into the future, but the scope of impacts from existing mining expansion is not considered extensive. We concluded in the 2013 proposed listing rule and reaffirm here that, by itself, mining is not currently considered a significant impact to the Bi-State population, though mining exploration continues, and mining activity could occur at any time in the future.

Conservation efforts that address the impacts from mining have continued to be implemented since publication of the proposed listing rule, such as reducing human-related disturbances (e.g., road noise/traffic). The BSAP includes conservation actions targeting development and human disturbances that will reduce the minor or potential impacts from mining (Bi-State TAC 2012, entire). Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**,

below), we believe impacts associated with mining in the Bi-State population area are not a reasonably anticipated concern into the future.

Grazing and Rangeland Management

Livestock grazing continues to be the most widespread land use across the sagebrush biome (Connelly et al. 2004, p. 7-29; Knick et al. 2003, p. 616; Knick et al. 2011, p. 219), including within the Bi-State area. Links between grazing practices and population levels of sage-grouse are still not well defined (Braun 1987, p. 137; Connelly and Braun 1997, p. 231). Depending on timing and intensity, grazing can have both positive and negative impacts to greater sage-grouse populations. Sage-grouse populations responded favorably to higher grazing levels after peak vegetative productivity, but declined when grazed earlier (Monroe et al. 2017, p. 1102). Livestock grazing can reduce the available food sources needed during breeding and brood-rearing periods (Braun 1987, p. 137; Dobkin 1995, p. 18; Connelly and Braun 1997, p. 231; Beck and Mitchell 2000, pp. 998–1000). But while some studies have reported grass height as important for sage-grouse nesting habitat, others have reported weak or no effects, and other studies concluded no influential effects of grass-related variables on nesting success (Service 2020, pp. 65–66). In the Bi-State area, studies have suggested that grazing, or more importantly maintenance of residual grass cover, may not influence nest success in the Bi-State area as much as in other regions (Kolada et al. 2009b, pp. 1343–1344; Coates et al. 2017a, p. 55). This may be because the most prevalent nest predator in the Bi-State area, the common raven, is potentially less influenced by grass cover than mammalian predators (Coates et al. 2008, entire). Studies suggest that a threshold may exist whereby

grazing can occur without detriment to sage-grouse resources. We note, however, the specifics of this threshold remain uncertain (Service 2020, p. 66).

Potential negative effects of livestock grazing on the sagebrush ecosystem include reduced water infiltration rates, reduced cover of herbaceous plants and litter, compacted soils, and increased soil erosion (Braun 1998, p. 147; Dobkin et al. 1998, p. 213). These impacts change the proportions of shrubs, grasses, and forbs in affected areas, and increase the propensity for invasion by nonnative invasive plant species (Service 2020, p. 67). Additionally, as far back as the mid-1900s, livestock grazing has been implicated in facilitating the spread of cheatgrass (Leopold 1949, p. 165; Billings 1951, p. 112). Livestock grazing reduces invasion resistance by imposing a competitive disadvantage on native herbaceous understory species and altering soil properties (Reisner et al. 2013, p. 10). While livestock grazing has been used strategically in sage-grouse habitat to control some invasive weeds (Merritt et al. 2001, p. 4; Olsen and Wallander 2001, p. 30; Connelly et al. 2004, p. 7-49) and woody plant encroachment (Riggs and Urness 1989, p. 358), there is limited evidence that controlling established cheatgrass through grazing is feasible. Rest from grazing may, in fact, be a more effective strategy of building resistance to invasion into a site (Reisner et al. 2013, p. 10). Collectively, these studies suggest managed livestock grazing at moderate intensities in the Bi-State area may be benign or even beneficial to some seasonal sage-grouse habitats, but when grazing intensity exceeds this moderate use level, livestock grazing can have negative effects on sage-grouse habitat and individuals (Boyd et al. 2014, p. 60).

Historically, extensive rangeland management has been conducted by Federal agencies and private landowners to reduce shrub cover and improve forage conditions for

livestock in the sagebrush-steppe ecosystem (Connelly et al. 2004, p. 7-28; Knick et al. 2011, p. 220; Pyke 2011, p. 534). Today, ongoing removal or control of sagebrush in the Bi-State area is limited. The BLM and USFS have stated that, with rare exceptions, they no longer convert sagebrush to other habitat types, and that future treatments shall maintain, improve, or restore Bi-State sage-grouse habitat (BLM 2016, p. 11; HTNF 2016, p. 16). Federal land managers currently focus on improving the diversity of the native plant community, reducing conifer encroachment, or reducing the risk of large wildfires. On private lands in the Bi-State area, our understanding of sagebrush treatments is limited. Known instances of the elimination of sagebrush by chemical and mechanical means are apparent, but their extent remains to be quantified. The ability to restore or rehabilitate overgrazed areas depends on the condition of the area relative to its site potential (Knick et al. 2011, p. 232). Active restoration is required where the native understory is reduced (Pyke 2011, p. 539). If an area has soil loss or invasive species, returning the native plant community may be impossible (Daubenmire 1970, p. 82; Knick et al. 2011, p. 232; Pyke 2011, p. 539).

Infrastructure related to livestock management such as water developments (e.g., springs, tanks, guzzlers) and fences in shrub-steppe habitats are common on public lands (Connelly et al. 2004, p. 7-35). Development of springs and other water sources can artificially concentrate domestic livestock and wild ungulates in mesic areas, thereby exacerbating grazing and trampling impacts to sage-grouse nesting and brood-rearing areas (Braun 1998, p. 147; Knick et al. 2011, p. 230). Diverting water sources can result in the loss of riparian or wet meadow habitat that sage-grouse depend upon as sources of forbs and insects. However, water developments can also be beneficial to sagebrush

vegetation communities, as this practice can help distribute livestock to water troughs and away from riparian areas, minimizing concentrated impacts of livestock grazing.

In the Bi-State area, there are 149 grazing allotments identified across all PMUs. Of these, 122 are considered active allotments, encompassing approximately 73 percent of suitable sage-grouse habitat. Most grazed lands are managed by the BLM and USFS, although much of the meadow habitats are located on private lands (BSLPG 2004, entire). Several rangeland health assessments (RHAs) or their equivalent have been completed on 120 allotments (104 that are active) and have not been conducted on the remaining 29 allotments (18 that are active). While there are public allotments or portions of allotments exhibiting adverse impacts from current or historical livestock grazing (e.g., vegetation condition or composition is generally less than desired), our understanding is the majority of allotments in the Bi-State area are in good condition (Axtell 2008, pers. comm.; Murphy 2008, pers. comm.; Nelson 2008, pers. comm. BLM 2014b, *in litt*.; Bi-State TAC 2017, pp. 31–33), and livestock grazing is generally thought to have a limited impact on sage-grouse habitat (Bi-State TAC 2012, entire). Livestock grazing will continue into the indefinite future within the Bi-State area at its current or slightly decreased level, and thus remain a discretionary action where Federal agencies have the ability to alter use when renewing grazing permits. Also, it appears that Federal land managers are moving in a direction that affords greater discretion to sage-grouse habitat needs when evaluating livestock management and the majority of allotments have or will have pending renewals and associated terms and conditions that consider sage-grouse habitat, including the establishment or placement of infrastructure (Nelson 2008, pers. comm.; BLM 2016, pp. 11–12; HTNF 2016, pp. 16–18).

In addition to domestic livestock, feral horses can negatively impact meadows and brood-rearing habitats used by sage-grouse, and these impacts can be more severe given horses cannot be managed on a seasonal basis (Connelly et al. 2004, p. 7-37; Crawford et al. 2004, p. 11). Horse presence may negatively affect sagebrush vegetation communities and habitat suitability for sage-grouse by decreasing grass cover, fragmenting shrub canopies, altering soil characteristics, decreasing plant diversity, and increasing the abundance of invasive cheatgrass. In areas utilized by both horses and cattle, it is unknown whether grazing impacts are synergistic or additive (Beever and Aldridge 2011, p. 286). The most substantial impacts from feral horses in the Bi-State area occur in the Pine Nut, Mount Grant, and White Mountains PMUs (Axtell 2008, pers. comm.; Bi-State TAC 2012, pp. 19, 37, 41), although they are also known to occur within the Bodie and South Mono PMUs. We are unaware of the specific severity and scope of impacts caused by feral horses on the Bi-State DPS and sage-grouse habitat, although localized areas of concern in all PMUs are apparent. Most important are probable impacts to mesic areas within the Pine Nut, Mount Grant, and White Mountains PMUs. Management of herd size by Federal agencies is an ongoing challenge as horse management is expensive and often controversial. Based on this understanding, we anticipate future impacts caused by wild horses to increase, especially as horse herds are growing by 20 percent annually. However, despite this increase, the threat will have a minor impact on sagebrush habitat.

Existing regulatory mechanisms such as BLM land management plans and USFS LRMPs further reduce the magnitude of threats associated with grazing and rangeland management. For example, the Central California Standards and Guidelines of the Bishop RMP provide additional direction for the management of permitted livestock grazing on

public lands administered by the Bishop Field Office. Standards are set for soil, species, riparian, and water quality, and metrics by which the achievement of these standards could be measured were established. This enables BLM to manage livestock grazing to ensure that species such as sage-grouse are "healthy and in numbers that appear to ensure stable to increasing populations; habitat areas are large enough to support viable populations or are connected adequately with other similar habitat areas." Additionally, the Carson City District Land Use Plan Amendment for the Nevada and California Greater Sage-grouse Bi-State Distinct Population Segment addresses conservation of the Bi-State area by providing specific direction to management of the DPS and its habitat, including grazing management and wild horse and burro management (BLM 2016, entire). Numerous land use allocations restrict or substantially limit new habitat and bird disturbances and identify Best Management Practices to further minimize allowable actions. For more details on plans that address the impacts of grazing and rangeland management, see the Existing Regulatory Mechanisms of the Species Report (Service 2020, pp. 124–136).

Analyzing the overall impacts of grazing is difficult, as there is little direct evidence linking grazing effects and sage-grouse population responses. Analyses for grazing impacts at landscape scales important to sage-grouse are confounded by the fact that almost all sage-grouse habitat has at one time been grazed and thus no ungrazed control areas exist for comparisons (Knick et al. 2011, p. 232). Overall, impacts from historic grazing and current rangeland management occur within localized areas throughout the Bi-State DPS's range, though it is more pronounced in some PMUs than others. Domestic livestock and feral horses have the potential to negatively affect sage-

grouse habitats by decreasing grass cover, fragmenting shrub canopies, altering soil characteristics, decreasing plant diversity, and increasing the abundance of invasive plant species, although their impacts and management potential can differ. Grazing and domestic livestock management has the potential to result in sage-grouse habitat degradation, though there is some conflicting information on whether some of the impacts of grazing are positive or negative. The Pine Nut and Mount Grant PMUs may be most sensitive to impacts from grazing as both PMUs are generally lower in elevation and receive less precipitation, making their sagebrush habitat less resistant to withstanding changes. Across the remainder of the PMUs, localized areas of meadow degradation are apparent, and these conditions may influence sage-grouse populations, as meadows are essential for recruitment of young.

Overall, impacts from past grazing and rangeland management occur within localized areas in all PMUs, although impacts are more pronounced in some PMUs than others. We concluded in the 2013 proposed listing rule that grazing and rangeland management was a factor (albeit not significant) for proposing to list the DPS as a threatened species as a result of ongoing habitat degradation impacts that may affect sage-grouse habitat in the Bi-State area, resulting in an overall reduction in aspects of habitat quality (e.g., fragmentation, lack of understory plants, increased presence of nonnative plant species), especially in the Pine Nut and Mount Grant PMUs. While we recognize that livestock and feral horses may negatively impact sage-grouse habitat, we affirm that it does not appear that this is a significant concern in the Bi-State area today.

Importantly, conservation efforts that address the impacts from grazing and rangeland management have continued to be implemented since publication of the

proposed listing rule, including (but not limited to): (1) Completing drafts and beginning to implement the new BLM and USFS Land Use Plan amendments (U.S. Department of the Interior and USDA 2015, entire), which are a considerable improvement for conservation of the Bi-State DPS and its habitat; repairing watering facilities, irrigation structures, and fencing around natural riparian areas to control grazing activity; increasing monitoring and management of horse and burrow herds; and restoring meadow/riparian habitat in critical brood-rearing habitat areas. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), impacts from grazing and rangeland management are significantly reduced.

The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as livestock and wild horse grazing. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, below), we believe impacts associated with grazing and rangeland management are not a concern now or in the foreseeable future.

Nonnative Invasive Plants and Native Woodland Succession

Shifting vegetation communities within the Bi-State area are altering sagebrush habitat that supports sage-grouse. Nonnative invasive plants such as cheatgrass alter sagebrush community structure, composition, productivity, nutrient cycling, and hydrology (Vitousek 1990, p. 7). Nonnative plants may also cause declines in native plant populations through mechanisms such as competitive exclusion and niche displacement (Mooney and Cleland 2001, p. 5446). They can create long-term changes in ecosystem

processes, such as altering fire cycles and other disturbance regimes; these changes can persist even after an invasive plant is removed (Zouhar et al. 2008, p. 33).

Nonnative plants degrade existing sage-grouse habitat, replacing vegetation essential to sage-grouse for food and cover (Connelly et al. 2000a, pp. 971–972; Miller et al. 2011, pp. 160–164). The presence of cheatgrass influences lek persistence, nest site selection, and ultimately population performance (Blomberg et al. 2012, p. 7; Knick et al. 2013, p. 1544; Lockyer et al. 2015, p. 791; Coates et al. 2016b, p. 12747). Nonnative plants affect sage-grouse habitat and population demographics both in the short term (e.g., nest site selection, loss of forbs and associated insects) and in the long term (e.g., population growth, sagebrush displacement and habitat fragmentation).

A variety of nonnative invasive plants are present within the Bi-State area, although cheatgrass is of greatest concern. Local managers and scientists consider cheatgrass to be a low-level threat across four PMUs (White Mountains, South Mono, Bodie, and Desert Creek-Fales), a moderate threat in the Mount Grant PMU, and a high threat in the Pine Nut PMU (Bi-State TAC 2012, pp. 19, 26, 32, 37, 41, 49). Areas of greatest concern are in the Pine Nut PMU where cheatgrass abundance is greatest and where there are restoration challenges following several recent wildfires. Averaged across the entire Bi-State, percent cover of cheatgrass is generally low (Peterson 2003, entire), and conversion to an annual grass dominated community is currently limited to only a few locations. Anecdotal reports suggest this assessment remains generally true, though it is apparent that the abundance and distribution of cheatgrass has increased over the past decade.

Efforts are ongoing to restore or rehabilitate sage-grouse habitat affected by nonnative plant species, but the techniques for accomplishing these efforts remain mostly unproven, experimental, and often logistically difficult (Pyke 2011, pp. 543–544). Regardless, restoration efforts such as localized weed treatments have been applied within all the Bi-State PMUs.

Based on our understanding and past experience with nonnative invasive species in the Great Basin Region, we anticipate that impacts from nonnative species will continue or increase into the future. According to a mapping of sagebrush habitats across the range of greater sage-grouse that categorized these habitats based on their resistance and resilience to disturbance, both resistance and resilience are low in the warm and dry sagebrush habitats contained within the Nevada portion of the Bi-State (Pine Nut, Mount Grant, and Desert Creek portion of the Desert Creek–Fales PMUs) and most of the South Mono PMU (Chambers et al. 2014, pp. 16–17). That is, these areas have lower productivity and higher susceptibility to cheatgrass or other invasive annual grass incursion and will therefore face greater restoration challenges should fire occur. In the wetter and cooler sagebrush habitats found in the White Mountains, Bodie, Fales portion of the Desert Creek–Fales PMUs, and high-elevation sites of the Mount Grant PMU, resilience and resistance were ranked as moderately high to high, implying these locations have greater productivity and are generally less suitable to invasive annual grass establishment (Chambers et al. 2014, p. 43).

In addition to nonnative plant invasions within sagebrush habitat, some native tree species are increasing in sagebrush habitat and impacting the suitability of the habitat for the various life processes of the sage-grouse. Pinyon-juniper woodlands are a native

vegetation community that can encroach upon, infill, and eventually replace sagebrush habitat. The cause of this conversion from shrubland to woodland is debatable but may be due to a suite of causes acting in concert with active wildfire suppression including: domestic livestock grazing (reduced competition from native grasses and forbs and facilitation of tree regeneration by increased shrub cover and enhanced seed dispersal), climatic fluctuations favorable to tree regeneration, enhanced tree growth due to increased water use efficiency associated with carbon dioxide fertilization, and recovery from past disturbance (natural and anthropogenic) (Miller et al. 2008, p. 10; Baker 2011, p. 200; Miller et al. 2011, pp. 167–169; Bukowski and Baker 2013, p. 560). Each of these factors have likely influenced the current pattern of vegetation in the Bi-State area today and have led to an estimated 40 percent decline in sagebrush extent due to woodland succession and isolation of sage-grouse populations across the DPS.

Land managers in the Bi-State area consider pinyon-juniper encroachment a substantial threat to sage-grouse because it impacts habitat quality, quantity, and connectivity, and increases the risk of avian predation to sage-grouse populations (BSLPG 2004, pp. 20, 39, 96; Bi-State TAC 2012, pp. 18–47). Previously occupied sage-grouse locations throughout the Bi-State area are thought to have been abandoned due to woodland succession (Bi-State TAC 2012, pp. 18–47). The extent of the conversion to pinyon-juniper woodland varies by PMU, with the South Mono PMU being the least impacted (approximately 13 percent loss) and the Pine Nut PMU being the most influenced (approximately 50 percent loss). The remainder of the PMUs (White Mountains, Mount Grant, Desert Creek-Fales, and Bodie) are each estimated to have experienced approximately a 40 percent loss of historical sagebrush vegetation to

woodland succession. In total, over the past 150 years, an estimated 390,000 ha (963,000 ac) of sagebrush habitat has converted to woodland vegetation, resulting in a loss of availability of total sagebrush habitat in the Bi-State area (which is not synonymous with suitable sage-grouse habitat as presented in Table 1) from slightly over 1,000,000 ha (2,580,000 ac) in 1850 to approximately 650,000 ha (1,600,000 ac) today across the Bi-State DPS (USGS 2012, unpublished data).

In order to counter the impact of pinyon-juniper encroachment, treatments to thin or remove woodland species are ongoing. Recent research supports previous assertions that these treatments would expand sage-grouse habitat and ultimately be used successfully by birds (Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Olsen 2019, pp. 21–22). Sage-grouse response to woodland encroachment has been negative to the incursion but in some instances responsive to treatment actions. Sage-grouse encountering pinyon-juniper communities coupled with the rate of movement through these communities negatively affected bird survival (Prochazka et al. 2017, p. 46); however, sage-grouse readily nested in conifer treatment sites after trees had been removed (Severson et al. 2017, p. 53). Woodland treatments increased suitable available breeding habitat and enhanced nest and brood success (Sandford et al. 2017, p. 63). Sage-grouse avoided pinyon-juniper communities across varying degrees of community dominance; this avoidance increased survival (Coates et al. 2017b, pp. 31–33). Removal of pinyon-juniper trees encroaching into sagebrush vegetation communities can increase sage-grouse population growth through improving juvenile, yearling, and adult survival as well as improving nest survival (Olsen 2019, pp. 21–22). This research found population growth was 11.2 percent higher in treatment than in control sites within 5

years of conifer removal. Therefore, woodland encroachment into occupied sage-grouse habitat reduces, and likely eventually eliminates, sage-grouse occupancy. However, treatment action to remove trees increases sagebrush habitat, and these habitats are used successfully by sage-grouse.

Prior to the development of the BSAP in 2012, approximately 18 woodland thinning or removal projects had been undertaken, removing approximately 5,454 ha (13,479 ac) of woodland (Bi-State TAC 2012, p. 5). Since this time, an additional 81 projects have been initiated, treating approximately 18,798 ha (46,450 ac). While it is premature to detect a population-level response of sage-grouse to these treatments in the Bi-State region, increases in occupied habitat and increases in nest and brood success as well as survival parameters are anticipated based on recent research finding a positive overall outcome for population performance and connectivity (Coates et al. 2017b, pp. 31–33; Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Olsen 2019, pp. 21–22). Furthermore, preliminary analysis of marked birds in the Bi-State area demonstrates grouse use of these treatments and offers support for these research findings (Mathews et al. 2018, pp. 33–34). Implementation and planning of additional woodland treatment projects are also under way over the next several years covering tens of thousands of acres.

Using the best available data, we estimate that the current acres of conifer removal treatments is within the range of estimated acres of woodland expansion and, further, that these treatments will continue based on ongoing commitments provided by land managers to implement the BSAP.

Overall, we consider woodland succession to pose a substantial threat to the Bi-State DPS. However, we consider impacts from woodland succession to be reduced by conservation measures with a high degree of implementation and effectiveness, recognizing that restoring historical connectivity and preventing further loss of suitable habitat requires continued focused active management.

Both nonnative invasive plants and native woodland succession are impacting the sage-grouse and its habitat in the Bi-State area. In general, nonnative plants are not abundant throughout the Bi-State area, with the exception of cheatgrass that occurs in all PMUs and is most extensive and of greatest concern in the Pine Nut PMU. Cheatgrass is a nonnative annual species that will likely continue to expand throughout the Bi-State region in the future and increase the adverse impact that currently exists to sagebrush habitats and sage-grouse through outcompeting beneficial understory plant species and altering the fire ecology of the area. Land managers have had limited success preventing cheatgrass invasion in the West, and elevational barriers to occurrence are becoming less restrictive. The best available data suggest that future conditions that could promote expansion of cheatgrass will be most influenced by precipitation and winter temperatures (Bradley 2009, p. 200). Cheatgrass is a serious challenge to the sagebrush shrub community, and its spread will be detrimental to sage-grouse in the Bi-State area. In addition, the encroachment of native woodlands (particularly pinyon-juniper) into sagebrush habitats continues to occur throughout the Bi-State area. Currently, however, treatment actions are on par with the expansion rate.

Overall, invasive nonnative and native plants occur throughout the entire Bi-State DPS's range. We concluded in the proposed listing rule that their spread was a significant

factor for proposing to list the DPS as a threatened species based on the extensive amount of pinyon-juniper encroachment and cheatgrass invasion that is occurring throughout the DPS's range, and the interacting impact these invasions have on habitat quality (e.g., reduces foraging habitat, increases likelihood of wildfire) and habitat fragmentation. Today, we affirm that nonnative and native invasive species occur throughout the Bi-State DPS's range and are significant threats to the species both currently and in the future. We expect this threat will increase across the range into the future unless it is actively managed.

Several regulatory mechanisms identified in existing federal land use plans address the impact of nonnative invasive plants and native woodland succession, the BSAP (Bi-State TAC 2012, entire) includes measures to counter the effects of these threats. In the past few years, we have gained increased certainty about the effectiveness of removal efforts for pinyon-juniper woodland. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, below), the threat of native woodland succession is being reduced, though it is still impacting sagebrush habitat throughout the DPS. Conservation measures are less effective at controlling and ameliorating the effects of nonnative invasive plants, and thus they will continue to affect sagebrush habitat into the foreseeable future.

Wildfires and Altered Fire Regime

Wildfire is the principal disturbance mechanism affecting sagebrush communities. The nature of historical fire patterns, particularly in big sagebrush, is not well understood; however, it was historically infrequent (Miller and Eddleman 2000, p. 16; Zouhar et al.

2008, p. 154; Baker 2011, pp. 189, 196). Most sagebrush species have not developed evolutionary adaptations such as re-sprouting and heat-stimulated seed germination found in other shrub-dominated systems, such as chaparral, that are exposed to relatively frequent fire events. Natural fire regimes and landscapes were shaped by a few infrequent large fire events; historical fire rotation was 50–200 years in mountain big sagebrush communities and 200–350 years in Wyoming big sagebrush communities (Baker 2011, p. 196; Bukowski and Baker 2013, pp. 556–558). In general, fire extensively reduces sagebrush within burned areas, and big sagebrush varieties, the most widespread species of sagebrush, can take decades to reestablish and even longer to return to pre-burn conditions (Service 2020, p. 79). While no specific studies have been conducted within the Bi-State area to inform our knowledge of fire rotation, we expect the pattern in Wyoming big sagebrush and mountain big sagebrush communities in the Bi-state area to be similar to those described above for the remainder of the species' range.

Both increases and decreases in the natural fire regime can have detrimental effects on sagebrush. When intervals between wildfire events become unnaturally long, woodlands can encroach into sagebrush communities as the prolonged interval between fires allows seedlings to establish and trees to mature (Miller et al. 2011, p. 167). Currently, active wildfire suppression continues to occur throughout the Bi-State DPS.

Conversely, the invasion and establishment of nonnative invasive annual grasses, such as cheatgrass and medusahead rye (*Taeniatherum caput-medusae)* can increase wildfire frequency within sagebrush ecosystems and negatively influence the likelihood of recovery (Zouhar et al. 2008, p. 41; Miller et al. 2011, p. 167; Balch et al. 2013, p. 178). Cheatgrass shortens historical fire patterns by providing an abundant and easily

ignitable fuel source that facilitates fire spread and recovers within 1–2 years of a wildfire event, leading to a recurring wildfire cycle that prevents sagebrush reestablishment (Young and Evans 1978, p. 285; Eiswerth et al. 2009, p. 1324; Balch et al. 2013, pp. 180–181). It is difficult and usually ineffective to restore sagebrush after annual grasses become established due to the positive feedback with fire, invasive species seed bank establishment, and alterations to soil and hydrologic processes (Paysen et al. 2000, p. 154; Connelly et al. 2004, pp. 7-44–7-50; Pyke 2011, p. 539).

Fire can have direct impacts on sage-grouse and their habitat. If fire does not completely remove sagebrush, it can reduce suitable nesting habitat, herbaceous understory vegetation used for forage and cover by sage-grouse hens and chicks, and potentially insects used for feeding by chicks. Additionally, isolation and fragmentation of populations due to habitat losses from wildfire presents a higher probability of extirpation in disjunct areas (Knick and Hanser 2011, p. 395; Wisdom et al. 2011, p. 469). This is a concern within the Bi-State area, specifically throughout the Pine Nut and portions of the South Mono and Desert Creek-Fales PMUs where burned habitat may be influencing already small and disjunct populations. As areas become fragmented and isolated through disturbances such as wildfire, persistence may be hampered by the limited ability of individuals to disperse into areas that are otherwise not self-sustaining. Thus, while direct loss of habitat due to wildfire has been shown to be a significant factor associated with population persistence for sage-grouse (Beck et al. 2012, p. 452), the indirect effect posed by loss of connectivity among populations may greatly expand the influence of this threat beyond the physical fire perimeter (Knick and Hanser 2011, pp. 401–404).

Sagebrush recovery rates following wildfire are highly variable, and precise estimates are often hampered by limited data from older burns. Factors contributing to the rate of shrub recovery include the amount of and distance from unburned habitat, abundance and viability of seed in soil seed bank (sagebrush seeds are typically viable for one to three seasons depending on species), rate of seed dispersal, and pre- and post-fire weather, which influences seedling germination and establishment (Young and Evans 1989, p. 204; Maier et al. 2001, p. 701; Ziegenhagen and Miller 2009, p. 201). Full recovery to pre-burn conditions in mountain sagebrush communities ranges between 25 and 100 years, and in Wyoming big sagebrush communities potentially ranges between 50 and 120 years (Baker 2011, pp. 194–195). By 25 years post-fire, Wyoming big sagebrush typically has less than 5 percent pre-fire canopy cover (Baker 2011, p. 195).

Wildfire is considered a relatively high risk across all the PMUs in the Bi-State area due to its ability to affect large landscapes in a short period of time (Bi-State TAC 2012, pp. 19–49). Furthermore, the future potential of this risk is exacerbated by the presence of people, invasive species, and climate change. While numerous wildfires have occurred in the Pine Nut, and South Mono PMUs (fewer in the other PMUs) over the past 18 years, to date there have been relatively few large-scale events (Service 2020, Table 3). In general, current data also do not indicate an increase of wildfires in the PMUs over time with the exception of the Pine Nut PMU where fire occurrence is more frequent (Service 2018, unpublished data). Furthermore, cheatgrass has a more substantial presence in the Pine Nut PMU, which appears to mirror (much more than the rest of the Bi-State area) the damaging fire and invasive species cycle impacting sagebrush habitat across much of the Great Basin.

The loss of habitat due to wildfire across the West is anticipated to increase due to the intensifying synergistic interactions among fire, people, invasive species, and climate change (Miller et al. 2011, p. 184). The past- and present-day fire regimes across the sage-grouse's range have changed with a demonstrated increase of wildfires in the more arid Wyoming big sagebrush communities and a decrease of wildfire across many mountain sagebrush communities (Miller et al. 2011, pp. 167–169). Both altered fire regime scenarios have caused significant losses to sage-grouse habitat through facilitating conifer expansion at high-elevation interfaces and nonnative invasive weed encroachment at lower elevations (Miller et al. 2011, pp. 167–169). In the face of climate change, both scenarios are anticipated to worsen (Baker 2011, p. 200; Miller et al. 2011, p. 179), including in the Bi-State area. Predicted changes in temperature, precipitation, and carbon dioxide are all anticipated to influence vegetation dynamics and alter fire patterns, resulting in increasing loss and conversion of sagebrush habitats (Neilson et al. 2005, p. 157). Furthermore, climate scientists suggest that, in addition to the predicted change in climate toward a warmer and generally drier Great Basin, variability of annual and decadal wet-dry cycles will likely increase and act in concert with fire, disease, and invasive species to further stress the sagebrush ecosystem (Neilson et al. 2005, p. 152, Ault et al. 2014, p. 7538). The anticipated increase in suitable conditions for wildland fire will likely further interact with people and infrastructure. Human-caused fires have increased and are correlated with road presence across the sage-grouse range (Miller et al. 2011, p. 171).

Based on the best available information, approximately 117 wildfire events have affected approximately 83,859 ha (207,220 ac) of sagebrush habitat across the Bi-State

area since 2000, but conversion of sagebrush habitat to a nonnative invasive vegetation community has been largely restricted (Pine Nut PMU withstanding). It appears that a lack of historical fire has facilitated the establishment of woodland vegetation communities and loss of sagebrush habitat. Both the "too little" and "too much" fire scenarios present challenges for the Bi-State DPS. The former influences the current degree of connectivity among sage-grouse populations in the Bi-State DPS and the extent of available sagebrush habitat, likely affecting sage-grouse population size and persistence. The latter, under current conditions, now has the potential to quickly alter substantial percentages of remaining sagebrush habitat. Restoration of sagebrush communities is challenging, requires many years, and may be ineffective in the presence of nonnative invasive grass species. Research in the Great Basin found that sage-grouse habitat features are unlikely to occur in many burned areas even 20 years post-restoration (Arkle et al. 2014, p. 15).

Several regulatory mechanisms target the potential impact of wildfires and altered fire regime. Within the Bi-State area, participants in the BSAP (Bi-State TAC 2012, entire) have treated areas to reduce the threat of wildfire by using broadcast burns and mechanical treatment (e.g., fuel breaks and conifer removal projects). To lower the risk of wildfire, approximately 1,806 ha (4,462 ac) of fuels reduction treatments have been conducted to remove conifers (Bi-State TAC 2018, unpublished data). Additionally, the reseeding of 7,699 ha (19,025 ac) from past fires has been completed. The efficacy of these treatments to achieve desired results is generally unknown.

Overall, the threat of wildfire and the existing altered fire regime occurs throughout the Bi-State DPS's range. We concluded in the proposed listing rule that

significant impacts would be expected to continue or increase in the future based on a continued fire frequency pattern that exacerbates pinyon-juniper encroachment into sagebrush habitat in some locations, but also an increased fire frequency in other locations that promotes the spread of cheatgrass and other invasive species that in turn can hamper recovery of sagebrush habitat. Within the Bi-State DPS, the continued reduced fire frequency exacerbates pinyon-juniper encroachment into sagebrush habitat in some locations. However, an increased fire frequency in other locations promotes the spread of cheatgrass and other invasive species that in turn can hamper recovery of sagebrush habitats in other locations. While it is not currently possible to predict the extent or location of future fire events in the Bi-State area, we anticipate fire frequency to increase in the future due to the increasing presence of cheatgrass, human footprint, and the projected effects of climate change.

The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as wildfire ignition risks and catastrophic fire. Fuels reduction projects and rehabilitation efforts post-wildfire have been and will continue to be implemented into the future to address the potential impacts from wildfire, including (but not limited to): conducting conifer (pinyon-juniper) removal and conducting weed treatments for invasive, nonnative plants such as cheatgrass. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, below), we conclude that impacts due to the threat of wildfires and altered fire regime have been reduced since the time of the 2013 proposed listing rule. We expect that, into the future, continued

implementation of the BSAP will further reduce the impacts of wildfire and altered fire regime.

Climate

In considering future climate projections for the Bi-State area, we analyzed multi-model ensembles that made use of multiple greenhouse gas emission scenarios. In general, downscaled climate change model predictions in the Bi-State area tend to agree on an increasing temperature regime (Cayan et al. 2008, pp. S38–S40; He et al. 2018, p. 11; Gonzalez et al. 2018, Chapter 25) and stable to increasing local precipitation, with a shift in timing of local precipitation events (Diffenbaugh et al. 2005, p. 15776; Cayan et al. 2008, p. S28; He et al. 2018, p. 14: Reich et al. 2018, p. 21). The environment will be relatively drier due to elevated temperature, increased rates of evapotranspiration, more precipitation falling as rain instead of snow, and more frequent and prolonged drought (Neilson et al. 2005, p. 150; He et al. 2018, pp. 9, 11, 16). The precipitation variables are an important predictor of sagebrush occurrence as well as to greater sage-grouse occurrence, as timing and quantity of precipitation greatly influences plant community composition and extent—specifically forb production, which in turn affects nest and chick survival and ultimately population performance (Blomberg et al. 2012, p. 7; Coates et al. 2018, p. 252). Impacts associated with climate change may increase the magnitude of threats impacting the Bi-State DPS, as its effects interact with other stressors such as disease, invasive species, prey availability, moisture, vegetation community dynamics, disturbance regimes, habitat degradation, and habitat loss (Service 2020, p. 89).

Downscaled climate change projections in the Great Basin and Eastern Sierra also predict acceleration in fire frequency, with fires potentially becoming larger and more

severe, and fire seasons becoming longer (Service 2020, pp. 87–88). Furthermore, drought frequency and persistence are anticipated to increase (Ault et al. 2014, p. 7545; Reich et al. 2018, p. 31; Gonzalez et al. 2018, entire). In the Bi-State area, drought is a natural part of the sagebrush ecosystem. Sage-grouse population performance in the Bi-State region responds to alterations in annual precipitation (Coates et al. 2018, p. 252; Coates et al. 2020, p. 27). While there is variation among subpopulations, on average findings suggest a 50 percent increase in precipitation corresponds to a 15.5 percent increase in population growth the following year. Moreover, these results indicate that precipitation needs to be approximately 20 percent greater than average for population recovery following drought, consistent with results from the Great Basin in the absence of wildfire (Coates et al. 2016b, p. 12747; Coates et al. 2018, p. 255).

Sage-grouse are affected by drought through the loss of vegetative habitat components, reduced insect production (Connelly and Braun 1997, p. 9), and potentially exacerbation of West Nile virus (WNv) and predation exposure (Gibson et al. 2017, p. 177; Prochazka et al. 2017, p. 47; Coates et al. 2018, p. 255). Drought reduces vegetation cover (Milton et al. 1994, p. 75; Connelly et al. 2004, p. 7-18), potentially resulting in increased soil erosion and subsequent reduced soil depths, decreased water infiltration, and reduced water storage capacity. These habitat component losses can result in declining sage-grouse populations due to increased nest predation and early brood mortality associated with decreased nest and brood cover and food availability (Braun 1998, p. 149; Moynahan et al. 2007, p. 1781). Furthermore, there are known occasions where the reduced condition of brood-rearing habitat due to weather has resulted in little

to no recruitment within certain PMUs (Bodie, Pine Nut) (Gardner 2009, pers. comm.; Coates 2012, pers. comm.).

Within the Bi-State area, several projects have been undertaken to improve meadows and riparian areas for sage-grouse that could help increase population resiliency in response to increasing frequency of drought. These projects include grazing exclosures, changes to grazing management plans, prescribed fires, invasive plant control, mechanical treatments, and conservation easements intended to improve the resiliency of meadow habitats on privately owned lands (Bi-State TAC 2018, unpublished data).

Climate change is not known to currently impact the Bi-State DPS to such a degree that the viability of the species is at stake, although climate change has been shown to influence the impact of drought and the annual water cycle and these in turn have been shown to influence grouse population performance in the Bi-State area (Coates et al. 2018, p. 251; Reich et al. 2018, pp. 31, 33). However, while it is reasonable to assume the Bi-State area will experience vegetation changes into the future (as presented above), we do not know the degree to which these changes will ultimately have impacts on the Bi-State DPS. An analysis conducted by NatureServe, which incorporates much of the information presented above, suggests a substantial contraction of both sagebrush and sage-grouse range in the Bi-State area by 2060 (Comer et al. 2013, pp. 142, 145).

Occurrence of cheatgrass has generally been restricted to elevations below approximately 1,700 m (5,500 ft.) above mean sea level (Bradley 2010, p. 202). More recently, this barrier appears less certain in the Bi-State area as cheatgrass occurs at elevations previously thought to be relatively unfavorable based on the grass's ecology.

This situation suggests that few locations in the Bi-State area are immune to cheatgrass invasion. Climate change may strongly influence the spread of this species as the available climate data suggests changes in timing of precipitation and increasing winter temperatures favorable to this species (Bradley 2009, p. 200). Predictions on the timing, type, and amount of precipitation contain the greatest uncertainty. In the Bi-State area, model scenarios that result in the greatest expansion of cheatgrass suggest much of the area remains suitable to cheatgrass presence with some additional high-elevation sites in the Bodie Hills, White Mountains, and Long Valley becoming more suitable than they are today (Bradley 2009, p. 204). On the opposite end of the spectrum, model scenarios that result in the greatest contraction in cheatgrass range suggest low-elevation sites such as Desert Creek-Fales and Mount Grant PMUs become less suitable for this invasive species but high-elevation sites (Bodie and White Mountains PMUs), where habitat conditions are generally marginal today, become more suitable in the future.

Based on this information we assume that climate change (acting both alone and in concert with impacts such as wildfire and nonnative invasive species) could be pervasive throughout the range of the Bi-State DPS, potentially degrading habitat to such a degree that all populations would be negatively affected with some low-elevation sites or populations currently exposed to greater cheatgrass abundance (Pine Nut, Desert Creek-Fales, South Mono and portions of the Mount Grant PMUs). Therefore, given the scope and potential severity of climate change when interacting with other threats in the future, the overall impact of climate change to the Bi-State DPS at this time is considered moderate to high.

We concluded in the proposed listing rule that climate change will potentially act in combination with other impacts to the Bi-State DPS, further diminishing habitat and increasing population isolation, making the DPS more susceptible to demographic and genetic challenges or disease. Although no regulatory mechanisms are available that can ameliorate the effect of changing climate or increasing drought, ongoing implementation of various conservation measures in the BSAP increases the resilience of the habitat to the effects of threats exacerbated by climate change and drought, such as wildfire and invasive plants (e.g., through removal of pinyon-juniper woodland). We expect that, into the future, continued implementation of the BSAP will further reduce the impacts of these threats associated with climate change.

Recreation

Recreational activities such as fishing, hiking, horseback riding, and camping, off-highway vehicle (OHV) use (including snowmobiles), and mountain biking occur throughout the range of the greater sage-grouse, including throughout the Bi-State DPS area. These activities can degrade wildlife resources, water, and land by distributing refuse, disturbing and displacing wildlife, increasing animal mortality, and decreasing diversity of plant communities (Boyle and Samson 1985, pp. 110–112).

The effects of OHV use on sage-grouse have not been directly studied (Knick et al. 2011, p. 219). However, sage-grouse avoidance of activities associated with development suggests they are disturbed by persistent human presence (Holloran 2005, pp. 43, 53, 58; Doherty et al. 2008, p. 194). Sage-grouse response to disturbance may be influenced by the type of activity, recreationist behavior, predictability of activity, frequency and magnitude, activity timing, and activity location (Knight and Cole 1995, p.

71). Disruption of sage-grouse during vulnerable periods at leks, or during nesting or early brood-rearing, could affect reproduction and survival (Baydack and Hein 1987, pp. 537–538).

Indirect effects to sage-grouse from recreational activities may include impacts to vegetation and soils and facilitation of the spread of invasive species. One study found long-term (2-year) reductions in sagebrush shrub canopy cover as the result of repeated OHV trips (Payne et al. 1983, p. 329). Increased sediment production and decreased soil infiltration rates were observed after disturbance by motorcycles and four-wheel drive trucks on two desert soils in southern Nevada; noise from these activities can also cause additional disturbance (Eckert et al. 1979, p. 395; Knick et al. 2011, p. 219; Blickley et al. 2012, p. 467). Unpaved roads fragment sagebrush landscapes and subsidize predators adapted to humans; they also provide disturbed surfaces that facilitate the spread of invasive plant species (Knick et al. 2011, p. 219).

Potential disturbance caused by non-motorized forms of recreation (fishing, camping, hiking, big game hunting, dog training) are most prevalent in the South Mono and Bodie PMUs. These PMUs are also exposed to tourism-associated activity centered on Mono Lake and the towns of Mammoth Lakes and Bodie. The exact amount of recreational activity or user days occurring in the area is not known; however, the number of people in the area appears to increase annually (Nelson 2008, pers. comm.; Taylor 2018, pers. comm.).

A 2012 assessment reported recreation and human disturbance to be low-level threats in the Bodie and Mount Grant PMUs but relatively high threats in the Pine Nut and South Mono PMUs (Bi-State TAC 2012, pp. 19, 32, 37, 49). To address these

apparent challenges, across the Bi-State, vehicular travel is limited to designated roads and trails and development of new roads is largely restricted. In addition, organized OHV events are prohibited during specific dates and in specific habitats (breeding and winter) limiting the exposure of birds (BLM 2016, pp. 13–14; HTNF 2016, p. 43).

Currently, there are few quantifiable data available to assess the degree of the impacts of recreation. The level of recreational activity associated with a specific road, for instance, is not known even though anecdotal information suggests that the level of activity (OHV numbers) is generally increasing. All the PMUs are relatively close to urban centers; thus, we anticipate recreational activity will continue and likely increase. However, all public lands in the Bi-State restrict OHV use to designated roads and trails and existing land use plans afford management oversite of this activity, thereby lessening the likelihood of broad scale habitat degradation.

Overall, recreation occurs throughout the Bi-State DPS's range, although we do not have data that would indicate impacts to sage-grouse or their habitat are significant. We concluded in the proposed listing rule and reaffirm here that, by itself, recreation is not considered a significant impact at this time. However, if left unchecked, some forms of recreation could become a concern based on anticipated increases of recreational use within the Bi-State area in the future. Conservation efforts that address recreational impacts have continued to be implemented since publication of the proposed listing rule, including (but not limited to): reducing human-related disturbances in high-use recreation areas (e.g., installing sage-grouse educational signs), conducting seasonal closures of lek viewing areas, and implementing both permanent and seasonal road closures. With

continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), impacts from recreation are significantly reduced.

The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as human disturbance to the Bi-State DPS, including recreation-related impacts. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, below), we believe impacts associated with recreation are not a concern into the future.

Disease

Sage-grouse are hosts for a variety of parasites and diseases (Thorne et al. 1982, p. 338; Connelly et al. 2004, pp. 10-4–10-7; Christiansen and Tate, 2011, p. 114). The disease of greatest concern to the Bi-State DPS is WNv, which can cause serious impacts to grouse species, potentially influencing population dynamics (Petersen 2004, p. 46). WNv has spread across North America since 1999 (Marra et al. 2004, p. 394). It is thought to have caused millions of wild bird deaths since its introduction, but most WNv mortality goes unnoticed or unreported (Ward et al. 2006, p. 101; Walker and Naugle 2011, p. 128). Sage-grouse are considered to have high susceptibility to WNv and high levels of mortality (Clark et al. 2006, p. 19; McLean 2006, p. 54).

Sage-grouse deaths resulting from WNv have been detected in 10 States—including in the Bi-State area—and in 1 Canadian Province (Walker and Naugle 2011, pp. 133, 135). Since 2002, mortalities have been documented annually. Mortality from WNv has been shown to cause population declines in populations throughout the West (Service 2020, pp. 106–107). Scientists have expressed concern regarding the potential

for exacerbating WNv persistence and spread due to the proliferation of surface water features (Friend et al. 2001, p. 298; Zou et al. 2006, p. 1040; Walker et al. 2007b, p. 695; Walker and Naugle 2011, p. 140). WNv persists on the landscape after it first occurs as an epizootic, suggesting this virus will remain a long-term issue in affected areas (McLean 2006, p. 50).

The long-term response of different sage-grouse populations to WNv infections is expected to vary markedly depending on factors that influence exposure and susceptibility, such as temperature, land uses, and sage-grouse population size (Walker and Naugle 2011, p. 140). Small, isolated, or genetically limited populations are at higher risk as an infection may reduce population size below a threshold where recovery is no longer possible, as observed in an extirpated population in Wyoming (Walker and Naugle 2011, p. 140). Larger populations may be able to absorb impacts resulting from WNv as long as the quality and extent of available habitat supports positive population growth (Walker and Naugle 2011, p. 140). However, impacts from this disease may act in combination with other stressors resulting in reduction of population size, bird distribution, or persistence (Walker et al. 2007a, p. 2652). Small populations, such as the populations within the Bi-State area, may be at high risk of extirpation simply due to their low population numbers and the additive mortality WNv causes (Christiansen and Tate, 2011, pp. 125–126).

The documented loss of four sage-grouse to WNv in the Bodie (n=3) and Desert Creek-Fales (n=1) PMUs (Casazza et al. 2009, p. 45) has heightened our concerns about the potential impact of this disease in the Bi-State area. At that time, these disease-caused mortalities represented only 4 percent of the total sage-grouse mortalities observed in the

Bi-State area, but additional mortality attributed to predation could have been due in part to disease-weakened individuals. Mortality caused by disease acts in a density-independent or additive manner. The fact that it can act independently of habitat and suppress a population below carrying capacity makes it a concern. Existing and developing models suggest that the occurrence of WNv is likely to increase throughout the range of the species, and, based on projected increases in temperature caused by changes in climate, occurrence in the Bi-State may also increase (Paz 2015, p. 3).

Based on our current knowledge of the virus, the relatively high elevations and cold temperatures common in much of the Bi-State area likely reduce the chance of a DPS-wide outbreak. However, warmer, lower elevation sites such as portions of the Mount Grant and Desert Creek-Fales PMUs may be more suitable for outbreaks. The impact on individual populations from WNv outbreaks may influence the dynamics of the Bi-State DPS as a whole through the loss of population resiliency and the associated challenges of recolonizing extirpated sites through natural emigration.

Climate change may also influence the spread of disease. Temperature and precipitation both directly influence potential for WNv transmission (Walker and Naugle 2011, p. 131). In sage-grouse, WNv outbreaks appear to be most severe in years with higher summer temperatures (Walker and Naugle 2011, p. 131) and under drought conditions (Epstein and Defilippo 2001, p. 105). Therefore, current climate change projections for higher summer temperatures, more frequent or severe drought, or both make more severe WNv outbreaks likely in low-elevation sage-grouse habitats where WNv is already endemic, and also make WNv outbreaks possible in higher elevation sage-grouse habitats that have been WNv-free due to relatively cold conditions.

The development or maintenance of anthropogenic water sources in the Bi-State area, some of which likely provide suitable conditions for breeding mosquitoes, potentially increases the likely prevalence of the virus above that which could be sustained naturally by existing water bodies such as streams and meadows. To partially ameliorate this concern, Federal land managers require livestock water troughs to be emptied when not in use (BLM 2016, p. 11; HTNF 2016, p. 17).

We concluded in the proposed listing rule, and reaffirm here, that by itself, WNv is not considered a significant impact at this time because it is currently limited by ambient temperatures that do not allow consistent vector and virus maturation. However, WNv could be a concern for the future if predicted temperature increases associated with climate change result in this threat becoming more consistently prevalent. No current regulatory mechanisms address the impacts of WNv. However, with continued implementation of conservation actions (WNv surveillance and mosquito abatement measures) associated with the BSAP (Bi-State TAC 2012, entire), the minor or potential impacts from WNv are reduced to the point that we find disease is not currently impacting the resiliency of the Bi-State DPS, nor do we expect it to impact the DPS in the foreseeable future.

Predation

Predation of sage-grouse is the most commonly identified cause of direct mortality during all life stages (Schroeder et al. 1999, p. 9; Connelly et al. 2000b, p. 228; Casazza et al. 2009, p. 45; Connelly et al. 2011a, p. 65). Major predators of adult sage-grouse include several species of diurnal raptors (especially the golden eagle (*Aquila chrysaetos*)), coyotes (*Canis latrans*), red foxes (*Vulpes vulpes*), and bobcats (*Lynx rufus*)

(Hartzler 1974, pp. 532–536; Schroeder *et al.* 1999, pp. 10–11; Schroeder and Baydack 2001, p. 25; Rowland and Wisdom 2002, p. 14; Hagen 2011, p. 97). Juvenile sage-grouse also are killed by many raptors as well as common ravens, badgers, red foxes, coyotes and weasels (*Mustela* spp.) (Braun 1995, entire; Schroeder *et al.* 1999, p. 10). Nest predators include badgers, weasels, coyotes, common ravens, American crows, and magpies (*Pica* spp.); sage-grouse eggs have also been consumed by elk *(Cervus canadensis)* (Holloran and Anderson 2003, p. 309) and domestic cows (*Bovus* spp.) (Coates *et al.* 2008, pp. 425–426; Dinkins *et al*. 2013, p. 305). However, sage-grouse have co-evolved with a variety of predators, and their cryptic plumage and behavioral adaptations have allowed them to persist (Schroeder et al. 1999, p. 10; Coates 2007, p. 69; Coates and Delehanty 2008, p. 635; Hagen 2011, p. 96). Although many predators consume sage-grouse, none specialize on the species (Hagen 2011, p. 97). Generalist predators may still have a significant effect on ground-nesting birds, because unlike specialist predators, generalist predator numbers are independent of prey density (Coates 2007, p. 4).

Predation is typically the principal cause of nest loss, which is a key determinant in sage-grouse population dynamics (Schroeder et al. 1999, p. 15; Taylor et al. 2012, p. 342). Sage-grouse nest depredation can be total (all eggs destroyed) or partial (one or more eggs destroyed). However, hens abandon nests in either case (Coates 2007, p. 26). Nest success across the California portion of the Bi-State area is within the normal range, with some locations even higher than previously documented (Kolada 2009a, p. 1344; Mathews et al. 2018, p. 54). However, the lowest estimates occur in Long Valley (South Mono PMU; 21 percent; Kolada 2009a, p. 1344), which is of concern as this is a core

population for the species in the Bi-State area and is also the population most likely exposed to the greatest amount of nest predators (Kolada et al. 2009b, p. 1344; Mathews et al. 2018, p. 53). The negative impact from reduced nesting success in this location is presumably being offset by other demographic statistics such as chick or adult survival (Service 2020, p. 116).

A number of factors have been reported to influence the density and diversity of predators, including agricultural development, landscape fragmentation, livestock presence, habitat alterations, and human populations, among others (Service 2020, p. 113). These factors have the potential to increase predation pressure on all life stages of sage-grouse by forcing birds to nest in less suitable or marginal habitats with no cover to shield them, and by increasing travel time through habitats where they are vulnerable to predation. Where sage-grouse habitat has been altered, the influx of predators can decrease annual recruitment into a population (Service 2020, p. 113).

Raven abundance has increased as much as 1,500 percent in some areas of western North America since the 1960s (Coates and Delhanty 2010, p. 244). Human-made structures in the environment increase the magnitude of raven predation, particularly in low-canopy cover areas, by providing ravens with perches and nesting substrate (Braun 1998, pp. 145–146; Coates 2007, p. 155; Bui 2009, p. 2). Reduction in patch size and diversity of sagebrush habitat, as well as the construction of fences, power lines, landfills, and other infrastructure (as discussed in *Infrastructure*) also are likely to encourage the presence of the common raven (Coates et al. 2008, p. 426; Bui 2009, p. 4; Howe et al. 2014, p. 41). High sage-grouse nest densities in small patches of quality habitat (which result from habitat fragmentation or disturbance associated with the

presence of edges, fencerows, or trails) may increase predation rates by making foraging easier for predators (Holloran 2005, p. C37).

The presence of ravens is negatively associated with grouse nest and brood fate (Bui 2009, p. 27; Gibson et al. 2018, pp. 14–15). Raven abundance was strongly associated with sage-grouse nest failure in northeastern Nevada, with resultant negative effects on sage-grouse reproduction; an increase of 1 raven per 10-km (6-mi) survey transect was associated with a 7.4 percent increase in nest failure (Coates and Delehanty 2010, p. 243). In the Virginia Mountains (just north of the Bi-State DPS), ravens were the most common nest predator, accounting for almost 47 percent of nest depredations (Lockyer et al. 2013, p. 246).

Threats associated with livestock grazing and predation may interact. In general, all recorded encounters between livestock and grouse nests resulted in hens flushing from nests (Coates et al. 2008, p. 462), which could expose the eggs to predation. There is strong evidence that visual predators like ravens use hen movements to locate sage-grouse nests (Coates 2007, p. 33); this is a concern for the Bi-State DPS given that ravens are the primary predators of sage-grouse in the Bi-State area. Livestock may also trample nests and sagebrush bushes and seedlings, thereby impacting future sage-grouse food and cover (Connelly et al. 2004, p. 7-31). Additionally, the odds of common raven occurrence, a pervasive sage-grouse nest predator, increased by approximately 46 percent in areas where livestock were present (Coates et al. 2016a, p. 10). The presence of infrastructure might also increase the magnitude of predation; increased raven presence may be attributable to the presence of water developments and associated perching structures (windmills and fences) (Coates et al. 2016a, p. 10).

Predator removal efforts have sometimes shown short-term gains that may benefit seasonal survival rates, but there is limited support of these efforts influencing sustainable population growth (Cote and Sutherland 1997, p. 402; Hagen 2011, p. 9; Leu and Hanser 2011, p. 27; Dinkins et al. 2016, pp. 54–55; Peebles et al. 2017, p. 475). For example, raven removal has been shown to have a positive effect on nest success (Dinkins et al. 2016, p. 54); however, ultimate results on population growth rates are negligible or not as well understood. Removal of ravens from an area in northeastern Nevada caused only short-term reductions in raven populations (less than 1 year) as apparently transient birds from neighboring sites repopulated the removal area (Coates 2007, p. 151). Raven removal in one Wyoming study resulted in a 50 percent reduction in raven densities during 2008–2014, while non-removal sites saw a 42 percent increase in raven densities (Peebles et al. 2017, p. 476). The authors reported increases in lek counts following a 1-year lag during raven removal; however, other factors were also associated with increased lek counts in this study that included minimum temperatures and precipitation during the brood-rearing period.

As specified in the BSAP and associated project spreadsheet (Bi-State TAC 2012, entire), the participants have worked to reduce threats to sage-grouse in the Bi-State DPS from predators. Removal of infrastructure (e.g., landfills, tall structures) may be a crucial step to reducing the presence of sage-grouse predators (Bui 2009, pp. 36–37; Leu and Hanser 2011, pp. 270–271). In the Bodie PMU, perching and nesting sites have been eliminated by infrastructure removal (e.g., windmill, transmission line). In the Desert Creek/Fales PMU, 3 km (1.85 mi) of fence in the Sweetwater Summit area was fitted with perch deterrents. Additionally, nearly 24,281 ha (60,000 ac) of conifer-encroached

sagebrush have been treated in the Bodie, Desert Creek/Fales, Pine Nut, Mount Grant, and South Mono PMUs to remove conifers and reduce perch sites for predators.

Overall, predation is currently known to occur throughout the Bi-State DPS's range. It is facilitated by habitat fragmentation and composition, infrastructure (fences, power lines, and roads) and other human activities that may be altering natural population dynamics in specific areas throughout the Bi-State DPS's range. The impacts of predation on sage-grouse can increase where habitat quality has been compromised by anthropogenic activities and ultimately influence population performance (Coates 2007, pp. 154, 155; Bui 2009, p. 16; Hagen 2011, p. 100). Landscape fragmentation, habitat degradation, and human populations have likely increased predator populations through increasing the ease of securing prey, and through human structures like landfills adding food sources. Other human structures can provide nest or den substrates for predator species. Certain sage-grouse populations are exhibiting deviations in vital rates below those anticipated, and the deviation may be related to predation. The populations with this issue are the Long Valley population (South Mono PMU), which is one of the two largest (core) populations in the Bi-State DPS, as well to the Desert Creek population (Desert Creek-Fales PMU) and the Pine Nut PMU. If assuming potential predation is connected to the deviations, the Bodie and White Mountains PMUs are likely least affected by predation.

At natural levels and in unaltered habitat, it is unlikely that predation would be a significant impact to the DPS, given that the sage-grouse have coevolved with a number of predators, and no predators specialize on sage-grouse. However, we recognize that, in concert with altered habitat, it may become an increasing concern in the future. As more

habitats face development (including roads, power lines, and other anthropogenic features such as landfills, airports, and urbanization), we expect the risk of increased predation to spread, possibly with negative effects on the sage-grouse population trends. We concluded in the proposed listing rule, and reaffirm here, that, by itself, predation is not considered a significant impact at this time. There are no regulatory mechanisms addressing predation directly, but regulatory mechanisms and conservation efforts that indirectly influence predation have continued to be implemented since publication of the proposed listing rule, including (but not limited to): removing and limiting structures that attract predators (e.g., fencing, power lines), and conducting initial procedures to remove the landfill in Long Valley. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), impacts from predation are significantly reduced.

The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as predation risks to the Bi-State DPS. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, below), we believe that predation is not a concern into the future.

Small Population Size and Population Isolation

The Bi-State DPS is relatively small and both geographically and genetically isolated from the remainder of the greater sage-grouse distribution. All isolated populations of sage-grouse are more vulnerable to genetic, demographic, or stochastic events. However, available data indicate genetic diversity in the Bi-State area is currently high (Oyler-McCance and Quinn 2011, p. 18). Thus, we currently have no indication that

genetic factors such as inbreeding depression, hybridization, or loss of genetic diversity are acting on the Bi-State DPS. However, populations in the Bi-State area have unique detectable qualities that allow differentiation from one another (Oyler-McCance et al. 2014, entire; Tebbenkamp 2014, entire). Also, the Parker Meadows area (a single isolated lek system located in the South Mono PMU) is experiencing a disproportionately high degree of nest failures due to nonviable eggs (Gardner 2009, pers. comm.), suggesting a possible manifestation of genetic challenges; this small breeding complex has the lowest reported genetic diversity in the Bi-State area (Oyler-McCance et al. 2014, p. 1304). We do not know if this is caused by inbreeding depression, loss of genetic diversity, or other factors, but to address this, a translocation project was developed in conjunction with the USGS and implemented in 2017. There has been some initial success in survival of transferred broods (Mathews et al. 2018, p. 37).

The Bi-State DPS comprises approximately 50 active leks representing several relatively discrete populations. Fitness and population size across a variety of taxa are strongly correlated, and smaller populations are more challenged by environmental and demographic stochasticity (Keller and Waller 2002, pp. 239–240; Reed 2005, p. 566). These small, isolated populations may face future genetic challenges. When coupled with mortality stressors related to human activity and significant fluctuations in annual population size, long-term persistence of small populations (in general) can be challenging (Traill et al. 2010, entire). The Pine Nut PMU has the smallest number of sage-grouse of all Bi-State area PMUs (usually less than 100 individuals as observed from data collected between 2003 and 2017, representing approximately 5 percent of the

DPS). However, each population in the Bi-State DPS is relatively small, as is the entire DPS on average (estimated at approximately 3,280 individuals).

One way to address population health and viability is through analysis of effective population size. Effective population size is defined as the size of the idealized population of breeding adults that would experience the same rate of loss of heterozygosity, change in the average inbreeding coefficient, or change in variance in allele frequency through genetic drift as the actual population (Frankham et al. 2002, pp. 312–317). As effective population size decreases, the rate of loss of genetic diversity increases. The consequences of this loss of genetic diversity, reduced fitness through inbreeding depression and reduced adaptive (evolutionary) potential, are thought to elevate extinction risk (Frankham 2005, p. 135). Studies suggest effective population size should exceed 50 to 100 individuals to avoid short-term extinction risk caused by inbreeding depression, and mathematical models suggest that effective population size should exceed 500 individuals to retain evolutionary potential and avoid long-term extinction risk (Franklin 1980, entire; Soule 1980, entire). Some estimates of effective population size have been as high as 5,000 individuals, but these estimates are thought to be highly species specific and influenced by many extrinsic factors (Lande 1995, p. 789).

Sage-grouse have one of the most polygamous mating systems observed among birds (Deibert 1995, p. 92). Asymmetrical mate selection (where only a few of the available members of one sex are selected as mates) should result in reduced effective population sizes (Deibert 1995, p. 92), meaning the actual amount of genetic material contributed to the next generation is smaller than predicted by the number of individuals present in the population. Furthermore, variation in female reproductive success,

fluctuating population size, unequal sex ratios, the fact that not all males breed each year, and other sage-grouse characteristics all reduce effective population size (Frankham 1995, p. 796; Aldridge and Brigham 2003, p. 30; Stiver et al. 2008, p. 473; Bush 2009, p. 108). Each of these influencing factors on effective population size occurs in the Bi-State DPS and suggests population sizes in sage-grouse must be greater than in non-lekking bird species to maintain long-term genetic diversity.

The effective population size of a wildlife population is often much less than its actual size. We are unaware of specific data or literature that definitively identifies the number of sage-grouse needed to maintain an effective population size of birds that would also result in a viable population. However, some literature exists to help us understand the complexities of answering this question for the Bi-State DPS or any other region within the range of the greater sage-grouse. One study concluded that up to 5,000 individual sage-grouse may be necessary to maintain an effective population size of 500 birds (Aldridge and Brigham 2003, p. 30). Their estimate was based on individual male breeding success, variation in reproductive success of males that do breed, and the death rate of juvenile birds. Similarly, a meta-analysis based on a wide array of species determined that a minimum viable population size (actual population size) necessary for long-term persistence should be on the order of 5,000 adult individuals (Traill et al. 2010, p. 32), though others have argued a minimum viable population would be from 2 to 10 times this figure (Franklin and Frankham 1998, p. 70; Lynch and Lande 1998, p. 72). However, another analysis countered that there is no single minimum population size number for all taxa, and that extinction risk depends on a complex interaction between life-history strategies, environmental context, and threat (Flather et al. 2011, entire).

Based on data from 2018, the median abundance estimate of the Bi-State DPS spring breeding population is approximately 3,305 individuals (95 percent CRI=2,247–4,683; Coates *et al*. 2020, p. 26). This estimate (as well as PMU specific estimates) was derived using the integrated population model outputs of male abundance based on lek count and demographic (telemetry) data, as well as by multiple post–hoc adjustments, given results of ancillary research. Adjustments included reported distributions for detection probability (Coates *et al*. in press, entire), lek attendance probability (Wann *et al*. 2019, p. 7), and sex ratio (Hagen *et al*. 2018, p. 4). Also included was an adjustment to account for 'unknown' leks, based on a 95 percent assumed known lek value. This value was derived from expert knowledge by members of the Bi-State Technical Advisory Committee. Using this estimate and the studies identified above describing effective population size being on the order of 10 to 20 percent of the actual population size, in the Bi-State area, the estimated average effective population size (for the entire Bi-State area in 2018) is approximately 330 to 661 sage-grouse, below the 5,000 individual threshold recommended by some researchers, but above the 50 individual threshold. Genetic and radio–telemetry studies, however, indicate that some sage-grouse populations in the Bi-State area are isolated, suggesting that the effective population size is actually less (Table 2). Based on these data, we calculate the effective population size for four generally discrete populations in the Bi-State (as described in Oyler-McCance *et al*. 2014, Figure 4) to provide context surrounding long–term genetic viability of these units (Table 2).

Table 2. 2018 estimated population size and range of estimated effective population size by genetic cluster for the Bi-State area, Nevada and California.

PMU	Estimated median	Estimated effective

	population size 2018	population size range 2018
Pine Nut	33	3–6
Desert Creek–Fales, Mount Grant, Bodie	2,342	234–468
Long Valley	818	81–163
White Mountains	45	4.5–9
Bi-State DPS	3,305	330–661

Empirical data from Colorado showed the effective population size in Gunnison sage-grouse to be about 20 percent of actual population size (Stiver et al. 2008, p. 478). We are unaware of any other published estimates of minimal population sizes necessary to maintain genetic diversity and long-term population sustainability in sage-grouse and specifically for the Bi-State DPS, and whether the described effective population sizes above are of concern. Most populations of the Bi-State DPS have been below the possible minimum population sizes as described above, in large part due to the natural cycling of sage-grouse populations, yet continue to persist.

Small population size and a discontinuous population structure occur throughout the Bi-State DPS's range, which could make the Bi-State DPS more vulnerable to impacts of threats described herein both currently and likely in the future in the absence of any ameliorating conservation efforts. However, conservation efforts addressing the threats acting upon these small populations have been implemented since publication of the proposed listing rule, including (but not limited to) translocation of sage-grouse into the Parker Meadows subpopulation, restoring critical brood-rearing habitat areas, and addressing invasive nonnative and native plants. Because we expect conservation

implementation to continue under the BSAP (Bi-State TAC 2012, entire), the risks associated with small population size will be reduced.

Summary of Threats

Throughout the threats discussion, we considered individual threats and, where appropriate, how they interact with other threats. Here, we consider the threats holistically to determine their impact on the Bi-State sage-grouse and its habitat.

Currently and into the future, the threats with the highest impact to the DPS are wildfire and altered fire regimes, and nonnative invasive and native woodland succession. Threats from urbanization and habitat conversion; infrastructure; mining; grazing and rangeland management; climate change; predation, and small population size and population isolation are also occurring. Threats from recreation and disease affect only a few individuals a year, and we do not expect that rate to increase into the foreseeable future. All of these threats are exacerbated by the population isolation and discontinuous population structure.

In summarizing the impacts of threats, we also consider impacts of renewable energy, commercial and recreational hunting, scientific and educational uses, and contaminants (including pesticides). Though impacts from these threats are expected to be minimal relative to the overall condition of the DPS (Service 2020, pp. 63–124), and though we did not present summary analyses of these threats in this *Federal Register* document, we still consider them when evaluating the cumulative impact of all threats on the DPS.

Small, isolated populations such as those found in the Bi-State area are more challenged by stochastic events such as disease epidemics, prey population crashes, or

environmental catastrophes. Interactions between climate change, drought, wildfire, WNv, and the limited potential to recover from population downturns or extirpations place significant challenges to the persistence of the Bi-State DPS of sage-grouse.

One of the most substantial interactions of threats is the cycle between climate change, cheatgrass, and altered fire regimes. Warmer temperatures and greater concentrations of atmospheric carbon dioxide create conditions favorable to cheatgrass, thus continuing the positive feedback cycle between the invasive annual grass and fire frequency (Chambers and Pellant 2008, p. 32; Global Climate Change Impacts in the United States 2009, p. 83; Halofsky et al. 2018, pp. 276–277). Fewer frost-free days also favor frost-sensitive woodland vegetation, which facilitates expansion of woodlands into the sagebrush biome, especially in the southern Great Basin (Neilson et al. 2005, p. 154). Thus, sagebrush habitats in the Great Basin will likely be lost at more southerly latitudes and low-elevation sites, and upper elevation areas will be more susceptible to woodland succession and cheatgrass invasion. In the Bi-State area, substantial changes in vegetation communities could occur between 2025 and 2100 (Neilson et al. 2005, p. 155; Bradley 2010, p. 204; Comer et al. 2013, p. 142; Finch 2012, p. 10).

Overall, the cumulative impact of all threats affecting the Bi-State DPS can be influenced by interactions with co-occurring threats, resulting in significant impacts to the resiliency, redundancy, and representation of the DPS as a whole. However, as a result of conservation actions associated with the 2012 BSAP (Bi-State TAC 2012, entire), impacts from all threats individually and combined are generally being reduced from their current levels and will continue to be reduced even more in the future.

Policy for Evaluation of Conservation Efforts When Making Listing Decisions

The purpose of PECE (68 FR 15100; March 28, 2003) is to ensure consistent and adequate evaluation of recently formalized conservation efforts when making listing decisions. The policy provides guidance on how to evaluate conservation efforts that have not yet been implemented or have not yet demonstrated effectiveness. The evaluation focuses on the certainty that the conservation efforts will be implemented and the effectiveness of the conservation efforts in making listing a species unnecessary. The policy presents nine criteria for evaluating the certainty of implementation and six criteria for evaluating the certainty of effectiveness for conservation efforts. These criteria are not considered comprehensive evaluation criteria. The certainty of implementation and the effectiveness of a formalized conservation effort may also depend on species-specific, habitat-specific, location-specific, and effort-specific factors. We consider all appropriate factors in evaluating formalized conservation efforts. The specific circumstances will also determine the amount of information necessary to satisfy these criteria.

To consider that a formalized conservation effort contributes to forming a basis for not listing a species, or listing a species as threatened rather than endangered, we must find that the conservation effort is sufficiently certain to be (1) implemented and (2) effective, so as to have contributed to the elimination or adequate reduction of one or more threats to the species identified through section 4(a)(1) analysis under the Act. The elimination or adequate reduction of section 4(a)(1) threats may lead to a determination that the species does not meet the definition of threatened or endangered, or is threatened rather than endangered.

An agreement or plan may contain numerous conservation efforts, not all of which are sufficiently certain to be implemented and effective. Those conservation efforts that are not sufficiently certain to be implemented and effective cannot contribute to a determination that listing is unnecessary, or a determination to list as threatened rather than endangered. Regardless of the adoption of a conservation agreement or plan, however, if the best available scientific and commercial data indicate that the species meets the definition of "endangered species" or "threatened species" on the day of the listing decision, then we must proceed with appropriate rulemaking activity under section 4 of the Act. Further, it is important to note that a conservation plan is not required to have absolute certainty of implementation and effectiveness in order to contribute to a listing determination. Rather, we need to be reasonably certain that the conservation efforts will be implemented and effective such that the threats to the species are reduced or eliminated.

Prior to the Bi-State DPS becoming a candidate species in 2010, a variety of conservation initiatives were put in place to conserve the DPS and its habitat. The most significant initiative was the creation of the *Nevada Governor's Sage Grouse Conservation Team* in June 2002 who, in cooperation with local stakeholders (the Bi-State Local Area Working Group), developed the first edition of the Greater Sage Grouse Conservation Plan for the Bi-State area in 2004 (BSLPG 2004, entire) to begin a cooperative effort to address threats to the Bi-State DPS and its habitat. The 2004 Action Plan served as the foundation for the conservation of the Bi-State DPS and its habitat. These efforts were later enhanced by both local- and national-level conservation strategies for sage-grouse conservation (including in the Bi-State area) associated with

organizations including the Sage Grouse Initiative, and the Bi-State LAWG, the latter of which is specifically focused on Bi-State DPS conservation.

In December 2011, the Bi-State Executive Oversight Committee (EOC) was formed to leverage collective resources and assemble the best technical support to achieve long-term conservation of the Bi-State DPS and its habitat. The EOC comprises resource agency representatives from the Service, BLM, USFS, NRCS, USGS, NDOW, and CDFW. Recognizing that conservation efforts were already under way by this point in time, the EOC directed a Bi-State TAC, comprising technical experts/members from each agency, to summarize the conservation actions completed since 2004, and to develop a comprehensive set of strategies, objectives, and actions that would be effective for the long-term conservation of the Bi-State DPS and its habitat. These strategies, objectives, and actions comprise the 2012 BSAP (Bi-State TAC 2012, entire), which is actively being implemented by the signatory agencies identified above, as well as Mono County, who is committed to implementing all relevant actions within the County (which harbors the two core populations of the Bi-State DPS). A majority of the conservation efforts outlined in the BSAP have already been started or completed (see sections 2.2 and 2.3 of the Action Plan (Bi-State TAC 2012, pp. 4–13) and the updated project spreadsheet (Bi-State TAC 2019), and the *Past and Ongoing Management Efforts* discussion in the Species Report (Service 2020, pp. 137–144).

Additionally, in February 2013, a Conservation Objectives Team (COT) of State agencies and Service representatives prepared the *Greater Sage-Grouse (Centrocercus urophasianus) Conservation Objectives Final Report* (COT Report; Service 2013a, entire). This peer-reviewed report serves as a benchmark, delineating reasonable

objectives necessary for the conservation and survival of greater sage-grouse, including the Bi-State DPS. The guidance includes management recommendations for the species and its habitat and establishes thresholds based on the degree to which threats need to be reduced or ameliorated to conserve greater sage-grouse so that it would not be in danger of extinction or likely to become in danger of extinction within the foreseeable future. Conservation success is expected to be achieved by removing or reducing threats, such that population trends would eventually be stable or increasing, even if numbers are not restored to historical levels. The 2012 BSAP is the main document guiding implementation of conservation actions, and the COT provides additional scientific background and guidelines for those actions.

Based on information provided in the 2013 proposed rules and discussions with the EOC, TAC, and LAWG, signatory agencies in 2014 provided a package of information examining their commitments, including staffing and funding, to implement the actions needed for conservation of the Bi-State DPS and its habitat, as outlined in the BSAP. They also provided an updated prioritization of various conservation actions and site-specific locations in which to implement such actions, as needed, based on the Conservation Planning Tool (CPT—linked, data-driven predictive models and interactive maps that identify and rank areas for management actions and provide a basis to evaluate those actions) and the BSAP's Adaptive Management Strategy (Bi-State EOC 2014, *in litt.*). The agency commitment letters, which were one component of the information provided by the EOC (BLM 2014a, *in litt*.; CDFW 2014b, *in litt*.; Mono County 2014, *in litt*.; NDOW 2014, *in litt*.; USDA 2014, *in litt*.; USGS 2014a, *in litt*.), outlined many partially completed or new conservation actions that will be implemented and completed

to address the threats that were identified in our October 28, 2013, proposed listing rule (78 FR 64358).

The EOC evaluated the [then current] Bi-State DPS survey and trend information and concluded that their unified and collaborative approach addresses the conservation needs of the Bi-State DPS (Bi-State EOC 2014, *in litt.*). Additionally, the EOC concluded that each partner agency is committed to implementing the BSAP and providing the necessary resources to do so regardless of the outcome of the Service's listing decision (Bi-State EOC 2014, *in litt.*). In the past year, several agencies have provided updated letters reaffirming their commitment to the BSAP and the TAC (BLM 2019, *in litt.*; Mono County 2018, *in litt.*; NDOW 2018, *in litt.*; NRCS 2018, *in litt.*; USFS 2018, *in litt.*).

The information provided by the EOC indicates that significant conservation efforts are currently being implemented and that further actions are proposed for implementation in the future. These combined actions address the threats that (synergistically) are resulting in the most severe impacts on the DPS and its habitat now and into the future. These conservation actions are described in our detailed PECE analysis (Service 2019, entire).

Using the criteria in our PECE policy (68 FR 15100, March 28, 2003), we evaluated the certainty of implementation (for those measures not already implemented) and effectiveness of conservation measures in the BSAP. Below is a summary of our full PECE analysis, which can be found at *http://www.regulations.gov* under either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107.

The BSAP (Bi-State TAC 2012, entire) was designed to reduce or ameliorate threats impacting the Bi-State DPS. We have determined that the conservation efforts in the BSAP meet the PECE criteria with regard to certainty of implementation because of (but not limited to): (1) The agency commitments of staffing and significant funding (over $45 million in the period 2015–2024); and (2) continued participation on the Bi-State EOC, TAC, and LAWG to ensure the most important conservation efforts are occurring at any given time considering ongoing research and monitoring that may influence changes in management strategies, as outlined in the BSAP's Science-based Adaptive Management Plan and through use of the CPT. Additionally, we have certainty of implementation by the various agencies for conservation efforts that address many different impacts. In particular, we have certainty of implementation for those completed and ongoing conservation efforts expected to provide the most significant conservation value to the Bi-State DPS and its habitat, including actions (as outlined in the agencies' 2014, 2018, and 2019 commitment letters and work plans, and the comprehensive project database (Bi-State TAC 2019)) that:

(1) Protect and restore critical brood-rearing habitat (reduces impacts from development/habitat conversion, grazing and rangeland management, and effects resulting from climate change). Lead agencies under the BSAP implementing conservation actions to reduce these impacts are NRCS (e.g., conservation easements, riparian/meadow restoration), USFS (e.g., private-public land exchanges, riparian/meadow restoration or improvement, grazing management, wild horse management), BLM (e.g., riparian/meadow restoration, meadow irrigation and structure

repair, racetrack fence removal, wild horse management), and Mono County (e.g., fencing modification).

(2) Restore habitat impacted by the spread of invasive, nonnative plants and pinyon-juniper encroachment (reduces impacts from nonnative, invasive and certain native plants, wildfire, predation, and effects resulting from climate change). Lead agencies under the BSAP implementing conservation actions to reduce these impacts are NRCS (e.g., pinyon-juniper removal), USFS (e.g., pinyon-juniper removal, riparian/meadow restoration, invasive weed treatments), and BLM (e.g., pinyon-juniper removal, riparian/meadow restoration, invasive weed treatments, wildfire fuel break treatments, fencing removal).

(3) Ensure stable or increasing sage-grouse populations and population structure to: (a) Prioritize management actions related to synergistic impacts on already fragmented habitat, such that management efforts occur in locations that benefit the DPS the most (reducing impacts such as infrastructure, urbanization, and recreation), and (b) develop and implement sage-grouse translocation from stable subpopulations to other small subpopulations that may be experiencing a high risk of extirpation (reduces impacts from small population size and population structure). Lead agencies under the BSAP implementing conservation actions to reduce these impacts are USGS, NDOW, and CDFW. Actions under way by CDFW include conducting telemetry, research, or monitoring surveys that inform the CPT of adjustments to the BSAP conservation strategy that provide the greatest benefit to the DPS or its habitat (see section 6.5 in the BSAP (Bi-State TAC 2012, pp. 75–76) and implementing translocation programs from stable subpopulations to subpopulations that may be at high risk of extinction). Actions

under way by BLM include permanent and seasonal road closures, nesting habitat seasonal closures, and fencing removal or marking; actions under way by USFS include permanent and seasonal road closures and power line removal. Actions under way by Mono County include coordination with private landowners to encourage reduced infrastructure and closure and relocation of the Long Valley landfill.

We also note that BLM, USFS, NRCS, and Mono County have provided specific plans and timetables laying out various conservation efforts for implementation from 2015 through 2024 (BLM 2014a, *in litt.*; Mono County 2014, *in litt.*; USDA 2014, *in litt.*), while CDFW, NDOW, and USGS have provided textual descriptions of their intended actions and contributions from 2015 through 2024 (CDFW 2014b, *in litt.*; NDOW 2014, *in litt.*; USGS 2014a, *in litt.*); many agencies sent letters reaffirming their commitment to the EOC and the TAC (BLM 2019, entire; Mono County 2018, *in litt.*; NDOW 2018, *in litt.*; NRCS 2018, *in litt.*; USFS 2018, *in litt.*). Additionally, the collaboration between the Service, BLM, USFS, NRCS, Mono County, USGS, NDOW, and CDFW requires regular meetings and involvement from the parties, whether at the level of the Bi-State EOC, TAC, or LAWG, in order to implement the BSAP fully. These meetings have occurred regularly since 2014.

We are confident that the conservation efforts (as outlined in the BSAP, agency commitment letters, and our detailed PECE analysis, as well as the TAC comprehensive project database) will continue to be implemented because we have a documented track record of active participation and implementation by the signatory agencies and commitments to continue implementation into the future. Conservation measures, such as pinyon-juniper removal, establishment of conservation easements for critical brood-

rearing habitat, cheatgrass removal, permanent and seasonal closure of roads near leks, removal and marking of fencing, and restoration of riparian/meadow habitat have been completed over the past 15 years, are currently occurring, and have been prioritized and placed on the agency's implementation schedules for future implementation. Agencies have committed to remain participants and continue conservation of the DPS and its habitat. The BSAP has sufficient methods (science advisors, the CPT, and a Science-based Adaptive Management Strategy) for determining the type and location of the most beneficial conservation actions to be implemented, including continued receipt of new population and threats information in the future that will guide conservation efforts.

We have determined that the conservation efforts in the BSAP meet the PECE criteria with regard to certainty of effectiveness to remove or reduce threats facing the Bi-State DPS because of, but not limited to, past project effectiveness within the Bi-State area or within sagebrush habitat areas across the range of the greater sage-grouse, and documented effective methodologies for addressing the threats identified as impacting the Bi-State DPS. For example:

(1) Development and Habitat Conversion—Conservation efforts to reduce development and habitat conversion are anticipated to occur in critical brood-rearing habitats across five PMUs, including through conservation easements and land exchanges (see detailed PECE analysis, Section 3.0). In total, 12,243 ha (30,254 ac) have been entered into conservation easements or acquired through land purchase or exchange since 2012 (Bi-State TAC 2018, p. 25). Our analysis of the database and the agency commitment letters reveals partially completed and future conservation efforts will occur in the Pine Nut, Bodie, Desert Creek-Fales, Mt. Grant, and South Mono PMUs, totaling

approximately 7,284 ha (18,000 ac) of lands identified as important for conservation by the TAC. These efforts have funding obligated and are in various stages of easement development, with many anticipated to be completed in a few years (BSAP 2019). Further, an effort to acquire approximately 5,870 ha (14,500 ac) of lands in the Pine Nut PMU by the Carson City BLM has been approved and is anticipated to finalize in spring of 2020. These areas include high-priority targets identified in the BSAP, and are consistent with the COT Report's ex-urban conservation objective to limit urban and exurban development in sage-grouse habitats (Service 2013a, p. 50). In total, approximately 31 percent of all private lands containing suitable sage-grouse habitat across the Bi-State are enrolled under an easement program or have been acquired by federal and State agencies and this number is expected to increase to 57 percent when combining additional efforts that are ongoing and reasonably likely to occur. Furthermore, these acquisitions represent approximately 67 percent of private lands identified as important for conservation of the species in the 2012 Action Plan. These actions are considered effective at reducing impacts from development and habitat conversion because conserving and managing lands in perpetuity are the most successful tools for permanent protection of critical sage-grouse habitat (as demonstrated by Pocewicz et al. (2011) in Wyoming).

(2) Grazing and Rangeland Management—Conservation actions under the BSAP continue to reduce grazing impacts and ensure management of livestock consistent with the needs of the DPS. This includes 46 projects across the range of the DPS that have been completed since 2012, including (but not limited to): maintaining, improving, or restoring riparian/meadow sites impacted by grazing animals across multiple PMUs,

improving BLM grazing allotment permit terms and conditions to protect riparian areas, and reducing the risk of overgrazing that can facilitate the dominance of cheatgrass in upland habitats (Bi-State TAC 2019, *in litt.*). An additional 32 projects focused on maintaining area closures to permitted livestock, monitoring compliance with permitted terms and conditions, maintenance of "let-down" fencing, and meadow irrigation have also been conducted on an annual and ongoing basis since 2012. The conservation efforts database identifies seven projects that are either in progress or not yet started, including new grazing permit processing and the restoration of degraded sagebrush and meadow habitat at several sites in the Desert-Creek Fales, Bodie, and Mount Grant PMUs (Bi-State TAC 2019, *in litt.*). Additionally, the BSAP identifies a specific strategy (MER6) to address grazing issues related to wild horse populations, which are known to negatively impact meadows and brood-rearing habitats used by the Bi-State DPS (Bi-State TAC 2012, p. 92).

The effectiveness of these grazing and rangeland management conservation efforts are confirmed by published literature (Boyd et al. 2014, entire; Stevens et al. 2012, p. 301; Davies et al. 2011, pp. 2575–2576; Pyke 2011, p. 537), which articulate the value of maintaining functional working landscapes that include grazing activities with site-specific management as necessary (e.g., restoring meadows to improve sage-grouse brood-rearing habitat) to ensure longevity of sagebrush ecosystems and the habitat areas deemed most critical to the Bi-State DPS.

(3) Nonnative Invasive Plants and Native Woodland Succession—Because both nonnative invasive plants and particularly native woodland species (pinyon-juniper encroachment) displace the sagebrush ecosystem necessary for the Bi-State DPS,

significant conservation efforts are being and will continue to be implemented to address these problems. With regard to nonnative invasive plants, the Bi-State EOC and TAC recognize that effective control programs can be labor intensive and costly; however, the Bi-State EOC and TAC believes there is value for the Bi-State DPS in being strategic in implementing the conservation efforts that potentially reduce the impact these plants have on the DPS's habitat (e.g., treating nonnative, invasive plants in strategic areas to potentially reduce the likelihood of an outbreak or improve a priority habitat area) (Espinosa 2014, *in litt.*). Since 2012, chemical or mechanical treatments of nonnative plant species have occurred on nearly 526 ha (1,300 ac), and weed monitoring was completed on 858 ha (2,121 ac) across multiple PMUs (Bi-State TAC 2018, p. 30). Two projects are currently under way or planned for the future that target invasive, nonnative plants on more than 243 ha (600 ac) in the Desert Creek-Fales and Pine Nut PMUs (cheatgrass is considered a high threat in Pine Nut compared to other PMUs). Additionally, the USFS committed to control least 40.5 ha (100 ac) of cheatgrass each year from 2015 through 2024 in the Pine Nut PMU (USDA 2014, *in litt.*). While combatting invasive annual grasses remains a challenge, the most effective method to date is through the retention of a healthy native perennial understory, which is the primary objective of both the TAC and LAWG (Bi-State TAC 2018, p. 30). Methods of active restoration of degraded sites can be effective through herbicide or mechanical means but require additional actions such as reseeding with perennial species (Frost and Launchbaugh 2003, pp. 43–44; Jones et al. 2015, p. 17).

With regard to pinyon-juniper encroachment, ecologists have developed clear and effective recommendations to target appropriate phases of encroachment (specific age

and density structure) to ensure restoration occurs in sagebrush and sage-grouse habitat areas that are most meaningful (e.g., critical brood-rearing habitat, corridors in fragmented areas) (e.g., Bates et al. 2011, pp. 476–479; Davies et al. 2011, pp. 2577–2578). Accordingly, BLM, USFS, and NRCS are strategically targeting phases I and II pinyon-juniper encroachment in the Bi-State area, which is supported by literature as effective with careful planning and execution (e.g., Bates et al. 2011, pp. 476–479; Davies et al. 2011, pp. 2577–2578). As of December 2018, pinyon and juniper removal has taken place on more than 18,700 ha (46,400 ac) within or adjacent to sage-grouse habitat, including minor projects to remove phase I tree encroachment from nesting habitat to more intensive mechanical removal within both phase I and phase II areas to expand available sage-grouse habitat and enhance existing conditions within nesting, brood-rearing, and winter habitats, representing approximately 25 percent of all conifer treatments proposed in the 2012 Action Plan (Bi-State TAC 2018, p. 27.). Furthermore, conifer treatment maintenance has been completed on more than 3,000 ha (7,400 ac). Approximately 8,245 ha (20,373 ac) of additional conifer treatments are currently in progress and have analyses under the National Environmental Policy Act (NEPA) either completed or under development (Bi-State TAC 2018, *in litt*.).

Subsequent to our prior withdrawal of the 2013 proposed listing rule, several studies have been published that demonstrate the effectiveness of pinyon-juniper removal across the range of the greater sage-grouse. These studies have demonstrated that: sage-grouse readily nest in conifer treatment sites after trees had been removed (Severson et al. 2017, p. 53); woodland treatments increased suitable available breeding habitat and enhanced nest and brood success (Sandford et al. 2017, p. 63); and removal of pinyon-

juniper trees encroaching into sagebrush vegetation communities can increase sage-grouse population growth through improving juvenile, yearling, and adult survival as well as improving nest survival (Olsen 2019, pp. 21–22). Additionally, sage-grouse population growth was 11.2 percent higher in treatment versus control sites within 5 years of conifer removal (Olsen 2019, pp. 21–22). Thus, we conclude that pinyon-juniper removal is effective in restoring areas impacted by woodland succession such that they become suitable and productive for sage-grouse, reducing the magnitude of the threat on the species.

(4) Infrastructure—Conservation efforts to reduce infrastructure are focused on roads, power lines, fencing, and a landfill. Permanent and seasonal road closures over a minimum of 2,137 miles in the Bodie, Desert Creek-Fales, Mount Grant, South Mono, and Pine Nut PMUs will reduce the likelihood of mortality and improve vital rates for sage-grouse near leks, including nesting and brood-rearing areas. Nearly 22 miles of power line and fencing removal projects have occurred in the Bodie, Pine Nut, and South Mono PMUs, and approximately 141 miles of fencing have been marked or modified across all PMUS. Some of these projects require annual maintenance, such as let-down fences, and three projects that will mark and modify fencing in the Pine Nut, Desert Creek-Fales, or South Mono PMUs are scheduled to be completed in the future. Additionally, a landfill in the Long Valley area of the South Mono PMU is a significant source of predators for one of the two core populations of the Bi-State DPS; Mono County is undergoing the initial stages of relocating this landfill (Bi-State TAC 2014, *in litt.*; Mono County 2014, *in litt.*: Mono County 2018, *in litt*.).

Removing or modifying the types of infrastructure described above will be effective at reducing the amount of invasive plants present along or around developed areas (Manier et al. 2014, pp. 167–170), reducing existing habitat fragmentation and potential vectors for invasive plants (Gelbard and Belnap 2003, pp. 424–431); removing some edge effects that can lead to avoidance of nesting in suitable habitat areas (Aldridge and Boyce 2007, pp. 516–523); reducing or removing anthropogenic noise that disturbs normal behavior patterns of sage-grouse (Blickley 2013, pp. 54–65); reducing collision-related mortalities (associated specifically with fencing) (Stevens et al. 2012, pp. 299–302); and making currently undesirable habitat areas (that attract predators) favorable by sage-grouse as nest and brood sites by reducing predator attractants (e.g., power lines, landfill) (Dinkins et al. 2012, pp. 605–608).

(5) Wildfire—Fires have consumed some important habitat areas within the range of the Bi-State DPS, primarily within the Pine Nut PMU, but also recently as a result of the Spring Peak fire within the Bodie and Mount Grant PMUs and the Boot Fire in the Desert Creek–Fales PMU (Espinosa 2014, *in litt.*: Service 2020, p. 26). Site restoration activities are planned to be implemented following wildfires by utilizing the CPT to identify sites that are the best candidates for enhancing or returning sagebrush habitats to conditions that benefit sage-grouse (Espinosa 2014, *in litt.*). Restoration efforts will be tracked for success, noting that some actions (e.g., seeding) vary in success rate, given variables such as elevation, precipitation, and site-conditions prior to a fire (Espinosa 2014, *in litt.*). Recovery of functional sagebrush habitats following wildfire and restoration actions can take decades (potentially several sage-grouse generations) to be realized, and requires monitoring to assure conservation objectives are met (such as

ensuring appropriate levels of sagebrush and native herbs are established, and reducing nonnative plant dominance) (Arkle et al. 2014, p. 17). Additionally, the Bi-State TAC currently utilizes the CPT and field reconnaissance to maximize the likelihood of enhancing the desired sagebrush community composition post-fuels reduction treatment activities (Espinosa 2014, *in litt.*). As of December 2018, restoration following wildfire has resulted in fire rehabilitation treatments on more than 7,690 ha (19,000 ac) (Bi-State TAC 2018, *in litt.*).

(6) Small Population Size and Population Structure—The BSAP specifically identifies a strategy (MER7) to address small population size issues in the Bi-State area, by identifying potential sage-grouse population augmentation and reintroduction sites, developing translocation guidelines, and potentially implementing augmentation and reintroduction efforts (Bi-State TAC 2012, p. 93). Specific actions include developing contingency plans for the Parker Meadows and Gaspipe Spring subpopulations in the South Mono PMU, and populations in the Pine Nut PMU; and evaluating the need for augmentation for the Fales population of the Desert Creek-Fales PMU, the Powell Mountain area of the Mount Grant PMU, the McBride Flat/Sagehen Spring area in the Truman Meadows portion of the White Mountains PMU, and Coyote Flat of the South Mono PMU.

In 2016, CDFW began implementing a plan to translocate sage-grouse from stable subpopulations in the Bi-State area to the Parker Meadows subpopulation in the South Mono PMU (Bi-State TAC 2014, *in litt*.; CDFW 2014b, *in litt.;* Mathews et al. 2018, pp. 14–34). Prior to initiating this effort, members of the Bi-State TAC conducted a site visit to assess habitat condition and conducted removal of conifer trees that had become

established in proximity to the lek and brood-rearing meadow. Preliminary results suggest that translocated birds are increasingly remaining in the Parker Meadows area. Additionally, probability of nest initiation and nest success have increased, brood success is on par with the remainder of the DPS, and lek counts have increased over the past two years (Bi-State TAC 2018, pp. 13–14; Mathews et al. 2018, pp. 28–34). Efforts on this current action are directly relevant to future conservation efforts for other unstable subpopulations. It is reasonable to assume future translocations in the Bi-State area have a high likelihood of effectiveness given continued careful consideration to all the variables (including translocation that would occur concurrent with other threat reduction activities, such as conifer removal or predator control), and published literature that also indicates success of translocated sage-grouse when successful translocation methodology is followed (Musil et al. 1993, pp. 89–90; Reese and Connelly 1997, pp. 239–240; Hennefer 2007, pp. 33–37; Baxter et al. 2008, pp. 184–185).

For details of additional conservation efforts related to effects associated with climate change, disease, predation, and other threats, please see the full PECE analysis (Service 2019, entire).

We will have an ongoing role in monitoring the implementation and effectiveness of the partially completed and future conservation efforts given our regular participation with the Bi-State EOC, TAC, and LAWG, participation in providing updated versions of the BSAP, and by reviewing any monitoring and research reports. We are satisfied that the conservation efforts evaluated will be effective in reducing threats to the Bi-State DPS and its habitat; however, to do so, they do not need to be applied on every acre of suitable and unsuitable sage-grouse habitat. For instance, not all of the native pinyon-

juniper vegetation needs to be removed, such as in areas within the range of the Bi-State DPS where pinyon-juniper historically occurred. Rather the effort needs, and is expected, to be implemented in areas that are most likely to support sage-grouse (post-removal) and critical areas that address habitat fragmentation or reduced-connectivity issues. These efforts need to occur at a rate that significantly reduces further habitat losses, which is consistent with the objective to address pinyon-juniper expansion provided in the March 22, 2013, COT Report for conservation of the greater sage-grouse (Service 2013a, pp. 47–48), including the Bi-State DPS.

We have determined that the agencies' resource commitments (e.g., staffing and funding, including more than $45 million from 2015 through 2024), and a demonstrated record of implementation will ensure continued conservation of habitat for the Bi-State DPS. The BSAP has sufficient monitoring and reporting requirements to ensure that the proposed future conservation measures are implemented as planned and are effective at removing threats to the DPS and its habitat. The collaboration between the Service, BLM, USFS, NRCS, Mono County, USGS, and the States of Nevada and California requires regular team meetings (Bi-State EOC, TAC, and EOC), and continued involvement of all parties will occur (Bi-State EOC 2014, *in litt.*) in order to implement the BSAP fully. We find that the future conservation efforts in the BSAP meet the PECE criteria for certainty of implementation and effectiveness, and can be considered as part of the basis for our final listing determination for the Bi-State DPS.

In conclusion, we find that the conservation efforts in the BSAP, and as outlined in the agencies' 2014, 2018, and 2019 commitment letters, meet the PECE criteria with regard to certainty of implementation (for those measures not already implemented) and

effectiveness and can be considered as part of the basis for our listing determination for the Bi-State DPS. Our full analysis of the 2012 BSAP, and additional materials submitted to the Service as mentioned above, pursuant to PECE can be found at *http://www.regulations.gov* under either Docket No. FWS–R8–ES–2018–0106 or Docket No. FWS–R8–ES–2018–0107.

Summary of Comments and Recommendations

As discussed above in **Previous Federal Actions**, the Bi-State DPS of the greater sage-grouse has a long and complex listing history. This has included multiple public comment periods since the proposed rules were published on October 28, 2013 (78 FR 64328, 78 FR 64358). In the period 2013–2015, we published five documents announcing to the public new comment periods, extensions to the comment periods, new information that became available, and a 6-month extension of making the final listing determination (78 FR 77087, December 20, 2013; 79 FR 19314, April 8, 2014; 79 FR 26684, May 9, 2014; 79 FR 31901, June 3, 2014; and 79 FR 45420, August 5, 2014). We held one public hearing in Minden, Nevada, on May 28, 2014, and one public hearing held in Bishop, California, on May 29, 2014. Newspaper notices inviting general public comment and advertisement of the information and public hearings was published in The Inyo Register, The Record Courier, and the Reno-Gazette Journal.

When we reinstated the proposed listing rule on April 11, 2019, we reopened the comment period for 60 days (84 FR 14909); the comment period opened on April 12, 2019, and closed on June 11, 2019. When we announced the 6-month extension on October 1, 2019 (84 FR 52058), we reopened the public comment period for an additional 30 days; the comment period closed on October 31, 2019. In all comment

periods, we also contacted appropriate Federal and State agencies, Tribes, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. We did not receive any requests for further public hearings.

Between 2013 and 2015, we received more than 6,400 public comments on the proposed rules. In 2019, we have received more than 2,600 public comments in response to the reinstatement of the proposed rules and the 6-month extension. Submitted comments were both for and against listing the species. All substantive information provided during the comment periods and relevant to this finding has either been incorporated directly into this withdrawal or is addressed below. For additional responses to comments for which there is no updated information since 2015, please see the previous withdrawal of the proposed listing rule published on April 23, 2015 (80 FR 22828).

We also received a few comments related to the proposed 4(d) rule, and more than 200 comment letters both in support of and opposition to the proposed critical habitat designation; however, given the decision to withdraw the listing proposal, no further assessment of the proposed 4(d) rule and critical habitat designation is necessary at this time.

(1) Comment: Several commenters inquired as to how the BLM RMPs, USFS LRMPs, the BSAP, and the plans developed by the LADWP are used in our evaluation of existing regulatory mechanisms. Commenters also questioned the effectiveness of these plans and of the effectiveness of regulatory mechanisms in general. Other commenters suggested that existing regulatory mechanisms are adequate.

Our Response: Existing regulatory mechanisms that could provide some protection for greater sage-grouse in the Bi-State area include: (1) Local land use laws, processes, and ordinances; (2) State laws and regulations; and (3) Federal laws and regulations. Regulatory mechanisms, if they exist, may preclude the need for listing if such mechanisms are judged to adequately address the threats to the species such that listing is not warranted. Conversely, threats on the landscape continue to affect the species and may be exacerbated when not addressed by existing regulatory mechanisms, or when the existing mechanisms are not adequate (or not adequately implemented or enforced).

We use an inherently qualitative approach to evaluate existing regulatory mechanisms when conducting a threats analysis for a proposed listing. In general, this means that we assess language in an existing mechanism/plan as well as any pertinent decisions instituted based on that language (track record) and evaluate it against the best available science informing species conservation. For the local land use regulatory mechanisms, the regulations in some counties identify the need for natural resource conservation and in some instances (such as Mono County) attempt to minimize impacts of development through zoning restrictions. To our knowledge, however, none preclude development, nor do they provide for monitoring of the loss of sage-grouse habitats. Similarly, State laws and regulations are general in nature and provide flexibility in implementation, and do not provide specific direction to State wildlife agencies, although they can occasionally afford regulatory authority over habitat preservation (e.g., creation of habitat easements and land acquisitions).

With respect to Federal laws, we note that recent LRMP and RMP amendments adopted by the Humboldt-Toiyabe and Inyo National Forests and BLM's Carson City District and Tonopah Field Office in the Bi-State area appear to offer significant improved certainty toward sage-grouse conservation. These changes in conjunction with existing RMPs and LRMPs, with demonstrated track records of effectiveness (such as the BLM Bishop Field Office's RMP), supports a conclusion that currently existing Federal regulations are effective regulatory mechanisms. Federally managed lands account for approximately 89 percent of the Bi-State DPS habitat. Additionally, we note that recent changes to RMPs and LRMPs associated with greater sage-grouse conservation across its range in the western United States do not apply to the Bi-State DPS. For additional detail see the *Existing Regulatory Mechanisms* section in the 2019 Species Report.

Since the proposed rule, we received additional information on Federal regulatory mechanisms. Jointly, the Humboldt-Toiyabe National Forest and the Carson City and Tonopah Offices of the BLM have developed new Land Use Plan Amendments (HTNF 2016, entire; BLM 2016, entire). The amendments more fully address conservation of the Bi-State area by providing specific direction to management of the DPS and its habitat, including (but not limited to) direct effects (such as land disturbance) and indirect effects (such as noise) caused by management of: recreation, grazing, weeds, wild horses and burros, minerals, fire management, and rights-of-way. Furthermore in 2019, the Inyo National Forest completed a revised Land Management Plan, which also improves management consideration of sage-grouse conservation (USFS 2019, entire). For additional discussion on existing regulatory mechanisms and our conservation efforts analysis, see discussions in Summary of Factors Affecting the Species and the *Existing*

Regulatory Mechanisms and *Conservation Efforts* sections in the 2019 Species Report (Service 2020, pp. 124–147).

Therefore, we conclude that the BLM and USFS Land Use Plan amendments will limit future additional impacts caused by discretionary actions, thus greatly enhancing the conservation afforded to the Bi-State DPS and its habitat.

The 2012 BSAP is not a regulatory mechanism. As such, we have evaluated it through our PECE policy, as described in **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, above. Since we have concluded that it is sufficiently certain to be both implemented and effective, we have considered how the measures included in the plan are ameliorating the magnitude of threats. The LADWP plans are also not regulatory mechanisms, and we have evaluated them as an existing and ongoing conservation measure.

(2) Comment: Several commenters stated that conservation efforts to date have not been adequate, as threats remain on the landscape.

Our Response: While considerable effort has been expended over the past several years to address some of the known threats throughout portions or all of the Bi-State DPS's estimated occupied range, threats to the continued viability of the DPS into the future remain. The development of the 2012 BSAP (Bi-State TAC 2012, entire) has highlighted the importance of not only habitat restoration and enhancement but also the role of the States and other partners in reducing many of the known threats to the Bi-State DPS. Cooperative, committed efforts by Federal and State agencies, as well as Mono County will result in full implementation of the 2012 BSAP, including funding and staffing commitments from 2015 through 2024 to address the most significant impacts to

the DPS and its habitat (BLM 2014a, *in litt*.; BLM 2019, *in litt*.; CDFW 2014b, *in litt*.; Mono County 2014, *in litt*.; Mono County 2018, *in litt*.; NDOW 2014, *in litt*.; NDOW 2018, *in litt*.; NRCS 2018, *in litt*.; USDA 2014, *in litt*.; USFS 2018, *in litt*.; USGS 2014a, *in litt*.). Such plans will help provide the ongoing, targeted implementation of effective conservation actions that are essential for the conservation of the Bi-State DPS and its habitat into the future. We discuss the various conservation efforts occurring currently and into the future within the estimated occupied range of the Bi-State DPS of greater sage-grouse in more detail in the detailed PECE analysis (Service 2019, entire) under **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**.

(3) Comment: A few commenters suggest that the Bi-State DPS is not a genetically unique subspecies or that it does not meet our standard for recognition as a DPS.

Our Response: In our 12-month finding on petitions to list three entities of sage-grouse (75 FR 13910, March 23, 2010), we found that the Bi-State population of sage-grouse meets our criteria as a DPS of the greater sage-grouse under Service policy (61 FR 4722, February 7, 1996). This determination was based principally on genetic information, where the DPS was found to be both markedly separated and significant to the remainder of the sage-grouse taxon. The Bi-State DPS defines the far southwestern limit of the species' range along the border of eastern California and western Nevada (Stiver et al. 2006, pp. 1–11). Sage-grouse in the Bi-State area contain a large number of unique genetic haplotypes not found elsewhere within the range of the species (Benedict et al. 2003, p. 306; Oyler-McCance et al. 2005, p. 1300; Oyler-McCance and Quinn 2011, p. 92, Oyler-McCance et al. 2014, p. 7). The genetic diversity present in the Bi-

State area population is comparable to other populations, suggesting that the differences are not due to a genetic bottleneck or founder event (Oyler-McCance and Quinn 2011, p. 91; Oyler-McCance et al. 2014, p. 8). These studies provide evidence that the present genetic uniqueness exhibited by Bi-State area sage-grouse developed over thousands and perhaps tens of thousands of years, hence, prior to the Euro-American settlement (Benedict et al. 2003, p. 308; Oyler-McCance et al. 2005, p. 1307; Oyler-McCance et al. 2014, p. 9). The available genetic information demonstrates that the Bi-State sage-grouse are both discrete from other greater sage-grouse populations and are genetically unique. Therefore, we believe the best scientific and commercial data available continues to clearly demonstrate that the Bi-State sage-grouse meet both the discreteness and significance criteria to be designated as a distinct population segment.

(4) Comment: Several commenters stated that the 2013 proposed listing rule dismissed past conservation measures without fairly addressing their breadth, effectiveness, and chance of success. Further, they submit that the Service must evaluate the conservation measures through (at minimum) an analysis consistent with PECE and must fully consider how conservation measures will reduce or remove threats. The commenters believe that a fair evaluation of the past conservation efforts would demonstrate that they are sufficient to protect the Bi-State DPS.

Alternatively, several commenters argue that past conservation efforts, while well-intended, have been inadequate to provide sufficient conservation for the DPS. Further, the commenters contend that the 2012 BSAP is voluntary in nature and does not meet the PECE standard, and that populations have continued to decline since the implementation of the BSAP.

Our Response: In this finding, we acknowledge and commend the commitment of many partners in implementing numerous conservation actions within the range of the Bi-State DPS. The PECE policy applies to formalized conservation efforts that have not yet been implemented or those that have been implemented but have not yet demonstrated whether they are effective at the time of listing. Our analysis of all conservation efforts currently in place and under development for the future is described in detail above in **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**. The effect of conservation efforts and regulatory mechanisms on the status of a species is considered under **Summary of Biological Status and Threats**.

In this document, we considered whether formalized conservation efforts such as the BSAP are included as part of the baseline through the analysis of the five listing factors or are appropriate for consideration under our PECE policy. All participating agencies have provided letters affirming their commitment to the plan, as well as funding and implementation schedules (Service 2019, entire). Due to these and other considerations as outlined in our detailed PECE analysis, we concluded that the 2012 BSAP is highly certain to be implemented.

We acknowledge that the most recent population studies show that some sage-grouse populations in the Bi-State DPS have declined (Coates et al. 2020, Table 3). However, the Bi-State DPS as a whole is showing a stable, long-term trend. Conservation measures are in place to counter negative population growth (such as the Parker Meadows translocation project). Currently, 53 of the 76 high-priority projects have been initiated representing 68 percent of the projects originally identified (Bi-State TAC 2018, p. 3). Twelve projects (17 percent) were evaluated and determined to lie outside of

occupied sage-grouse habitat and were subsequently removed from the list of priorities. Furthermore, 142 of the 159 identified actions in the BSAP have been initiated and are in stages of completion, meaning they are in progress, ongoing, occur annually, or have been evaluated as part of the planning process (Bi-State TAC 2018, p. 45; Service 2019, p. 33). Given that these measures are still ongoing, we do not expect that positive gains from these measures would yet be reflected in population studies.

Overall, due to many factors as outlined in our detailed PECE analysis, we concluded that future conservation measures are highly certain to be effective in ameliorating the threats currently impacting the Bi-State DPS. Therefore, we find the Bi-State DPS is not in danger of becoming extinct throughout all or a significant portion of its range, and is not likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range, and we are withdrawing the proposed listing, 4(d), and critical habitat rules for the Bi-State DPS (see **Determination of Status for the Bi-State DPS** below).

(5) Comment: Numerous commenters suggested that predators are a significant threat and that we did not account for this impact accurately. Further, many commenters suggested predator removal programs should be implemented. Alternatively, several commenters suggested that predator control is not sustainable and may have negative and unintended consequences.

Our Response: As discussed in *Predation*, we recognize that predation of sage-grouse is the most commonly identified cause of direct mortality during all life stages. However, we note that sage-grouse have coevolved with a suite of predators (Schroeder et al. 1999, pp. 9–10), yet the species has persisted. Thus, this form of mortality is

apparently offset by other aspects of the species life-history under "normal" conditions. However, when non-endemic predators are introduced into a system (one with which the prey species did not evolve (e.g., domestic cats and dogs)), or when other factors influence the balance between endemic predator and prey interactions, such that a predator gains a competitive advantage, predation may overwhelm a prey species life-history strategy and ultimately influence population growth and persistence (Braun 1998, pp. 145–146; Holloran 2005, p. 58; Coates 2007, p. 155; Bui 2009, p. 2; Coates and Delehanty 2010, p. 243; Howe et al. 2014, p. 41). Therefore, we agree that increases in sage-grouse predator abundance and predation rates are a concern by potentially negatively affecting population growth. However, we maintain that predation is a proximal cause of mortality and increases in predator abundance and predation rates are ultimately caused by changes in habitat conditions, which positively influence predator occurrence or efficiency. See also the *Urbanization and Habitat Conversion, Infrastructure,* and *Predation* sections in the associated Species Report for a detailed analysis on the impacts of predation (Service 2020, pp. 39–60, 110–117).

As a point of clarification, we agree that targeted, short-term predator removal programs may be warranted in instances where habitat restoration cannot be achieved in a timely manner. In these instances, predation rates and predator abundance may be artificially high and high sage-grouse mortality may be a concern. However, data do not appear to suggest that removal programs are sustainable or that they result in consistent increases in sage-grouse numbers (Hagen 2011, pp. 98–99). We intend to explore the potential benefits and negative ramifications caused by predator control through our continued coordination efforts with the Bi-State TAC and LAWG for continued

conservation of the Bi-State DPS. In 2018, a research project was initiated to explore the potential benefits gained through predator management. Specifically, this project targeted nesting common ravens in Long Valley associated with the local landfill through egg-oiling to prevent successful egg hatching. While final results will not be known for several years, preliminary results suggest improved nesting success of sage-grouse in Long Valley in the spring of 2019.

(6) Comment: Numerous commenters suggested that the degree of impact we assign to specific threat factors is not accurate and suggested revisions. Further, several commenters identified an inconsistency in our proposed listing rule associated with our assignment of significance level to grazing and rangeland management.

Our Response: The threats analysis and associated discussion of the degree of impact that is described in the Species Report (2013, 2014, and 2019 versions), our 2013 proposed listing rule, our 2015 proposed withdrawal, and this document are based upon the best available scientific and commercial information. No additional information or assessments were provided by the commenters to support their claim that the analysis and conclusions in our proposed listing rule were inaccurate. However, where applicable in our revised 2019 Species Report and this document, we have updated our threats analyses based on new information received since the proposed listing rule published on October 28, 2013 (78 FR 64358). With regard to potential inconsistencies in the threats analysis in the proposed rule, we made corrections to any inconsistencies identified by commenters and as applicable in both the revised 2019 Species Report and this document. Specifically, our 2013 proposed listing rule identified livestock grazing as a significant

threat in the summary of threats section but did not reach this conclusion in the livestock grazing section of the document. We have corrected that error in this finding.

(*7) Comment*: One commenter suggested that the potential threat to sage-grouse posed by fencing can be mitigated. Alternatively, another commenter stated that fencing is a major threat and expressed concern that there are no programs in place to require fencing to be removed.

Our Response: We agree that certain practices, such as making fences more visible to sage-grouse through the use of visual markers or employing the use of alternative fence designs, such as let-down fencing, can reduce certain impacts to the Bi-State DPS caused by fencing, specifically collision. However, we do not anticipate that these efforts will completely ameliorate the threat of collision. For example, one study found that marking fences reduced the fence collision rate during the sage-grouse breeding season by 83 percent (Stevens et al. 2012, p. 301). Nevertheless, collisions still occurred at marked fences, especially those in close proximity to spring breeding sites, suggesting marking alone did not completely resolve the concern. Furthermore, while direct mortality through collision may be minimized by these approaches, indirect impacts caused by predation and other forms of habitat degradation may remain (see the discussion of impacts due to fences under *Infrastructure* above and in the 2019 Species Report (Service 2020, pp. 54–57)). Therefore, a combination of approaches to managing fences and their impacts needs to be applied, which may include removal. These efforts are currently ongoing in the Bi-State area (Bi-State TAC 2018, p. 33).

With regard to the comment that fencing may be considered a major threat, we have described the impacts that may occur from fencing based on the best scientific and

commercial information available. We found that fencing impacts are widespread but generally minor. In addition, management actions are being undertaken to further ameliorate this threat. For example, approximately 20 km (13 mi) of fencing has been removed or modified in the Bi-State area, and approximately 101 km (63 mi) of fencing has been marked with visual flight diverters. Furthermore, the BLM RMP and USFS LRMP amendments prepared by the Humboldt-Toiyabe and Inyo National Forests, and the Carson City District and Tonopah Field Office of the BLM, specifically identify restrictions on new fence installation and removal or marking of fences already in place within 1.9–3.2 km (1.2–2 mi) of an active lek.

The removal of fencing throughout all of the Bi-State area is not feasible. However, consideration of alternative approaches to traditional fencing would help reduce impacts of fencing to sage-grouse (for example, use of let-down fence designs), and we will continue to work with partners to encourage implementation of reduced or alternative approaches to fencing in areas that are most important to the Bi-State DPS. Conservation efforts are under way currently and into the future to reduce fencing impacts in priority areas (e.g., BLM's removal of racetrack fencing in Bodie PMU, marking or modifying fencing in Pine Nut and South Mono PMUs) (Bi-State TAC 2018, entire).

(*8) Comment*: A few commenters suggested woodlands and woodland expansion is natural and should be left alone. Specifically, commenters speculated that forest occurrence is a reestablishment of sites that were harvested during historic mining in the latter part of the 1800s or that woodlands are naturally occurring. Further, the

commenters suggested that woodland treatments are not effective at positively influencing sage-grouse population performance.

Our Response: Across the Bi-State area, we estimate that approximately 40 percent of the historically available sagebrush habitat has been usurped by woodland succession over the past 150 years (USGS 2012, unpublished data). As described in the 2019 Species Report (Service 2020, pp. 73–79) and in *Nonnative Invasive Plants and Native Woodland Succession*, the cause of this increase is likely multifaceted but most certainly includes recovery from past disturbances such as mining. However, the support for this single mechanism is not apparent. For example, while there are locations within the Bi-State area where there are stumps from harvested trees attributable to the mining era, most locations do not contain evidence of past tree cutting. Furthermore, genetic evidence suggests that sage-grouse populations contained within the Bi-State area were historically more connected and that these connections began to erode relatively recently (Oyler-McCance et al. 2014, pp. 10–11). This finding suggests that barriers to movement, such as trees, were less restrictive historically as compared to today. No additional information was received by the commenter or others since the proposed listing rule published that would modify our understanding of this threat. Therefore, based on the best available information, we conclude that woodland expansion is a significant threat in the Bi-State area as it has reduced habitat availability and negatively influenced population connectivity. As a result, conservation efforts are under way currently and into the future to reduce potential woodland succession impacts in priority areas (e.g., BLM, USFS, and NRCS treatments of phase I and II pinyon-juniper encroachment in all six PMUs) (phases of pinyon-juniper encroachment are generally defined by percent tree

cover and tree age in the affected area) (Miller et al. 2008, p. 5; Bi-State TAC 2018, pp. 26–29).

Ultimately, the cause of woodland encroachment becomes less relevant in light of its implications as the response to tree presence by sage-grouse is uniformly negative (Commons et al. 1999, p. 238; Doherty et al. 2008, p. 187; Freese 2009, pp. 84–85, 89–90; Casazza et al. 2011, p. 159; Baruch-Mordo et al. 2013, p. 237; Prochazka et al. 2017, p. 46). Therefore, to reduce this impact on the Bi-State DPS and its habitat, as described in the BSAP, land managers should consider management of pinyon-juniper encroachment in specific areas that would most benefit the Bi-State DPS (e.g., lek sites, migration corridors, and brood-rearing habitat) and that is consistent with our understanding of a specific site's vegetation potential. The removal of trees conveys positive benefits to sage-grouse stemming from increased habitat availability, increased adult and nest survival, and ultimately overall improved population performance (Coates et al. 2017b, pp. 31–33; Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Prochazka et al. 2017, p. 46; Olsen 2019, pp. 21–22).

(*9) Comment*: Several commenters suggest that fire is the most significant threat to the Bi-State DPS and that post-fire restoration is difficult. Alternatively, several other commenters suggest that fire is a natural process and does not constitute a complete loss of habitat for the Bi-State DPS because sage-grouse will use burned areas.

Our Response: In the Species Report (Service 2020, pp. 79–86) and in *Wildfires and Altered Fire Regime*, we address potential habitat changes that may be related to wildland fires and post-fire restoration activities. We agree that fire is a natural process on the landscape within the Bi-State area; however, we also note that we found that the

"too-little" and "too-much" fire scenarios present challenges for the Bi-State DPS. In other words, in some locations, the lack of fire has facilitated the expansion of woodlands, especially into montane shrub communities. In other locations, recent fires have been followed by invasive-weed establishment facilitating a reoccurring fire cycle that restricts sagebrush restoration. These scenarios present challenges for the species. Still, although fires have occurred across the range of the Bi-State DPS historically and recently, we acknowledge that a sufficient amount of suitable habitat remains for sage-grouse use. Some of this remaining suitable habitat is threatened by additional fire because of adjacent invasive annual plants and woodland establishment, which can influence the frequency and intensity of future fire events. Further, impacts to remaining sagebrush habitat may be exacerbated due to interactions with other threats that are acting in the Bi-State area (see *Summary of Threats*). As a result of these impacts, conservation efforts are under way currently and into the future to reduce impacts associated with nonnative, invasive plants (e.g., multiple BLM and USFS invasive weed management treatments in multiple PMUs), and woodland succession (e.g., BLM, USFS, and NRCS treatments of phase I and II pinyon-juniper encroachment in all six PMUs) (Bi-State TAC 2014, *in litt.*).

Additionally, while short-term (and potentially long-term) impacts from fire events to sage-grouse are known to occur, including but not limited to habitat loss and population declines (Beck et al. 2012, p. 452; Knick et al. 2011, p. 233; Wisdom et al. 2011, p. 469), we agree that some information suggests sage-grouse use of burned habitat. Small fires may maintain a suitable habitat mosaic by reducing shrub encroachment and encouraging understory growth. However, without available nearby

sagebrush cover, the broad utility of these sites is questionable (Woodward 2006, p. 65). For example, sage-grouse using burned areas were rarely found more than 60 m (200 ft) from the edge of the burn and may preferentially use the burned and unburned edge habitat (Slater 2003, p. 63).

We recognize that fire is natural and the primary disturbance mechanism in the sagebrush ecosystem. We also recognize that sage-grouse will selectively utilize portions of burned habitat. However, the challenge that wildfire presents to the sustainability of the system remains, especially given the relatively limited and fragmented suitable sagebrush habitat present in the Bi-State area. Still, land managers within the range of the Bi-State DPS are currently implementing and will continue to implement conservation efforts into the future that are expected to reduce the potential impacts of wildfire as it relates to nonnative, invasive plants and pinyon-juniper encroachment (Bi-State TAC 2018, pp. 22–23).

(*10) Comment*: Several commenters suggested that climate change poses a significant impact to the Bi-State DPS and its habitat, including one commenter that stated we underestimated the impact that climate change and drought may have on the DPS.

Our Response: In the Species Report (Service 2020, pp. 86–94) and in *Climate,* we address potential impacts associated with climate change. We found that projected climate change and its associated consequences have the potential to affect sage-grouse and sagebrush habitat in the Bi-State area. The impacts of climate change interact with other stressors such as disease, invasive species, prey availability, moisture, vegetation community dynamics, disturbance regimes, and other habitat degradations and loss that

are already affecting the species (Strzepek et al. 2010, p. 5; Walker and Naugle 2011, entire; Finch 2012, pp. 60, 80; IPCC 2014, p. 60; Ault et al. 2014, p. 7545; Garfin et al. 2014, p. 463; He et al. 2018, pp. 16–17; Reich et al. 2018, p. 21). In the 2015 withdrawal of our proposed rule, we concluded that the overall impact of climate change to the Bi-State DPS at this time is considered moderate. Neither the commenters nor others provided new information related to climate change that would result in a change in our analysis. Our conclusion of moderate impact from climate change may ultimately prove to be conservative, but we believe this is the most supportable conclusion given the inherent uncertainties associated with climate modeling, especially prediction concerning precipitation. Additionally, conservation efforts associated with the 2012 BSAP (such as grazing exclosures, changes to grazing management plans, prescribed fires, invasive plant control, mechanical treatments, and conservation of meadow habitats) are increasing resiliency such that the magnitude of climate changes impacts will be reduced into the foreseeable future. If in the future substantial new information becomes available as to the specific impacts that may be incurred by the Bi-State DPS associated with climate change, we will revisit this assessment.

(*11) Comment*: Several commenters stated that we should have proposed listing the Bi-State DPS of greater sage-grouse as an endangered species as opposed to a threatened species.

Our Response: Section 3 of the Act defines an endangered species as any species that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. With regard to

the Bi-State DPS, we have identified a series of threats across the range of the Bi-State DPS that are resulting in the present or threatened destruction, modification, or curtailment of its habitat or range, and other natural or manmade threats affecting the DPS's continued existence. We have determined that, assuming current conditions continue into the future, these impacts are such that the DPS is likely to become an endangered species within the foreseeable future (i.e., the definition of a threatened species).

Many of these impacts are cumulatively acting upon the Bi-State DPS and increase the risk of extinction, but not to such a degree that the DPS is in danger of extinction today (see **Determination of Status for the Bi-State DPS**, below). However, after consideration of partially completed projects and future conservation efforts that we have found to be highly certain to be implemented and effective (see **Policy for Evaluation of Conservation Efforts When Making Listing Decisions**, above), we conclude the Bi-State DPS is not in danger of becoming extinct throughout all or a significant portion of its range, and is not likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range. Therefore, the Bi-State DPS of greater sage-grouse does not meet the definition of a threatened or endangered species, and we are withdrawing the proposed listing, 4(d), and critical habitat rules for the Bi-State DPS.

(*12) Comment*: Some commenters were concerned about the effects of listing on mining and associated activities conducted under the General Mining Law of 1872. One commenter suggested that listing did not take into consideration Federal mining law and

recognition of valid existing rights. Another commenter was concerned that there would be no assurances that development of a mining claim will result in the ability to mine it.

Our Response: In the proposed listing rule, we identified mining and associated activities to be a threat to the Bi-State DPS; however, today we consider it a less significant impact and one that does not occur across the entire Bi-State area. On federally managed land outside of designated wilderness and wilderness study area (approximately 92 percent of all federal lands (1,629,669 ha or 4,027,000 ac)), new mining may occur pursuant to the Mining Law of 1872 (30 U.S.C. 21 et seq.), which was enacted to promote exploration and development of domestic mineral resources, as well as the settlement of the western United States. It permits U.S. citizens and businesses to prospect hardrock (locatable) minerals and, if a valuable deposit is found, file a claim giving them the right to use the land for mining activities and sell the minerals extracted. Gold and other minerals are frequently mined as locatable minerals subject to the Mining Law of 1872. Federal agencies with jurisdiction over land where mining occurs will review mining and other actions that they fund, authorize, or carry out to determine if listed species may be affected in accordance with section 7 of the Act. Because we are withdrawing our proposed rule to list the Bi-State DPS and it will not be placed on the list of federally endangered or threatened species, consultations under section 7 of the Act will not be required specific to the Bi-State DPS.

As discussed above, potential exists for mining operations to expand both currently and into the future, but the scope of impacts from existing mining expansion is not considered extensive. We concluded that, by itself, mining is not currently considered

a significant impact to the Bi-State population, though mining exploration continues, and mining activity could occur at any time in the future.

(*13) Comment*: Several commenters stated that they believe mining is not a threat to the Bi-State DPS. Alternatively, another commenter suggested impacts from mining are significant.

Our Response: In the Species Report (Service 2020, pp. 60–63) and in *Mining*, we address potential impacts associated with mining activities. Sage-grouse could be impacted directly or indirectly from an increase in human presence, land use practices, ground shock, noise, dust, reduced air quality, degradation of water quality and quantity, and changes in vegetation and topography (Moore and Mills 1977, entire; Brown and Clayton 2004, p. 2). However, these effects are theoretical, given that information relating sage-grouse response to mineral developments is not extensive. Neither the commenters nor others provided new information related to this threat. While we maintain that it is reasonable to assume a negative impact from mining on sage-grouse, based on the current extent and location of mineral developments in the Bi-State area, we conclude that mining is not considered a significant impact at this time. Mining is a potential future concern based on its potential to impact important lek complexes and population connectivity. It may also create effects that combine with other threats currently acting on the Bi-State DPS resulting in a higher degree of negative impact in the future, though not to the extent that the species will become endangered in the forseeable future. See the *Mining* section of the 2019 Species Report for a complete discussion of the potential effects of mining activities on the Bi-State DPS and its habitat.

(14) Comment: Numerous commenters suggested that our grazing and rangeland management assessment in the proposed listing rule is not accurate and requires additional clarification. Specifically, they suggested that: (1) Current livestock grazing is compatible with sage-grouse conservation in the Bi-State area, (2) a more clearly defined delineation is needed between past and present grazing impacts, and (3) additional delineation is needed among grazing animals (such as cattle, horses, sheep). Alternatively, several other commenters suggested that grazing and rangeland management are a significant threat to the Bi-State DPS's conservation and that this threat is not adequately controlled by existing management programs.

Our Response: In the 2019 Species Report (Service 2020, pp. 65–73) and in *Grazing and Rangeland Management*, we found that the majority of sage-grouse habitat in the Bi-State area is not significantly impacted by livestock grazing. Specifically, RHAs or their equivalents (the standard used by Federal agencies to assess habitat condition) have been completed on allotments covering approximately 81 percent of suitable sage-grouse habitat in the Bi-State area. Of the allotments with RHAs completed, 81 percent (n=97) are meeting upland vegetation standards, suggesting that approximately 352,249 ha (870,427 ac) out of approximately 563,941 ha (1,393,529 ac) of suitable sage-grouse habitat are known to be in a condition compatible with sagebrush community maintenance. Furthermore, of the allotments with RHAs completed, 45 percent are meeting riparian standards and 27 percent are not, with the remainder being unknown or the allotment not containing riparian habitat. Of those not meeting riparian standards (approximately 15 percent), livestock were a significant or partially significant cause for the allotment failing to meet identified standards while the remainders were attributed to

other causes such as past mining activity or road presence. In each instance of an allotment not meeting standards due to livestock, remedial actions have been taken by the representative land managing agency (such as changes in intensity, duration, or season of use by livestock). Furthermore, while we have information on the class of livestock (i.e., sheep, cattle) associated with any given allotment, we did not analyze these allotments independently based on this difference.

While it is true that types of livestock will use vegetation communities differently, meaning some animals consume more shrubs and others consume more grasses, RHAs or their equivalents are a measure of the condition of the allotment against a desired condition, which includes among other things fish and wildlife habitat condition. Given that RHAs in the Bi-State area consider suitable sage-grouse habitat condition as part of their evaluation, including shrub and herbaceous cover, we consider RHAs as a unit of measure sufficiently fine-scaled to be informative. Ultimately, based on data contained within RHAs, we concluded that modern livestock grazing is not a significant impact on sage-grouse habitat.

We also note that historical impacts from livestock grazing and impacts caused by feral horses are apparent, but data to assess these impacts are limited. None of the commenters provided additional data to assist with this assessment. In total, we believe that historical impacts (past grazing and other land uses) and impacts from feral horse use is apparent in local areas, but we consider current management to be sufficient to address these issues.

(15) Comment: Several commenters provided information pertaining to population performance and size across the DPS as a whole as well as for individual Population Management Units.

Our Response: While we appreciate these updates, all of these comments and the data contained within them have been considered in the associated 2019 Species Report as well as within this document. Furthermore, we note that the most recent final results stemming from the IPM (Coates et al. 2020, entire) are similarly incorporated into our 2019 Species Report and this document. The data provided by commenters have either been updated by incorporating more recent data into the analysis or by making slight alterations to the modelling approach. Many preliminary research results are presented to the Local Area Working Group during regularly occurring meetings. These results, however, are often prone to change as the research is finalized. Therefore, the numbers presented in the 2019 Species Report and incorporated into this document represent the most up-to-date finalized findings and represent the best scientific and commercial data available.

(16) Comment: At least one commenter questioned the efficacy and rationale for the currently ongoing translocation effort in the Parker Meadows subpopulation. The commenter specifically expressed concern over the potential impact this action may have on the source population and further questioned whether the habitat in the Parker Meadows area is sufficiently suitable for the reintroduction.

Our Response: The 2012 Action Plan identified augmentation of the Parker Meadows subpopulation via translocation as a conservation action. This effort was identified as a need based on the small size of the subpopulation, genetic information

highlighting relatively low genetic diversity in the subpopulation, and recent monitoring results identifying low hatchability of clutches (females were laying eggs but these eggs were not hatching, suggesting eggs were either going unfertilized or genetic anomalies were inhibiting some aspect of egg development). To restore genetic and demographic health to the subpopulation, birds from outside the subpopulation were captured and moved to the Parker Meadows site. The overarching intent of this action was to conserve and enhance connectivity between PMUs, specifically between the South Mono and Bodie PMUs.

Prior to initiating this effort, members of the Bi-State TAC conducted a site visit to assess habitat condition. Habitat was deemed to be of suitable condition but for the occurrence of a limited number of conifer trees that had become established in proximity to the lek and brood-rearing meadow. These trees were removed prior to the augmentation. In addition, the Bi-State TAC evaluated the potential impact the source population may incur, due to the removal of birds, via the IPM. Essentially, the study evaluated how altering adult female and brood survival for the source population impacted population performance. The source population was the Bodie PMU, and the results suggested the removal of birds from this location would not affect overall population growth within this PMU. We evaluated the potential impact from this action in the 2019 Species Report, within the *Scientific and Educational Uses* section (Service 2020, pp. 101–104).

Ultimately, measuring the success of this translocation effort will require additional time. Preliminary results suggest that translocated birds are remaining in the Parker Meadows area at an increasing rate, probability of nest initiation and nest success

have increased, brood success is on par with the remainder of the DPS, and lek counts have increased over the past 2 years.

(17) Comment: Several commenters expressed concern over the estimated effective population size of the DPS as a whole as well as for specific populations.

Our Response: As discussed in *Small Population Size and Population Isolation*, studies suggest effective population size should exceed 50 to 100 individuals to avoid short-term extinction risk caused by inbreeding depression, and mathematical models suggest that effective population size should exceed 500 individuals to retain evolutionary potential and avoid long-term extinction risk (Franklin 1980, entire; Soule 1980, entire). However, some estimates of an effective population size necessary to retain evolutionary potential are as high as 5,000 individuals, although these estimates are thought to be highly species specific and influenced by many extrinsic factors (Lande 1995, p. 789). The effective population size of the Bi-State DPS in 2018 was between 330 and 661 birds (Table 2; Service 2020, pp. 119–121).

We agree that the size of the populations and the relative degree of isolation among populations within the Bi-State area is a concern to species conservation as it can exacerbate the effects of genetic issues, stochastic events, and other threats to the DPS. However, as discussed above, the current genetic diversity present in the Bi-State area population is comparable to other populations, suggesting that the differences are not due to a genetic bottleneck or founder event (Oyler-McCance and Quinn 2011, p. 91; Oyler-McCance et al. 2014, p. 8). The available genetic information demonstrates that the Bi-State sage-grouse are both discrete from other greater sage-grouse populations and are genetically unique. Further, a significant impetus of the 2012 Action Plan was to

facilitate connectivity among populations across the DPS. While we remain concerned regarding isolation of these populations, we believe that effective implementation of the 2012 Action Plan will help alleviate concerns over loss of genetic diversity or the accumulation of deleterious alleles.

(18) Comment: Several commenters identified new potential threats to the DPS, which were not apparent at the time of our proposed listing in 2013. Specifically, these include a potential change to how LADWP manages their lands in Long Valley, the potential for additional development within the designated West-wide Energy Corridor, a potential new hydro-pump storage energy development in the White Mountains PMU, and the development of a Programmatic Environmental Impact Statement pertaining to fuel break development in the Great Basin (PEIS).

Our Response: We appreciate these updates on potential threats and note that each of these identified new threats has been considered in the associated 2019 Species Report as well as in this document.

The Record of Decision on the West-wide Energy Corridor was signed in 2009 by the Secretaries of the Interior and Agriculture. This action was challenged in court the same year, and a settlement was reached in 2012. One aspect of the settlement was a reevaluation of the corridors identified in 2009, and the public scoping for this assessment was reopened in the past year. Thus, we have been aware of this potential activity for nearly a decade but recognize the renewed interest in its potential impact to the Bi-State DPS.

A section of these designated corridors passes through the Mount Grant PMU. This corridor section currently has a high-voltage transmission line in place, but

additional development may take place assuming the completion of this NEPA action. While we recognize that additional development may occur and may cause impacts to this population, we do not have any knowledge of, nor did the commenters provide, additional data informing the likelihood of future development. The reevaluation of these corridors is currently ongoing per the 2012 settlement. This reevaluation may, in fact, result in revisions to the 2009 corridor proposals. We do not have sufficient certainty at this time of what the potential impacts of this action may have on the Mount Grant PMU.

The LADWP is currently evaluating alterations to the amount of water it has traditionally provided for agricultural use in Long Valley. This water allocation has most commonly been used to irrigate portions of Long Valley to benefit forage production for local ranching operations. An ancillary benefit of this practice has been the enhancement of sage-grouse brood-rearing habitat. Thus, changes to this practice could influence the sage-grouse population in Long Valley by negatively impacting chick survival. To address these type of concerns, in June of 2019, LADWP sent a letter to the Service reaffirming their commitment to their 2013 Conservation Strategy (implemented by a memorandum of understanding with FWS), through which LADWP supports sage-grouse conservation by, in part, utilizing its water resources to maintain and improve important habitat for sage-grouse on their lands; and to continue using a collaborative, science-based, and adaptive management approach to achieve the best habitat results. Therefore, we recognize the potential impacts that alteration to water supplies in Long Valley may have on the local sage-grouse population, but we consider this to be a manageable stressor, in light of LADWP's continuing commitment toward Bi-State DPS conservation.

In 2019, an application was submitted to the Federal Energy Regulatory Commission to build and maintain a new hydro-pump storage facility within the White Mountains PMU, representing a potentially new threat to the DPS. However, this application was subsequently withdrawn. Therefore, the Service does not consider this formerly proposed facility to be an active threat to the Bi-State DPS.

In 2017, the BLM published a notice of intent to prepare the development of a Great-Basin-Wide Fuel Break PEIS. The purpose of this document is to expedite the development, enhancement, maintenance, and utilization of fuel breaks to prevent or minimize the likelihood of large-scale wildfire events, which are becoming more prevalent in the Great Basin. This would be accomplished by establishing strategic fuel breaks wherein fire fighters could stage and anchor suppression activities to increase quicker suppression response times. We recognize that Bi-State DPS habitat is included within the scope of the PEIS. Further, we recognize that fragmentation of habitats through the establishment of fuel breaks may negatively impact some wildlife species including greater sage-grouse (Shinneman et al. 2019, pp. 4–7).

There are trade-offs between the effects of habitat lost to fire and habitat lost or degraded by the establishment of a fuel break. Because the plan has not yet been prepared, it is difficult to fully assess its impacts on sagebrush habitat. Still, we anticipated that, after the PEIS is complete, site-specific NEPA analysis (or possibly categorical exclusion or determinations of NEPA adequacy analyses) will still be developed, as the PEIS does not detail the specific locations where these fuel breaks will be established. Given current direction provided by Land Use Plans in the Bi-State area, identified “Best Management Practices” outlined in the PEIS, and the existing

collaboration among the EOC, TAC, and LAWG, we contend that future discussions pertaining to the potential establishment of fuel breaks in the Bi-State area will be robust and afford substantial deference to sage-grouse as well as the integrity of the entire sagebrush ecosystem. Therefore, we do not consider the PEIS to negatively impact the species, and thus do not consider it in our threats analysis.

(19) Comment: One commenter questioned the feasibility of ongoing financial commitments provided by the Bi-State EOC toward the implementation of the 2012 BSAP.

Our Response: The BSAP identifies threats to the conservation of sage-grouse in the Bi-State area and delineates specific conservation actions to alleviate those threats. In 2014, the Bi-State EOC pledged to fund these actions at a value in excess of 45 million dollars over a 10-year timeframe. We recognize that funding commitments provided by Federal agencies over a 10-year time horizon may appear speculative, given these agencies typically work with annual funding cycles driven by the U.S. Congress appropriations process; however, agency managers still retain substantial discretion to forecast and plan how to utilize appropriations in a longer term strategy. From 2014 through 2018, approximately 26 million dollars have already been allocated, representing approximately 57 percent of pledged funds (Bi-State TAC 2018, p. 35). Furthermore, agency partners in the EOC recently updated their respective letters of commitment to continue funding for the next 5 years. Given the robust collaborative effort in the Bi-State area in combination with the realized funding track record over the past 5 years and recent reiterations of commitments for future funding, we consider the likelihood of future commitments to be high.

(20) Comment: One commenter suggested we should assess human population density on a county-by-county basis to determine how it compares to the four people per 1 km^2 threshold established by Aldridge et al. (2008).

Our Response: In 2008, Aldridge et al. (2008) published a peer-reviewed scientific article, which evaluated a number of predictive variables to compare locations of extant versus extirpated sage-grouse populations. We note that this correlative study does not imply causation but is a frequently used approach in wildlife studies and that this type of approach can be highly informative.

As discussed in *Urbanization and Habitat Conversion*, in modeling several measures of human population on greater sage-grouse persistence, including current population density, historical population density, and human population growth, the best predictor of sage-grouse extirpation was human population density in 1950 (Aldridge et al. 2008, p. 985). This finding suggests that human development has had long-term impacts on habitat suitability and sage-grouse persistence. Extirpation was more likely in areas having a moderate human population density of at least four people per 1 km^2 (10 people per 1 mi^2). Furthermore, increase in human populations from this moderate level did not infer a greater likelihood of extirpation, likely because much of the additional growth occurred in areas no longer suitable for sage-grouse (Aldridge et al. 2008, pp. 991–992).

In the 2019 Species Report, we examined the potential likelihood of population changes that may influence urbanization and habitat conversion in the future, by reviewing the most recent U.S. Census Bureau data (U.S. Census Bureau 2018). We found five of eight counties in the Bi-State area have documented declines in the

estimated number of people present between 2010 and 2017: Alpine, Mono, and Inyo Counties in California, and Mineral and Carson City Counties in Nevada. In addition, all of these counties except Carson City, Nevada, support substantially fewer than four people per 1 km^2 (10 people per 1 mi^2). The remaining three counties in the Bi-State area have seen human population increases over the past decade, ranging from 2.8 percent for Douglas County, Nevada, and 4.1 percent for Lyon County, Nevada, to 8.4 percent for Esmerelda County, Nevada (U.S. Census Bureau 2018). While Esmerelda County still contains substantially fewer than four people per km^2 (four people per 0.4 mi^2), both Lyon and Douglas Counties, Nevada, have from two to six times that population density.

Although we do not have specific information on possible future developments from each of these counties with documented human population increases, we are aware that recent development levels are reduced as compared to the past. Obviously, this metric can be informative but potentially misleading or unsatisfying. Frequently, counties have high- and low-density areas such as cities and towns or more rural developments. Evaluating the number of people per area does not capture the true distribution of people across the landscape. So, while it is reasonable to use the Aldridge et al. (2008) study to explore similarities or differences among locations, two counties with the same density of people can have differing levels of effects to sage-grouse based on the pattern of development.

(21) Comment: One commenter suggested we should invite and interview Native American tribal partners to share their knowledge of historical and pre-historical occurrence of sage-grouse in the Bi-State area.

Our Response: We agree that our Native American partners have a rich oral and written history in the Bi-State area, and we have been working with them since 2014 to incorporate their knowledge into the Bi-State collaboration. The first milestone of this endeavor occurred in 2016 in the form of a Traditional Ecological Knowledge Summit intended to engage and learn from the local and more broadly dispersed Native American Tribes in the Great Basin on sage-grouse history and conservation and the cultural significance of pinyon pine trees. This well-attended event presented an opportunity for the dissemination of traditional knowledge and subsequently led to the establishment of the Bi-State Traditional Natural Resources Committee. The intent of this committee is simple, to expand the breadth of the Bi-State collaboration such that decisions and actions are informed by and take into consideration Native American concerns and insights. We are pleased to further expand the Bi-State collaborative through the participation of Native American tribes and agree that inclusion of traditional knowledge is an imperative. With respect to this listing decision process specifically, we extended an invitation to Tribal partners to review and comment on our 2019 Species Report prior to its completion, but we did not receive any responses.

(22) Comment: One commenter stated that we must consider the best available science on impacts to sage-grouse wintering habitats and map Bi-State sage-grouse wintering habitat to assess threats to it. Further, they stated this is of critical importance because wintering habitats may be found outside habitats designated on the basis of breeding and nesting habitats.

Our Response: We concur that an understanding of wintering habitats is important to conservation and management of the Bi-State DPS. We further agree that

mapping of wintering habitat would be useful to assess threats. However, we are required to make our determination based on the best scientific and commercial data available at the time of our rulemaking, and information on wintering habitats as well as maps of wintering habitat are not currently available. In preparing this document, we considered the best scientific and commercial data available regarding the Bi-State DPS to evaluate their potential status under the Act. We solicited peer review of our evaluation of the available data, and our peer reviewers supported our analysis. Science is a cumulative process, and the body of knowledge is ever-growing. In light of this, the Service will always take new research into consideration into future analyses of the Bi-State DPS, but we are required to publish a final decision on the Bi-State DPS in the *Federal Register* by April 1, 2020. If plausible new research supports amendment or revision of this withdrawal document in the future, the Service will consider the new information consistent with the Act and our established work priorities at that time.

(23) Comment: One commenter suggested we should present up-to-date acreage for private lands covered by conservation easements and provide descriptions of projects funded by the NRCS.

Our Response: We estimate that, since 2003, approximately 10,415 ha (25,737 ac) of private land, which may provide suitable habitat for sage-grouse in the Bi-State DPS, are currently enrolled in various easement programs. The easements are targeted primarily at development and water rights and vary in length from 30 years to in perpetuity. The majority of these easement lands are located in the Bodie PMU, with the remainder of easements occurring in the Desert Creek-Fales, South Mono, Pine Nut, and White Mountains PMUs. In addition, we estimate that approximately 9,737 ha (24,060

ac) of previously private land within the Bi-State DPS has been acquired by State and Federal agencies over this same timeframe. In total, approximately 20,153 ha (49,800 ac) of land, either through conservation easements or acquisitions, has been substantially protected from urbanization challenges. These acres represent approximately 31 percent of total private lands containing mapped sage-grouse habitat across the Bi-State. Furthermore, 12,243 ha (30,254 ac) of the total 20,153 ha (49,800 ac) of easements and acquisitions completed since 2003 have been accomplished since the adoption of the BSAP in 2012. Further, we note that approximately 7,284 ha (18,000 ac) of private lands have funding obligated for conservation easements, but these transactions are still in progress. An effort to acquire approximately 5,870 ha (14,500 ac) of lands in the Pine Nut PMU by the Carson City BLM has been approved and is anticipated to finalize in spring of 2020.

The NRCS, via the Farm Bill, can fund restoration actions on private and public lands across the Bi-State DPS. The suite of actions they can fund is broad, but based on a Conference Report with the Service in 2010, there are three main types of conservation practice standards employed: management, vegetative, and structural. Examples of practices that fall under these three main categories include (but are not limited to): (1) Prescribed grazing assistance, upland and meadow management, access management; (2) forest slash management, cover crop, weed control, seeding; and (3) infrastructure, fish and wildlife structure, obstruction removal. While a variety of these practices have been employed in the Bi-State area, in general the preponderance of NRCS's efforts in the Bi-State area have focused on securing conservation easements and conifer removal. Since 2010, NRCS has placed into easement approximately 8,741 ha (21,600 ac) of private

lands. In addition, over this same timeframe, NRCS has funded the removal of approximately 4,649 ha (11,488 ac) of conifer trees for the benefit of the species across multiple PMUs.

(24) Comment: Several commenters expressed concern over population performance in some subpopulations and how this may result in range contraction of the DPS. Further one commenter submitted that we evaluate lek count data collected by the States and incorporate it into population trend analysis.

Our Response: We agree that some of the smaller peripheral populations experiencing population declines may result in range contractions in the Bi-State DPS as a whole. A recent analysis considering data from the past 24 years on four populations found that some populations in the Bi-State DPS are contracting their habitat use, with contractions most apparent in the Fales, Long Valley, and Sagehen populations (Coates et al. 2020, p. 44). Over this same time, distributional area in the Bodie Hills has increased (Coates et al. 2020, p. 44). Across the entire Bi-State area, these results suggest a median net loss of 858 ha (2,120 ac) annually. Additionally, recent changes in distribution (past 11 years) suggests a pattern similar to those described for the long-term spatial trend analysis.

This short-term analysis also considered additional populations (Coates et al. 2020, p. 51). These results suggest contractions of total area for the Desert Creek, Long Valley, Mount Grant, Pine Nut, Sagehen, and White Mountains populations and expansion in the Bodie Hills, Fales, and Parker Meadows populations. Similar to the long-term analysis, the net effect over the 11 years was a loss of total area occupied over time, which corresponds to a median loss of 2,312 ha (5,713 ac) annually since 2008

(Coates et al. 2020, p. 51). These apparent declines in certain populations and habitat use over the shorter time period was likely influenced by the fact that the DPS is in the downward portion of their cyclic population growth. We also note that a significant drought affected this DPS from 2011 to 2015, and based on our understanding of the drivers behind sage-grouse population cycles, this drought condition has very likely affected recent population performance. We will continue to monitor the condition of these smaller, peripheral populations while working with our partners to implement beneficial actions from the BSAP.

As part of our assessments of the Bi-State DPS, we request and review lek count data from NDOW and CDFW. We recognize that this data can be informative but further acknowledge that these data have limitations. For example, sage-grouse are known to forgo breeding activity during years of poor conditions, such as drought. Therefore, an individual animal may still be present in the population but does not attend the lek and therefore is not counted. While the data in this instance may suggest decline, it is misleading. There is support, however, that over a longer timeframe (8–10 years), lek counts act as a reasonable index to population performance. Modeling these data helps alleviate concerns over the inherent errors associated with lek counts. Further, integrating the observations with additional data such as that collected via telemetry studies makes for a much more robust approach to understanding population dynamics. Ultimately, we do not dismiss lek count information, but we contend that incorporating this information into a more holistic approach—such as the Integrated Population Model for the Bi-State DPS—is a more informative approach to understanding population abundance and trend.

(25) Comment: One commenter suggested we review Smith and Beck (2017) and contends that sagebrush treatments do not benefit greater sage-grouse and further that pinyon-juniper treatments also disturb sagebrush habitat, implying pinyon-juniper treatments do not benefit sage-grouse.

Our Response: We appreciate this information. We agree with the findings in this report and submit that these results have been supported by others investigating habitat selection by greater sage-grouse. While the removal of sagebrush to benefit herbaceous understory development was a relatively frequent activity in the 1940s to the 1970s (Knick et al. 2011, p. 220), this form of action has been greatly curtailed in the past two decades. There may still be benefits to this type of action, and it is still conducted sporadically, but recent treatment methodology has been to open small gaps in the shrub canopy to alter the mosaic of the landscape in hopes of improving brood-rearing habitat. The validity of this treatment approach remains uncertain, and our understanding of the appropriate sage-grouse habitat mosaic remains untested.

The intent of pinyon-juniper removal projects is to facilitate sagebrush community conservation and improve the suitability of a location for sage-grouse. Sage-grouse avoid tree communities, and their fitness is impacted by exposure to it. Furthermore, left unmanaged, trees will ultimately out-compete understory species (shrubs and herbaceous), resulting in a homogenous forested vegetation condition. Restoration of the shrub community at this point becomes extremely challenging. Targeted pinyon-juniper treatments in the Bi-State area are focused on, what is termed, phase I and phase II encroachment conditions. Phase I refers generally to conditions where trees are small (shrub high) with less than 10 percent canopy cover and the shrub

community remains intact. Phase II occurs as the tree canopy cover increase (10–30 percent), trees increase in size, and the shrub community begins to decrease in dominance.

Treatments of phase I communities is typically accomplished with garden pruners and pedestrian locomotion. This type of treatment would have negligible impact on the shrub community due to disturbance. As trees begin to increase in size, chainsaws and machinery are employed. In these instances, disturbance to the shrub community may occur but specific prescriptions and best management practices are followed to alleviate this exact concern. Shrub community disturbance in these instances do not equate to the treatments described by Smith and Beck (2017), where shrubs were specifically targeted for removal across large acreages. Finally, the potential short-term and restricted impact to the shrub community caused by tree removal treatments are outweighed by the long-term benefit gained through increasing and improving sage-grouse habitats.

(26) Comment: Several commenters expressed concern that economic development will be negatively impacted by listing and suggested that it is necessary for the Service to conduct an analysis of the impacts that listing a species may have on local economies prior to issuance of a final rule. Alternatively, one commenter submitted that the local economy will be positively benefited.

Our Response: Under the Act, the Secretary shall make determinations whether any species is an endangered species or a threatened species solely on the basis of the best scientific and commercial data available. Thus, the Service is not allowed to consider the economic impact of listing when making determinations whether a species is an endangered species or a threatened species.

Determination of Status for the Bi-State DPS

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence. For a more detailed discussion on the factors considered when determining whether a species meets the definition of "endangered species" or "threatened species" and our analysis on how we determine the foreseeable future in making these decisions, see *Regulatory Framework*, above.

Status Throughout All of Its Range

In this document, we reviewed the biological condition of the Bi-State DPS and its resources, and the influence of those resources on the species' overall viability and the risks to that viability. We presented summary evaluations of 11 threats analyzed in the Species Report: urbanization and habitat conversion (Factor A); infrastructure (Factor A); mining (Factor A); grazing and rangeland management (Factor A); nonnative invasive

plants and native woodland succession (Factor A); wildfires and altered fire regime (Factor A); climate change, including drought (Factor A); recreation (Factor E); disease (Factor C); predation (Factor C); and small population size and population isolation (Factor E). We also evaluate the adequacy of existing regulatory mechanisms (Factor D) in ameliorating the magnitude and effect of threats. Please see the Species Report (Service 2020, pp. 39–136) for a more detailed discussion of each threat.

In the Species Report, we also presented our evaluation of four additional threats: renewable energy (Factor A), commercial and recreational hunting (Factor B); scientific and educational uses (Factor B); and contaminants (including pesticides) (Factor E). In the species report, we concluded that, although these threats are currently having some impact on individual sage-grouse and their habitat, their overall effect now and into the future is expected to be minimal. We did not present summary analyses of those threats in this document but, did consider them in *Summary of Threats* and consider them now as a part of our determination of status.

When we issued a proposed rule to list the Bi-State DPS in 2013 (78 FR 64358, October 28, 2013), we found that the species was likely to become endangered in the foreseeable future throughout all of its range due to threats associated with native woodland succession, the wildfire-invasive plant cycle, effects associated with small population size, and increased fragmentation of sagebrush habitat in the Bi-State area. Many of these threats remain on the landscape today. Pinyon-juniper encroachment (Factor A) continues to alter sagebrush habitat in the Bi-State area. Effects due to wildfire (Factor A) and nonnative invasive plants (cheatgrass) (Factor A) also continue to alter and degrade sagebrush habitat. The effects of drought (Factor A) are exacerbating

impacts of wildfire, invasive plants, and altered wildfire regimes across the Bi-State area. In the future, climate change (Factor A) will result in warmer temperatures, altered precipitation regimes, and more frequent droughts. These changes will likely result in a greater intensity of these other threats into the foreseeable future. Drought in particular appears to have a strong influence on population dynamics and population cycling in the Bi-State DPS (Coates et al. 2020, pp. 27, 29).

Areas across the Bi-State DPS are experiencing combined impacts of threats from wildfire, invasive species, urbanization (Factor A), infrastructure effects (Factor A), and recreation (Factor E); these effects may be exacerbated by population isolation and discontinuous population structure (Factor E). Regulatory mechanisms (Factor D), particularly RMPs and land management plans, are helping to ameliorate some threats across the Bi-State DPS. These plans provide specific direction for management of the DPS and its habitat, including decreasing habitat disturbance (direct effects) and noise and other impacts (indirect effects), through provisions addressing recreation, grazing, weeds, wild horses, minerals, and fire management.

Impacts associated with Factor B (commercial and recreational hunting, and scientific and educational uses) are having very minor effects the Bi-State DPS now, and they are not expected to substantially increase within the foreseeable future. Predation (Factor C), particularly by ravens, is impacting the DPS, but not at a magnitude where resiliency is significantly affected. However, as habitat degradation and fragmentation continue to increase, the magnitude of the threat of predation could increase into the future.

The key distinction between now and the 2013 proposed listing rule is the implementation of the 2012 BSAP, which began implementation in 2014 with the publication of the 2014 EOC report and the letters of commitment from partner agencies. Ongoing and future conservation efforts associated with the BSAP are likely to increase habitat quantity, quality, and connectivity, and enhance resiliency, redundancy, and representation. Efforts associated with the BSAP will:

(1) Protect and restore critical brood-rearing habitat (reduces impacts from development/habitat conversion, grazing and rangeland management, and effects resulting from climate change).

(2) Restore habitat impacted by nonnative, invasive species (e.g., cheatgrass) and pinyon-juniper encroachment (reduces impacts from nonnative, invasive and certain native plants, wildfire, predation, and effects resulting from climate change).

(3) Improve our understanding of sage-grouse populations, structure, etc., to: (a) Prioritize management actions related to synergistic impacts on already fragmented habitat (reduced impacts such as infrastructure, urbanization, and recreation), such that management efforts occur in locations that benefit the DPS the most; and (b) develop and implement sage-grouse translocations from stable subpopulations to other small subpopulations that may be experiencing a high risk of extirpation (reduces impacts from small population size and population structure).

These measures will likely increase the number of sage-grouse and resiliency of populations throughout the Bi-State DPS. These efforts to stop and reverse habitat loss and fragmentation will make small populations of Bi-State sage-grouse less susceptible to the effects of habitat loss, degradation, and fragmentation. They will expand the amount

of protected habitat in critical brood-rearing habitat areas as well as restore currently unsuitable habitat in areas utilized for dispersal and colonization. As a whole, conservation efforts associated with the BSAP are expected to increase species redundancy and the Bi-State's ability to withstand future random, stochastic events.

Additionally, in recent years, we have gained increased certainty of the effectiveness of pinyon-juniper removal on restoring sagebrush habitat and the use of restored areas by sage-grouse (Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Olsen 2019, pp. 21–22). Further, sage-grouse using restored areas had significantly increased survival and brood success in treated versus control areas, with population growth was 11.2 percent higher in treatment than in control sites within 5 years of conifer removal (Olsen 2019, pp. 21–22).

Recent trend analyses have given us a stronger understanding of the population dynamics of the Bi-State DPS. The Bi-State DPS appears to be undergoing population cycling, which is typical of sage-grouse populations rangewide. The most recent study concluded that the DPS, as a whole, experiences stable trends over all three time periods studied, and that in the period 1995–2018, the DPS increased by 2 percent a year (95 percent CRI = 0.74–1.42) (Coates et al. 2020, p. 25). Although the Bi-State DPS experienced periods of decline, these declines were offset by later periods of population growth (Coates et al. 2020, p. 25). Overall, the modelled probability of extirpation of the Bi-State DPS over the next 10 years is very low (1.1 percent; Coates et al. 2020, Table 1). It is important to note that individual population trends of some populations within PMUs have declined, and areas such as Sagehen and Parker Meadows (both in the South Mono PMU) have high probabilities of extirpation over the next 10 years, though the extirpation

probability of the South Mono PMU is only 3.8 percent (Coates et al. 2020, Table 1). Longer-term extirpation probabilities are not available for all PMUs, but the 30-year probabilities of declining below 50 males for the North Mono Lake area (the Desert-Creek Fales, Bodie, and Mount Grant PMUs) and for the South Mono PMU were both 8 percent (Garton et al 2015, p. 14). Conservation efforts are in place to help offset declining populations such as the translocation of broods to Parker Meadows, which has shown some early signs of success. Conservation measures in other areas, including post-fire restoration, wild horse gathers, fuel reduction treatment, and pinyon-juniper removal, are further reducing the magnitude of threats.

Many of the conservation efforts associated with the BSAP have only been completed in recent years or are in the process of being completed. As discussed in more detail in our full PECE analysis, 142 of the 159 identified actions in the BSAP have been initiated and are in stages of completion, meaning they are in progress, ongoing, occur annually, or have been evaluated as part of the planning process (Bi-State TAC 2018, p. 45), but have not necessarily been completed. Thus, the full benefits of the conservation actions may not yet be achieved or apparent in sage-grouse population growth rates or in probabilities of extirpation, which are calculated by projecting past trends into the future. Some positive results are already apparent. For example, the translocation effort in Parker Meadows began in 2018 and has shown some early signs of success in improved reproductive success and recruitment. Overall, as described in our PECE analysis (Service 2019, entire), based on studies showing the effectiveness of other conservation actions (such as pinyon-juniper removal) and on detailed implementation schedules provided by agencies participating in the BSAP, we have sufficient certainty that

conservation efforts outlined in the BSAP will be implemented and effective, and will increase the viability of the species into the future.

The BSAP does not remove or eliminate all threats to the species, and we expect impacts from cheatgrass, pinyon-juniper encroachment, altered wildfire regime, and climate change to continue to act on the species into the foreseeable future. Overall, however, we find that the BSAP and existing regulatory mechanisms are reducing the level of threats and increasing population resiliency across the Bi-State DPS.

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we conclude that, due to the effects of conservation actions as analyzed under our PECE policy, the threats impacting the Bi-State DPS of the greater-sage grouse have been greatly reduced. Thus, after assessing the best available information, we conclude that the Bi-State DPS is not in danger of extinction throughout all of its range. We, therefore, proceed with determining whether the Bi-State DPS is likely to become so within the foreseeable future.

Threats such as wildfire and altered fire regimes, climate change, nonnative invasive plants and native woodland succession, recreation, and others are expected to continue or increase into the future. Within the foreseeable future, we expect the individual and combined impacts of these threats to continue to increase. In particular, effects associated with climate change, such as drought, will continue to degrade habitat supporting the Bi-State DPS. However, as noted above, actions associated with the BSAP are expected to increase resiliency, redundancy, and representation of the Bi-State DPS, increasing the overall viability of the DPS such that they will be able to withstand the increased magnitude of threats into the foreseeable future. Thus, after assessing the best

available information, we conclude that the Bi-State DPS is not likely to become in danger of extinction within the foreseeable future throughout all of its range.

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. Having determined that the Bi-State DPS is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so within the foreseeable future in a significant portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the "screening" analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) the portion *may* be significant; and, (2) the species *may* be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. Conversely, we emphasize that answering both of these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so within the foreseeable future throughout a significant portion of its range—rather, it is a threshold step to determine whether a more-detailed analysis of the issue is required.

If we answer these questions in the affirmative, we then conduct a more thorough

analysis to determine whether the portion does indeed meet both of the "significant portion of the range" prongs: (1) the portion is significant and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both prongs would the species warrant listing because of its status in a significant portion of its range.

At both stages in this process—the stage of screening potential portions to identify any that warrant further consideration, and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration—it might be more efficient for us to address the "significance" question or the "status" question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range.

For the Bi-State DPS, we chose to address the status question (i.e., identifying portions where the Bi-State DPS may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether any of the threats acting on the DPS are geographically concentrated in any portion of the range at a biologically meaningful scale. We examined the following threats throughout the range of the DPS: urbanization and habitat conversion (Factor A); infrastructure (Factor A);

mining (Factor A); grazing and rangeland management (Factor A); nonnative invasive plants and native woodland succession (Factor A); wildfires and altered fire regime (Factor A); climate change, including drought (Factor A); recreation (Factor E); disease (Factor C); predation (Factor C); renewable energy (Factor A), commercial and recreational hunting (Factor B); scientific and educational uses (Factor B); pesticides and other contaminants (Factor E), as well as the potential for effects from small population size (Factor E).

We identified one portion of the Bi-State DPS, essentially the Pine Nut PMU, that is experiencing a concentration of the following threats: urbanization, infrastructure, wildfire (and associated isolation and fragmentation of populations), cheatgrass, livestock and feral horses, nonnative woodland succession, and recreation. Although these threats are not unique to this PMU area, they are acting at a greater intensity here (e.g., higher risks from cheatgrass invasion created by more frequent wildfires), either individually or in combination, than elsewhere in the range. In addition, the PMU's small population size (usually less than 100 birds), coupled with the information suggesting this unit has a high projected probability of extirpation over the next 10 years (69.7 percent; Coates et al. 2020, Table 1), leads us to find that this portion meets the screening criteria of whether substantial information exists indicating the population occurring here may be threatened or endangered.

We then proceeded to the significance screening question, asking whether there is substantial information indicating that this portion of the range (i.e., the Pine Nut PMU) *may* be significant. As an initial note, the Service's most recent definition of "significant" within agency policy guidance has been invalidated by court order (see *Desert Survivors*

v. Dep't of the Interior, No. 16-cv-01165 (N.D. Cal. Aug. 24, 2018). Therefore, for purposes of this analysis the Service is screening for significant portions of the range by applying any reasonable definition of "significant." Biological importance/significance is often considered in terms of resiliency, redundancy, or representation.

We evaluated the available information about the portion of the DPS that occupies the Pine Nut PMU in this context, assessing its significance in terms of these conservation concepts, and determined the information did not substantially indicate it may be significant. Sage-grouse in this PMU exhibit similar habitat use and behaviors to sage-grouse in the remainder of the Bi-State DPS; thus, there is no unique observable environmental usage or behavioral characteristics attributable to just this area's population. While unique genetic characteristics have been documented in the PMU's birds, including haplotypes not present elsewhere in the DPS, particularly in the northern portion (Oyler-McCance et al. 2014, pp. 1303, 1308), we note that each of the five other populations in the DPS also exhibit unique genetic characteristics and haplotypes. So although there is genetic differentiation between the Pine Nut PMU and other PMUs, we found no information indicating that the Pine Nut PMU's genetic characteristics represent a unique or significant adaptive capacity compared to the remainder of the DPS.

In addition, the Pine Nut PMU has the smallest number of birds compared to the other PMUs in the DPS, making up approximately 5% of the total population (see Table 1 above), and there is very limited movement of these birds into occupied areas of other PMUs. For the northern portion of this PMU, which has very few birds and little to no lek attendance reported in recent years (see the description of the Pine Nut PMU in *Range and Population Estimates* above), there has been no detected movement of birds to other

PMUs. There is some movement of birds between the southern portion of Pine Nut PMU and the Desert Creek-Fales PMU and the Bodie PMU to the south, but this has involved only very few birds.

Overall, we found no substantial information that would indicate the Pine Nut PMU may be significant. While the Pine Nut PMU provides some contribution to the DPS's overall ability to withstand catastrophic or stochastic events (redundancy and resiliency, respectively), and to adapt to changing environmental conditions (representation), the best scientific and commercial information available indicates that this contribution is very limited in scope due to its small population size and isolation from other populations. Therefore, because we could not answer both screening questions in the affirmative, we conclude that the Pine Nut PMU portion of the range does not warrant further consideration as a significant portion of the range.

In addition to the Pine Nut PMU, we identified another portion of the DPS, the White Mountains PMU, where the information regarding projections of extirpation probability suggests the population may be experiencing a disproportionate response to threats. While the magnitude of most threats acting in this PMU (e.g., threats associated with cheatgrass, infrastructure, recreation, grazing, predation, and drought) are generally lower than the remainder of the range, it also has a projected high probability of extirpation (75.1 percent; Coates et al. 2020, Table 1). These projections were calculated from limited data, as completing surveys was difficult given the area's remoteness and being at the highest elevation for the Bi-State DPS, and as a result, the authors note that some leks needed to be omitted from the analysis due to data quality issues, leks could have been missed, and the model may underrepresent abundance for that PMU (Coates et

al. 2020, p. 36). (Coates et al. 2020, pp. 9, 36). However, though the model may underrepresent abundance (and thus over represent the probability of extirpation to some degree), out of an abundance of caution, we proceeded under the premise that this portion of the range meets the screening criteria of whether substantial information exists indicating the population occurring here may be threatened or endangered.

Subsequently, as with the Pine Nut PMU, we then proceeded to the significance screening question, asking whether there is substantial information indicating that this portion of the range (i.e., the White Mountains PMU) *may* be significant. As in the Pine Nut PMU, sage-grouse in the White Mountains PMU exhibit similar habitat use and behaviors to sage-grouse in the remainder of the Bi-State DPS; thus, there is no unique observable environmental usage or behavioral characteristics attributable to just this area's population. In the White Mountains PMU, unique genetic characteristics have been documented in the PMU's birds, including haplotypes not present elsewhere in the DPS (Oyler-McCance et al. 2014, pp. 1304, 1308). However, although there is genetic differentiation between the White Mountains PMU and other PMUs, we found no information indicating that the White Mountains PMU's genetic characteristics represent a unique or significant adaptive capacity compared to the remainder of the DPS.

Additionally, the White Mountains PMU has relatively few birds compared to most other PMUs in the DPS. Though exact counts are not available due to the isolated nature of this PMU, recent surveys have found only two leks, with between zero and nine males documented per lek per year (NDOW 2018, unpublished data). Historical evidence suggests bird densities in this area have always been low (Bi-State Local Planning Group 2004, p. 108); Service 2020, pp. 31–32). Additionally, there has been no recent recorded

movement of birds into occupied areas of other PMUs. Though a potential connectivity corridor exists between populations in the South Mono and White Mountains PMUs, the vegetation within this corridor has apparently changed due to woodland succession, and an aerial survey suggests that current vegetation is not suitable sage-grouse habitat (Bi-State Lek Surveillance Program 2012, p. 36; Service 2020, pp. 29–30).

Overall, we found no substantial information that would indicate the White Mountains PMU may be significant. While the White Mountains PMU provides some contribution to the DPS's overall ability to withstand catastrophic or stochastic events (redundancy and resiliency, respectively), and to adapt to changing environmental conditions (representation), the best scientific and commercial information available indicates that this contribution is very limited in scope due to its small population size and isolation from other populations. Therefore, because we could not answer both screening questions in the affirmative, we conclude that the White Mountains PMU portion of the range does not warrant further consideration as a significant portion of the range.

Because we did not identify any portions of the Bi-State DPS entity where: (1) it may be in danger of extinction or likely to become so in the foreseeable future; and (2) it may be significant, a more thorough significant portion of the range analysis is not required. Therefore, we conclude, based on this screening analysis, that no portions warrant further consideration through a more detailed analysis, and the Bi-State DPS is not in danger of extinction or likely to become so within the foreseeable future within a significant portion of its range. Our approach to analyzing significant portion of the species' range in this determination is consistent with the courts' holdings in *Desert*

Survivors v. Department of the Interior, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018); *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d , 946, 959 (D. Ariz. 2017); and *Center for Biological Diversity v. Everson*, 2020 WL 437289 (D.D.C. Jan. 28, 2020).

Determination of Status

Our review of the best scientific and commercial data available indicates that the Bi-State DPS of greater sage-grouse no longer meets the definition of a threatened species. Therefore, we are withdrawing our proposed rule to list the DPS as threatened. Consequently, we are also withdrawing the associated proposed 4(d) and critical habitat rules.

References Cited

A complete list of references cited in this rulemaking is available on the Internet at *http://www.regulations.gov* and upon request from the Reno Fish and Wildlife Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this document are the staff members of the U.S. Fish and Wildlife Service's Species Assessment Team and the Reno Fish and Wildlife Office.

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Aurelia Skipwith,
Director,
U.S. Fish and Wildlife Service.

[FR Doc. 2020-06384 Filed: 3/30/2020 8:45 am; Publication Date: 3/31/2020]