Petition to List the Pinyon Jay (*Gymnorhinus cyanocephalus*)
as Endangered or Threatened Under the Endangered Species Act

Photo: Mike Lewinski, Taos, NM

Submitted to the U.S. Secretary of the Interior
acting through the U.S. Fish and Wildlife Service

April 25, 2022

Defenders of Wildlife

NOTICE OF PETITION

April 25, 2022

Deb Haaland
Secretary of the Interior
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240

Martha Williams
Director
U.S. Fish and Wildlife Service
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via email

Dear Secretary Haaland:

Pursuant to the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b), the Administrative Procedure Act, 5 U.S.C. § 553(e), and the ESA's implementing regulations, 50 C.F.R. § 424.14, Defenders of Wildlife formally petitions the Secretary of the Interior to list the Pinyon Jay as an endangered or threatened species and to designate critical habitat concurrent with the listing. 50 C.F.R. § 424.12.

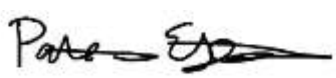
This Petition sets in motion a specific process, placing definite response requirements on the Secretary of the Interior and the U.S. Fish and Wildlife Service ("FWS"), by delegation. Specifically, FWS must issue an initial finding as to whether the Petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. §1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* Petitioners need not demonstrate that listing or reclassification is warranted; rather, petitioners must only present information demonstrating that the petitioned action may be warranted. While petitioners believe that the best available scientific and commercial data demonstrates that listing of the Pinyon Jay as endangered is in fact warranted, there can be no reasonable dispute that the available information indicates that listing this species as either endangered or threatened throughout all or a significant portion of its range may be warranted. FWS must promptly make an initial finding on the Petition and commence a status review as required by 16 U.S.C. § 1533(b)(3)(B).

As required by 50 C.F.R. § 424.14(b), Defenders provided written notice (via email) to the state agencies responsible for the management and conservation of the Pinyon Jay on March 16, 2022, more than 30 days prior to the submission of this Petition. A copy of the notice accompanies this Petition. *See* 50 C.F.R. § 424.14(c)(9). We anticipate that, in keeping with 50 C.F.R. § 424.14(f)(2), FWS will acknowledge the receipt of this Petition within a reasonable timeframe. As fully set forth below, this Petition contains all the information requested in 50 C.F.R. § 424.14(c)–(e) and 16 U.S.C. § 1533(e). All cited documents are listed in the Literature Cited section; electronic copies of these documents accompany this Petition; and pinpoint citations to these have been provided where appropriate. *See* 50 C.F.R. § 424.14(c)(5)–(6).

Petitioner Defenders of Wildlife ("Defenders") is a non-profit conservation organization dedicated to the protection of all native animals and plants in their natural communities. Defenders' 2019–2028 Strategic Plan identifies keystone species as one of several key groups of species whose conservation is a priority for our organization's work,[1] and has been working to protect the Pinyon Jay for years. Defenders uses science, education, litigation, and research to protect wild animals and plants. Known for our effective leadership on endangered species issues, Defenders also advocates for new approaches to wildlife conservation to protect species before they become endangered. Our programs reflect the conviction that saving the biodiversity of our planet requires protecting entire ecosystems and ensuring interconnected habitats. Founded in 1947, Defenders of Wildlife is a 501(c)(3) membership organization with nearly 2.2 million members and supporters.

If you have any questions, please feel free to contact us via the information contained in the signature blocks below.

Sincerely,



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[1] More information on Defenders' work is available at https://www.defenders.org and Defenders' 2019–2028 Strategic Plan is available at https://defenders.org/sites/default/files/2019-06/Defenders-of-Wildlife-2019-2028-Strategic-Plan.pdf.

Acknowledgments

Defenders of Wildlife thanks Patricia Estrella of the Field Conservation Program for authoring the Petition. Defenders also thanks staff members Bryan Bird, Cecilia Deidrich, Andrew Carter, Laura Nuñes, and Mae Lacey, and previous staff member and friend Carol Beidleman for their invaluable contributions.

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EXECUTIVE SUMMARY

The Pinyon Jay (*Gymnorhinus cyanocephalus*) is a medium-sized, blue, crestless bird species of the western United States. It is highly social, ranging in flocks of up to several hundred birds. The Pinyon Jay is named for its mutualistic relationship with piñon pines (*Pinus edulis*, *P. monphylla*). Pinyon Jays are adapted for the "harvest, transport, caching, and later retrieval of pine seeds." (Johnson and Balda 2020). Pinyon Jay biology is inextricably linked to piñon tree presence and reproduction. For example, the presence of stored piñon seeds accelerates gonadal development in late winter, a unique and extraordinary adaption in a temperate passerine (Ligon 1978, at 118–19).

Due in part to loss and degradation of its obligate piñon-juniper habitat, the Pinyon Jay is declining at an alarming rate. Over the last 50 years, the species has declined by an estimated 80%, faster than the Greater Sage-Grouse (Boone et al. 2018, at 190). Partners in Flight ("PIF") finds the Pinyon Jay long-term (1970-2014) population has declined by 85%, and the short-term (2004-2014) population change has declined by 3.7% (Rosenberg et al. 2016, at 52). The population half-life is estimated at 19 years, meaning that an additional 50% loss of the global population is expected by 2035. PIF therefore considers the Pinyon Jay as a species with a short "half-life" and high urgency (Rosenberg et al. 2016, at 3, 34, 52). The Pinyon Jay has been identified as a Road to Recovery Species on the Brink of Endangerment of Very High Urgency, one of only 22 bird species in that category in the United States and Canada (August 2021). Despite its precipitous decline, the Pinyon Jay and its habitat lack much needed protections to conserve this iconic species. As climate change threatens further destruction of the Pinyon Jay's habitat, it is more important than ever to give this imperiled species the protections it desperately needs, before it is too late.

The ESA states that a species shall be determined to be endangered or threatened in all or a significant portion of its range based on any one or combination of five factors. See 16 U.S.C. § 1533(a)(1). The Pinyon Jay faces threats under one or more of the five listing factors, and the cumulative effects thereof, that warrant listing it as an endangered or threatened species in all or a significant portion of its range.

Present or threatened destruction, modification, or curtailment of its habitat or range. Loss of piñon-juniper woodlands is a very significant threat to the Pinyon Jay. As a piñon-juniper obligate species, the Pinyon Jay cannot survive without piñon-juniper woodlands. Since the 1800s, millions of acres of piñon-juniper woodlands have been removed. Despite the well documented importance of piñon-juniper woodlands to the Pinyon Jay and numerous other species, land managers continue to remove extensive amounts of piñon and juniper in the name of wildfire risk reduction, resilience, or sagebrush restoration. In addition, Congress has passed statute and the federal land management agencies continue to promulgate numerous rules and regulations expediting the heavy manipulation or removal of piñon and juniper vegetation types. Climate change, which is causing reduced fecundity, recruitment, and vigor of piñon and juniper, exacerbates the effect of human destruction of Pinyon Jay habitat.

Disease or Predation. West Nile Virus, a mosquito-borne virus that infects over 300 bird species, has been detected in dead Pinyon Jays and may be contributing to Pinyon Jay population declines. Predation by American Crow and Common Raven is a major cause of Pinyon Jay nest failure.

Inadequacy of existing regulatory mechanisms. Regulatory mechanisms to protect the Pinyon Jay are woefully inadequate at the federal and state level. Only the Migratory Bird Treaty Act protects the

Pinyon Jay at the federal level. The MBTA only prohibits take of Pinyon Jays; it does not protect the species' habitat. Current regulations expedite the extensive removal of Pinyon Jay habitat with little or no analysis of the effects on Pinyon Jay. Because habitat loss and destruction are the largest threats to the Pinyon Jay, inadequate regulatory protections for its habitat also threaten the Pinyon Jay.

Other natural or manmade factors. Climate change and drought pose a significant threat to the Pinyon Jay. Climate models predict distributional changes of piñon-juniper woodlands and widespread mortality among needleleaf evergreen trees, such as piñon pine, is predicted across the southwestern United States by 2100.

Cumulative effects. The cumulative and synergistic effects of the threats that the Pinyon Jay faces, such as habitat removal, cheatgrass (*Bromus tectorum*) invasion, wildfire, and piñon and juniper mortality due to drought and climate change, has brought this species to the point where ESA listing is warranted.

Based on the factors outlined above, the Pinyon Jay warrants listing under the ESA.

I. INTRODUCTION

Defenders formally petitions the Secretary of the Interior ("Secretary"), acting through the U.S. Fish and Wildlife Service ("FWS"), to list the Pinyon Jay (*Gymnorhinus cyanocephalus*) as endangered or threatened under the Endangered Species Act ("ESA") and to designate critical habitat for the species within the United States. *See* 16 U.S.C. §§ 1531–1544; 50 C.F.R.§ 424.12.

In reviewing the Pinyon Jay's status, FWS must analyze whether the species warrants listing as endangered or threatened throughout all or any significant portion of its range. 16 U.S.C. § 1532(6), (20). If FWS finds that there are distinct population segments ("DPSs") of Pinyon Jay, it must evaluate each of those DPSs for listing under the ESA.[2]

If FWS determines to list the Pinyon Jay or any DPS thereof as threatened, Defenders petitions the agency to promulgate a final 4(d) rule to confer full take protections on the species concurrent with final listing. *See* 16 U.S.C. § 1533(d). Those protections are necessary and advisable to provide for the conservation of the species. As set forth in 50 C.F.R. § 424.14(j), "[t]he Services will conduct a review of petitions to . . . adopt a rule under section 4(d). . . of the [ESA] in accordance with the Administrative Procedure Act (5 U.S.C. [§] 553) and applicable Departmental regulations and take appropriate action."

This Petition is submitted pursuant to the ESA, 16 U.S.C. § 1533(b)(3)(A), the ESA's implementing regulations, 50 C.F.R. § 424.14, and the Administrative Procedure Act, 5 U.S.C. § 553(e). As required by 50 C.F.R. § 424.14(b), Defenders provided written notice (via email) to the state agencies responsible for the management and conservation of the Pinyon Jay on March 16, 2022, more than 30 days prior to the submission of this Petition. A copy of the notice accompanies this Petition. *See* 50 C.F.R. § 424.14(c)(9). We anticipate that, in keeping with 50 C.F.R. § 424.14(f)(2), FWS will acknowledge the receipt of this Petition within a reasonable timeframe. As fully set forth below, this Petition contains all the information requested in 50 C.F.R. § 424.14(c)–(e) and 16 U.S.C. § 1533(e). All cited documents are listed in the Literature Cited section; electronic copies of these documents accompany this Petition; and pinpoint citations to these have been provided where appropriate. *See* 50 C.F.R. § 424.14(c)(5)–(6).

II. GOVERNING PROVISIONS OF THE ENDANGERED SPECIES ACT

A. Species and Distinct Population Segments

The ESA defines the term "species" to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16). FWS and the National Marine Fisheries Service ("NMFS") have published a joint DPS policy, 61 Fed. Reg. 4722 (Feb. 7, 1996), which allows the agencies to protect and conserve vertebrate species, such as the Pinyon Jay, under the ESA on a regional basis. This DPS policy provides criteria for DPS analysis. To satisfy the DPS criteria, a vertebrate species population must be discrete from other populations of the species and significant to the species. Therefore, if FWS determines that the Pinyon Jay may not warrant listing throughout its range, it should use these criteria to determine whether any DPSs can be identified and may warrant listing.

[2] Should FWS determine that Pinyon Jay DPSs do in fact exist and that those DPSs warrant ESA designation, then Defenders requests that FWS analyze whether those DPSs represent a significant portion of the species' range such that listing of the species as a whole is appropriate.

B. Significant Portion of a Species' Range

The ESA defines an "endangered species" as any species that is "in danger of extinction throughout all or a significant portion of its range," 16 U.S.C. § 1532(6), and a "threatened species" as one that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20).

In 2014, FWS and the National Oceanic and Atmospheric Administration ("NOAA") issued their most recent policy on the interpretation of the "significant portion of its range" ("SPR") language. 79 Fed. Reg. 37,577 (July 1, 2014). The policy's definition of "significant portion" provides that "a portion of the range of a species is 'significant' if the species is not currently endangered or threatened throughout all of its range, but the portion's contribution to the viability of the species is so important that, without the members in that portion, the species would be in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range." *Id.* at 37,579. Courts have since deemed the SPR policy's definition of "significant" to be "inconsistent with the ESA." *See*, *e.g.*, *Ctr. for Biological Diversity v. Everson*, 435 F. Supp. 3d 69, 92 (D.D.C. Jan. 28, 2020) (citations omitted). Further, because of the numerous legal challenges to and vacatur of different aspects of the SPR policy, it cannot be relied upon. *See*, *e.g.*, *id.* at 98 (vacating the provision of the final SPR policy that provides "if the Services determine that a species is threatened throughout all of its range, the Services will not analyze whether the species is endangered in a significant portion of its range"); *Friends of Animals v. Ross*, 396 F. Supp. 3d 1, 10 (D.C. Cir. 2019) (citations omitted) (vacating and setting aside the listing decision because the agency relied on the now-vacated SPR policy).

Therefore, under any reasonable interpretation of the ESA, FWS must consider whether a species is endangered throughout all or a significant portion of its range or threatened throughout all or a significant portion of its range. If FWS determines that the petitioned species is endangered in a significant portion of its range, then the species should be listed as endangered throughout its range. If FWS determines that the petitioned species is threatened in a significant portion of its range (and not endangered in any significant portion of its range), then the species should be listed as threatened throughout its range. *See generally Defenders of Wildlife v. Norton*, 258 F.3d 1136, 1141–42 (9th Cir. 2001); 79 Fed. Reg. at 37,579–80 (citing *Norton*, 258 F.3d 1136 (giving operational meaning to the words on either side of the "or")).

C. Listing Factors

FWS must make its determination of whether a species is endangered or threatened based solely on one or more of the five factors set forth in 16 U.S.C. § 1533(a)(1):

(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.

16 U.S.C. § 1533(a)(1)(A)–(E); 50 C.F.R. § 424.11(c)(1)–(5).

D. 90-Day and 12-Month Findings

"To the maximum extent practicable," FWS is required to determine "whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted" within 90 days of receiving a petition to list a species. 16 U.S.C. § 1533(b)(3)(A). This is referred to as a "90-day finding." A "negative" 90-day finding ends the listing process and is a final agency action subject to judicial review. 16 U.S.C. § 1533(b)(3)(C)(ii). A "positive" 90-day finding leads to a formal, more comprehensive "status review" and a "12-month finding" determining, based on the best available scientific and commercial data, whether listing the species is warranted, not warranted, or warranted but precluded by other pending listing proposals for higher priority species. 16 U.S.C. § 1533(b)(3)(B). "Not warranted" and "warranted but precluded" 12-month findings are also subject to judicial review. 16 U.S.C. § 1533(b)(3)(C)(ii).

The ESA's implementing regulations define "substantial information," for the purpose of a 90-day finding, as "credible scientific or commercial information in support of the petition's claims such that a reasonable person conducting an impartial scientific review would conclude that the action proposed in the petition may be warranted." 50 C.F.R. § 424.14(h)(1)(i).

> [FWS's] determination as to whether the petition provides substantial scientific or commercial information indicating that the petitioned action may be warranted will depend in part on the degree to which the petition includes the following types of information:
>
> (1) Information on current population status and trends and estimates of current population sizes and distributions, both in captivity and the wild, if available;
> (2) Identification of the factors under section 4(a)(1) of the Act that may affect the species and where these factors are acting upon the species;
> (3) Whether and to what extent any or all of the factors alone or in combination identified in section 4(a)(1) of the Act may cause the species to be an endangered species or threatened species (i.e., the species is currently in danger of extinction or is likely to become so within the foreseeable future), and, if so, how high in magnitude and how imminent the threats to the species and its habitat are;
> (4) Information on adequacy of regulatory protections and effectiveness of conservation activities by States as well as other parties, that have been initiated or that are ongoing, that may protect the species or its habitat; and
> (5) A complete, balanced representation of the relevant facts, including information that may contradict claims in the petition.

50 C.F.R. § 424.14(d).

E. Reasonable Person Standard

Establishing the "reasonable person" standard for the substantial information determination, the ESA's implementing regulations and relevant case law demonstrate that "a petition need not establish a 'strong likelihood' or a 'high probability' that a species is either threatened or endangered to support a positive 90-day finding." *See* 79 Fed. Reg. 4877 (Jan. 30, 2014); *see also* 50 C.F.R. § 424.14(h)(1); *Am. Stewards of Liberty v. U.S. Dep't of the Interior*, 370 F. Supp. 3d 711, 717, 726 (W.D. Tex. 2019) ("Though 'substantial scientific and commercial information' may seem like a high bar, . . . the Service's regulations indicate otherwise . . . ."). In reviewing negative 90-day findings, the evidentiary threshold at the 90-day review stage is much lower than the one required under a 12-month review.

Courts have characterized the 90-day finding determination as a mere "threshold determination" and have held that it contemplates a "lesser standard by which a petitioner must simply show that the substantial information in the Petition demonstrates that listing of the species may be warranted." *See Humane Soc'y of the U.S. v. Pritzker*, 75 F. Supp. 3d 1, 15 (D.D.C. 2014) (quoting *Colo. River Cutthroat Trout v. Kempthorne*, 448 F. Supp. 2d 170, 176 (D.D.C. 2006)); *see generally* 16 U.S.C. § 1533(b)(3)(A). Accordingly, a petition does not need to establish that there is a high likelihood that a species is either endangered or threatened to trigger a positive 90-day finding.

F. Best Available Scientific and Commercial Data

FWS is required to make a 90-day finding on the Petition based solely on the best available scientific and commercial data. *See* 16 U.S.C. § 1533(b)(1)(A); 50 C.F.R. § 424.11(b). Therefore, FWS cannot deny listing merely because there is little information available, if the best available information indicates that a species may warrant listing as endangered or threatened under any one or any combination of the five ESA listing factors. This is particularly important during the 90-day review because, as noted above, FWS must make a positive 90-day finding and commence a status review when a "reasonable person" would conclude, based on the available evidence, that listing may be warranted.

1. <u>International Scientific and Commercial Data</u>

The International Union for Conservation of Nature ("IUCN") is the world's oldest and largest global environmental network and has become a leading authority on the environment. It is a neutral, democratic membership union with more than 1,400 government and non-governmental organization ("NGO") members, and more than 18,000 volunteer scientists and experts active in more than 160 countries (IUCN webpage 2021). Its work is supported by about 900 professional staff and has offices in more than 50 countries, plus hundreds of partners in public, NGO, and private sectors around the world (IUCN webpage 2021).

As part of its work, the IUCN compiles and updates the IUCN Red List, which "has evolved to become the world's most comprehensive information source on the global extinction risk status of animal, fungus[,] and plant species" (IUCN Red List webpage 2021). The IUCN Red List assessments are recognized internationally, are relied on in a variety of scientific publications, and are used by numerous governmental organizations and NGOs. The IUCN Red List has also been used to inform multilateral agreements, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES"), the Convention on the Conservation of Migratory Species of Wild Animals ("CMS"), and the Convention on Biological Diversity.

As a result of the scientific rigor with which Red List species extinction risk determinations are made, both FWS and NMFS have utilized IUCN Red List data and listing determinations when making ESA listing decisions even though the criteria differ from the ESA's statutory requirements for listing a species as endangered or threatened. *See* 50 C.F.R. § 424.11(f). This is because the IUCN Red List is considered a credible source of scientific data that meets the "best scientific and commercial data" requirement of the ESA. *See* 16 U.S.C. § 1533(b)(1)(A).

The IUCN Red List has assessed the Pinyon Jay as a "Vulnerable," with rapid population declines likely due to conversion and degradation of its piñon-juniper woodland habitat. (Birdlife International 2020). The IUCN specifically identified the U.S. Forest Service's ("USFS") piñon-juniper eradication efforts as significant contributors to the decline of piñon-juniper habitat across the Pinyon Jay range:

> [O]ngoing forest loss within the species's range is currently estimated at ~5.6% per three generations (Tracewski *et al.* 2016). Land managers have followed a policy to eradicate this woodland, with the U.S. Forest Service classifying it as "non-commercial" and placing it in a "no-value" category. . . . Piñon-juniper woodland is also often removed to create or promote shrublands for the benefit of sage-grouse, a species targeted for conservation efforts, despite its rates of decline being slower than those of *G. cyanocephalus*, which declines as a result (Boone et al. 2018). Currently herbicides, mechanical ploughing and fire are used to turn piñon-juniper woodland into pasture land for cattle.

(Birdlife International 2020). Therefore, the IUCN classification and determinations constitutes a source of credible evidence to satisfy the reasonable person standard for a positive 90-day finding on this Petition.

2. Species Protected by International Agreement

Pursuant to 50 C.F.R. § 424.11(f), "The Secretary shall give consideration to any species protected under such an international agreement, or by any State or foreign nation, to determine whether the species is endangered or threatened."

> The fact that a species of fish, wildlife, or plant is protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora . . . or a similar international agreement on such species, or has been identified as requiring protection from unrestricted commerce by any foreign nation, or to be in danger of extinction or likely to become so within the foreseeable future by any State agency or by any agency of a foreign nation that is responsible for the conservation of fish, wildlife, or plants, may constitute evidence that the species is endangered or threatened. The weight given such evidence will vary depending on the international agreement in question, the criteria pursuant to which the species is eligible for protection under such authorities, and the degree of protection afforded the species.

50 C.F.R. § 424.11(f). As detailed below in Section III.D.3, the Pinyon Jay is listed under Migratory Bird Treaty Act ("MBTA"), which implements four international conservation treaties the United States entered into with Canada in 1916, Mexico in 1936, Japan in 1972, and Russia in 1976 (USFWS n.d.). The Pinyon Jay is listed as part of the *Corvidae* family of birds in the Convention for the Protection of Migratory Birds and Game Mammals (Mexico) (Convention for the Protection of Migratory Birds and Game Mammals, 1972).

G. Protective Regulations for Threatened Species

Section 4(d) of the ESA directs FWS to issue regulations that are necessary and advisable to conserve species listed as threatened. *See* 16 U.S.C. § 1533(d). When a species is listed as threatened as opposed to endangered, the prohibitions identified in section 9 of the ESA do not automatically apply to that species. *See* 16 U.S.C. § 1538. Under section 9 of the ESA, it is unlawful to import, export, or take endangered species for any purpose, including commercial activity. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. 16 U.S.C. § 1532(19). The term "harm" is defined as any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. 50 C.F.R. § 222.102. The ESA prohibits any take of species listed as endangered, but some take of threatened species that does not interfere with survival and recovery may be allowed.

For threatened species, FWS can issue regulations under section 4(d) of the ESA to extend some, or all, of the section 9 prohibitions. In issuing a 4(d) rule, FWS considers the species' biological status, conservation needs, and threats and determines which activities need to be regulated or prohibited in order to conserve the species. Given the significant threats facing the Pinyon Jay, especially habitat loss and modification, the species should receive full protection under the ESA.

Therefore, pursuant to 50 C.F.R. § 424.14(j), if FWS determines to list the Pinyon Jay as threatened, Defenders petitions the agency to promulgate a final 4(d) rule to confer full take protections on the species concurrent with final listing. *See* 16 U.S.C. § 1533(d). Those protections are necessary and advisable to provide for the conservation of the species.

II. SPECIES DESCRIPTION

A. Common Name

This Petition will refer to *Gymnorhinus cyanocephalus* by the common name "Pinyon Jay" throughout.

B. Taxonomy

The taxonomy of *Gymnorhinus cyanocephalus* is:

Kingdom	*Animalia*
Subkingdom	*Bilateria*
Infrakingdom	*Deuterostomia*
Phylum	*Chordata*
Subphylum	*Vertebrata*
Superclass	*Tetrapoda*
Class	*Aves*
Order	*Passeriformes*
Family	*Corvidae*
Genus	*Gynmorhinus*
Species	*cyanocephalus*

(Integrated Taxonomic Information System webpage 2021).

The Pinyon Jay is classified as follows: Kingdom Animalia, Phylum Chordata, Subphylum Vertebrata, Class Aves, Subclass Neornithes, Order Passeriformes, Family Corvidae, Genus *Gymnorhinus*, Species *cyanocephalus*.

The Pinyon Jay was described in 1833 by the German naturalist Alexander Phillipp Maximilian and was first known as Maximilian's Jay. It was initially placed in the genus *Cyanocephalus* (Ridgway 1904, at 283–84). It is the only species in the genus *Gymnorhinus,* where it is currently placed.

Resemblance of the Pinyon Jay to Clark's Nutcracker (*Nucifraga colombian*a) led earlier authors to ally the jay with Old World corvids (Hardy 1969, at 360); however, based on nuclear and mitochondrial DNA analysis of the seven New World jay genera, the Pinyon Jay is now considered to be a sister to the *Cyanocitta* clade, which includes Steller's Jay (*C. stelleri)* and Blue Jay (*C. cristata,* Fernando et al. 2017, at 82). The two clades are estimated to have diverged about 3.5 million years ago. The *Gymnorhinus* and *Cyanocitta* genera were found to be sister to the genus *Aphelocoma,* which includes the scrub-jays and Mexican Jay (*A. wollweberi*).

Three subspecies of Pinyon Jay have been proposed (Johnson and Balda 2020). The proposals suggest that Rocky Mountain breeders have shorter, slightly decurved bills, Great Basin and southern Rockies birds have slightly longer, straighter bills, and southern California and northern Baja birds have longer and wider bills. However, differences in bill size and shape may reflect type of pine cone and seeds harvested (Johnson and Balda 2020), and no subspecies has been adopted (Clements et al. 2021).

C. Physical Characteristics

Except where noted, the following physical descriptions are summarized from Johnson and Balda (2020). The Pinyon Jay is a medium-sized, crestless jay, pale blue overall, except for the white bib on the throat, chin, and upper breast.

Photo: Sally King, National Park Service, Bandelier National Monument, NM

1. Appearance

Pinyon Jay hatchlings are naked, with pink skin and pterylae visible as rough areas. The bill of hatchlings is yellowish-pink with a whitish egg tooth. Eyes are tightly closed and mouth lining is a bright salmon red. The bill is gray in nestlings and yellow at the bill hinge. Legs are tan to pink.

Juvenile (first basic) plumage is mouse-gray overall, and the throat patch is indistinct. Feathers around the face and ears are dull blackish slate. Later-emerging feathers of the lateral spinal tract, loral, malar, and auricular areas may be bluer. Underparts are slate gray and paler than upper parts. The wings and tail are bluish-gray. The bill is black by 18 weeks.

The formative (first basic) plumage is present primarily from August of the natal year until July of the second calendar year. The extent of the pre-formative molt, and thus the number of feathers replaced, varies according to hatch date, with earlier-hatched individuals replacing more feathers. Most individuals replace most or all body feathers, with varying replacement of wing coverts, secondaries, and central rectrices. The body plumage is similar to the adult plumage except duller and grayer. It is brighter than the mouse gray of juveniles but duller than the bright blue of adults. Most juvenile rectrices are retained and are narrow and tapered, becoming clove brown with wear. Primary coverts are grayish to brownish and lack bluish fringes. Bill and legs are black; iris is chocolate brown.

The adult (definitive basic) body plumage is pale flax blue, with a deep cyanine blue crown and azure blue malar area. Males are typically brighter in color and have larger bibs than females, though the sexes overlap and cannot be distinguished by color (Johnson 1988a, at 1039; 1988b, at 1053). The inner webs of the remiges (flight feathers) are blackish and outer webs are blue. Rectrices (tail feathers) are blue. Bill and legs are black; iris is chocolate brown.

2. Measurements

Female Pinyon Jays tend to be smaller than males, but measurements of the sexes overlap; some large females are larger than small males (Marzluff and Balda 1992, at 86). In two studies, mean mass of adult females was 99 g (SD=0.68) and 98.9 g (SD=7.6, range=85-115). Mean male mass was 111 g (SD=0.68) and 108.1 g (SD=0.62. range=94-123), respectively.

Mean culmen, wing, tail, and tarsus lengths and bill depth are larger in adult males, also overlapping those of adult females (Table 1).

	Culmen (SD, range)	Wing (SD, range)	Tail (SD, range)	Tarsus (SD, range)	Bill Depth (SD, range)
Adult Males	35.34 (1.65, 31.2-38.0	152.14 (3.25, 146.0-159.0)	110.62 (3.99, 102.0-119.0)	37.0 (1.94, 34.0-40.5)	11.15 (0.64, 9.7-12.9)
Adult Females	3.18 (1.50, 30.8-36.5	145.20 (4.05, 139.0-154.0)	103.97 (4.0, 97.5-119.0)	35.81 (1.99, 28.9-39.1)	10.5 (0.62, 9.2-12.0)

Table 1. Measurements of adult male and female Pinyon Jays. Bill depth taken from Johnson and Balda (2020). All other measurements from Ligon and White (1974, at 285).

3. Similar Species

The Pinyon Jay's overall blue color, relatively short tail, and lack of a crest distinguish it from other sympatric jays. Steller's Jay and Blue Jay have crests and markings on the head. Woodhouse's Scrub-Jay (*A. woodhouseii*) and Mexican Jay have blue and gray upper parts but whitish or grayish underparts.

Pinyon Jays can also be distinguished from the other jays by their behavior. They are highly social and typically seen in flocks, which can comprise up to several hundred non-breeding individuals. The Steller's Jay social system is site-related dominance, described as falling between territoriality and coloniality (Walker et al. 2020). Blue Jay social organization is based on a mated pair, but they may form small groups in winter (Smith et al. 2020). Woodhouse's Scrub-Jay pairs are territorial, with non-breeding floaters and helpers in some populations (Curry et al. 2020). Mexican Jays defend group territories (McCormack and Brown 2020) and could therefore be mistaken for Pinyon Jays; however, in addition to appearance differences, the two species' distributions overlap only slightly, and Mexican Jay territorial groups tend to be much smaller than Pinyon Jay flocks (McCormack and Brown 2020; Johnson and Balda 2020).

D. **Behavior**

1. Social Behavior

Pinyon Jays are highly social, traveling through their large home ranges in flocks. Flock membership is stable over years but varies widely among seasons, depending on reproduction, immigration, and emigration. Although both young males and females wander away from their natal flock, most males return and remain in their natal flock, while mainly females disperse to neighboring flocks. Over 14 years, the Town Flock of northern Arizona comprised 47% adult males, 28% adult females, 15% yearling males, and 9% yearling females (Marzluff and Balda 1988, at 204.) In central New Mexico, sex ratios were similar: 49% adult males, 29% adult females, 12% yearling males, and 10% yearling females (Marzluff and Balda 1988, at 204 citing Ligon and White 1974). One flock studied near Flagstaff, AZ averaged 165 birds and varied from 121 to 292 birds over a nine-year period from 1974 to 1982 (Johnson and Balda 2020). However, flock sizes are highly variable geographically, and as Pinyon Jay populations have declined, average flock sizes have also apparently declined, with more recent reports indicate flocks of fewer than 100 birds (eBird 2021). In a more recent study in New Mexico, flock size varied from 10 in early spring to 110 in the fall, (Johnson and Smith 2007, at 7, 11). At another site in New Mexico, a flock of 135 separated into two or three smaller groups to nest (Johnson et al. 2014, at 74).

Pinyon Jay home ranges are large, typically several thousand hectares, and when food, particularly the pine cone crop, is sparse within their usual home range, they may irrupt into areas hundreds of kilometers outside it (Johnson and Balda 2020). Estimates of home range sizes are mainly from Arizona and New Mexico and have varied widely (Table 2). As it is impossible to follow a rapidly moving Pinyon Jay flock by vehicle or on foot, older estimates made without the benefit of telemetry technology are bound to be inaccurate. More recent telemetry studies are likely more accurate and have also found home ranges to be large, though estimates vary among studies (Table 2). The large home ranges suggest that management for Pinyon Jays should include large areas of habitat and consider uses for various behaviors and seasons.

2. Foraging

Pinyon Jays typically forage in flocks. When a mast crop of pine seeds is present, they first eat seeds in the morning, then they collect pine seeds synchronously, congregate in the tops of trees, and depart together to caching areas. Caching areas are typically open, often on sites which accumulate less snow in winter. They often cache in locations which are protected and conducive to seed germination (Ligon 1978, at 111; Johnson and Balda 2020). They have excellent spatial memory and recover more cached seeds than Woodhouse's Scrub-Jays, Mexican Jays, and Clark's Nutcrackers (Balda and Kamil 1989, at 490; Bednekoff et al. 1997, at 339). They also walk quietly through grassy areas in flocks foraging for arthropods. When piñon cones are unavailable, Pinyon Jays harvest and cache seeds of ponderosa and other pines. They also take juniper berries, cultivated grains, small reptiles, nestling birds, and small mammals (Johnson and Balda 2020).

Photo: Bryant Olsen

Location	Breeding	Nonbreeding	Both or Not Specified	Reference
AZ			"at least" 2072	Balda and Bateman 1971
AZ			2300	Marzluff and Balda 1992
NM			2890	Ligon 1971
NM	2042	2060	3580	Johnson et al. 2016
NM	4419	4599	5978	Johnson et al. 2016
NM			3103	Johnson et al. 2015

Table 2. Estimated Pinyon Jay home range areas in hectares. Studies published in 2015 and 2016 used radio telemetry and direct observations; estimates are minimum convex polygons. Earlier studies were observational only.

3. Breeding

The mating system of Pinyon Jays is social monogamy. Pair bonds typically last for life, and dissolution of a pair bond is extremely rare, although individuals which lose a mate typically re-mate quickly (Marzluff and Balda 1992, at 121, 131–33). A minority of Pinyon Jay extended families (22% in one study) have helpers at the nest. Helpers are young males who help feed, clean and guard nestlings (Marzluff and Balda 1992, at 218–19). Pinyon Jays may nest more than once in a calendar year, if food is abundant, but they may also avoid nesting in years when food is scarce (Ligon 1978, at 113). Some evidence suggests that fewer pairs of a flock nest when food is scarce (Johnson et al. 2021a, at 8).

Pinyon Jays nest in loose colonies, with nests constructed tens of meters apart (Marzluff and Balda 1992, at 160). A nesting colony can vary in size from 2 to 60 nests (Marzluff and Balda 1992 at 161; Petersen et al. 2014, at 19; Johnson et al. 2014, at 74; 2015, at 37; Pinyon Jay Working Group 2021a, at 1) and covering from a few hectares to 60 hectares or more (Johnson et al. 2014, at 71, 2015, at 37, 2017c, at 3, Johnson et al. 2018, at 2). Although Pinyon Jays tend to use traditional colony sites, colonies may move up to 500 m between years (Somershoe et al. 2020, at 38). One flock in Arizona nested at 24 different sites over 12 years (Marzluff and Balda 1992, at 161). Roost sites are typically in relatively dense woodland stands, within 500 m of the nesting colony (Somershoe et al. 2020, at 20).

Pinyon Jays lay one egg per day until a clutch is complete. Average clutch size is 4.12 (range 3-5, Johnson and Balda 2020). Eggs are pale blue with brown spots, and females apparently recognize their own eggs. Incubation begins with the laying of the third egg and lasts 17 days. Incubating females rarely leave the nest and are fed by their mates, either on the nest or off the nest. Males forage in groups and return to the colony together to feed incubation and brooding females. A feeding bout is very short, rarely lasting more than 45 seconds, which provides little opportunity for predators to locate nests. Pinyon Jay nestlings are fed arthropods, pine seeds, and occasionally lizards. After fledgling at approximately 21 days of age, fledglings gather and forage in groups called creches. Parents and helpers forage as a flock and return to feed these crechlings, mainly feeding their own offspring. Pinyon Jay crechlings beg loudly, and occasionally adults will feed unrelated crechlings, presumably to keep them quiet (Marzluff and Balda 1992, at 194, 196). Pinyon Jays typically only rear one brood per season (Johnson and Balda 2020).

Additional information on social behavior, mating systems, breeding, and foraging are available in Johnson and Balda (2020) and Marzluff and Balda (1992).

E. Range and Habitat

Range

1. Historical Range

No changes to the historical distribution have been documented. However, habitat destruction from the 1940s to 1970s (Lanner 1981, at 131–33) may have caused distributional shifts (Johnson and Balda 2020). Breeding Bird Survey ("BBS") data (Sauer et al. 2020) suggest that Pinyon Jay populations may be increasing in a few areas of the range, but other, larger areas show significant declines. In areas of decline, distributional shifts may eventually be documented (Johnson and Balda 2020). It is logical that previously occupied sites within the range have become unoccupied or flock size diminished as the population has declined, but that hypothesis has not been investigated.

2. Current Range

The Pinyon Jay is resident in suitable habitats in central Oregon, eastern and southern California, northern Baja California, throughout Nevada except the northwest, southern Idaho, Utah, Arizona except in southwestern counties, southern Montana, southwestern and central Wyoming, southwestern South Dakota, western Nebraska, western, central, and southern Colorado, extreme western Oklahoma, and throughout New Mexico, except for the eastern plains and southwest (Figure 1**Error! Not a valid bookmark self-reference.**) (Johnson and Balda 2020; eBird 2021).

3. Irruptions and Vagrants

When food, especially the pine cone crop, fails, Pinyon Jays may irrupt into other parts of Oregon, Idaho, Montana, California, Nebraska, and Arizona; and into southern Washington; northern Mexico; western and central Texas; and western Kansas. It is casual in North Dakota, coastal California, and Iowa. One record exists as far north as southwestern Saskatchewan (Johnson and Balda 2020; eBird 2021). Because irruptions and accidental records are quite variable and unpredictable, the range described and mapped here excludes both.

Habitat

Piñon-juniper or juniper woodlands cover over 75,000 square miles in the United States, including California, Arizona, Texas, New Mexico, Utah, Nevada, and Colorado (Lanner 1981, at 1–2), and juniper woodlands extend to eastern Oregon and Washington. Piñon and juniper extend into the Sierra Madre Occidental and Sierra Madre Oriental of Mexico and into Baja California Norte and Baja California Sur.

In the Southwest (Arizona, Colorado, New Mexico), the dominant piñon species is two-needle (aka Colorado) piñon (*Pinus edulis)*, with *P. fallax* occurring in the Mogollon Highlands in central Arizona, southern Arizona Sky Islands, and southeastern New Mexico; only the Mogollon Highlands are within the primary Pinyon Jay range. Single-needle piñon (*P. monophylla*) dominates in the Great Basin (Figure 2) (Utah and Nevada; Cole et al. 2008a, at 261 Figure 2). Junipers in New Mexico and from central Colorado to central Arizona are mainly one-seed juniper (*Juniperus monosperma*). Rocky Mountain juniper (*J. scopulorum*) occurs in the Colorado Plateau and southern Rockies (USNVC 2019), and Utah juniper (*J. osteosperma*) dominates in Utah, Nevada, and northern Arizona (Figure 3) (Lanner 1981, at 3–11). Other piñon and juniper species which do not occur primarily within the Pinyon Jay range are not described here.

Detailed studies and predictive modeling of Pinyon Jay habitat associations and use have only been conducted in New Mexico and the Great Basin. Studies in New Mexico have generally adopted a multi-scale perspective, while the study from the Great Basin (Boone et al. 2021, at 17–20) was a landscape-scale analysis. Habitat use in these two areas is similar in some respects and differs in others. In both areas, the jays use different vegetation types for different activities; e.g., foraging and caching in lower density woodlands and nesting in denser woodlands (Johnson et al. 2014, at 97–100; 2015, at 17–19; 2016, at 9).

Figure 1. Pinyon Jay Range, showing Bird Conservation Regions. Data from BBS. Irruptions and vagrants not included. CC BY Defenders of Wildlife 2021. See Appendix 1 for metadata.

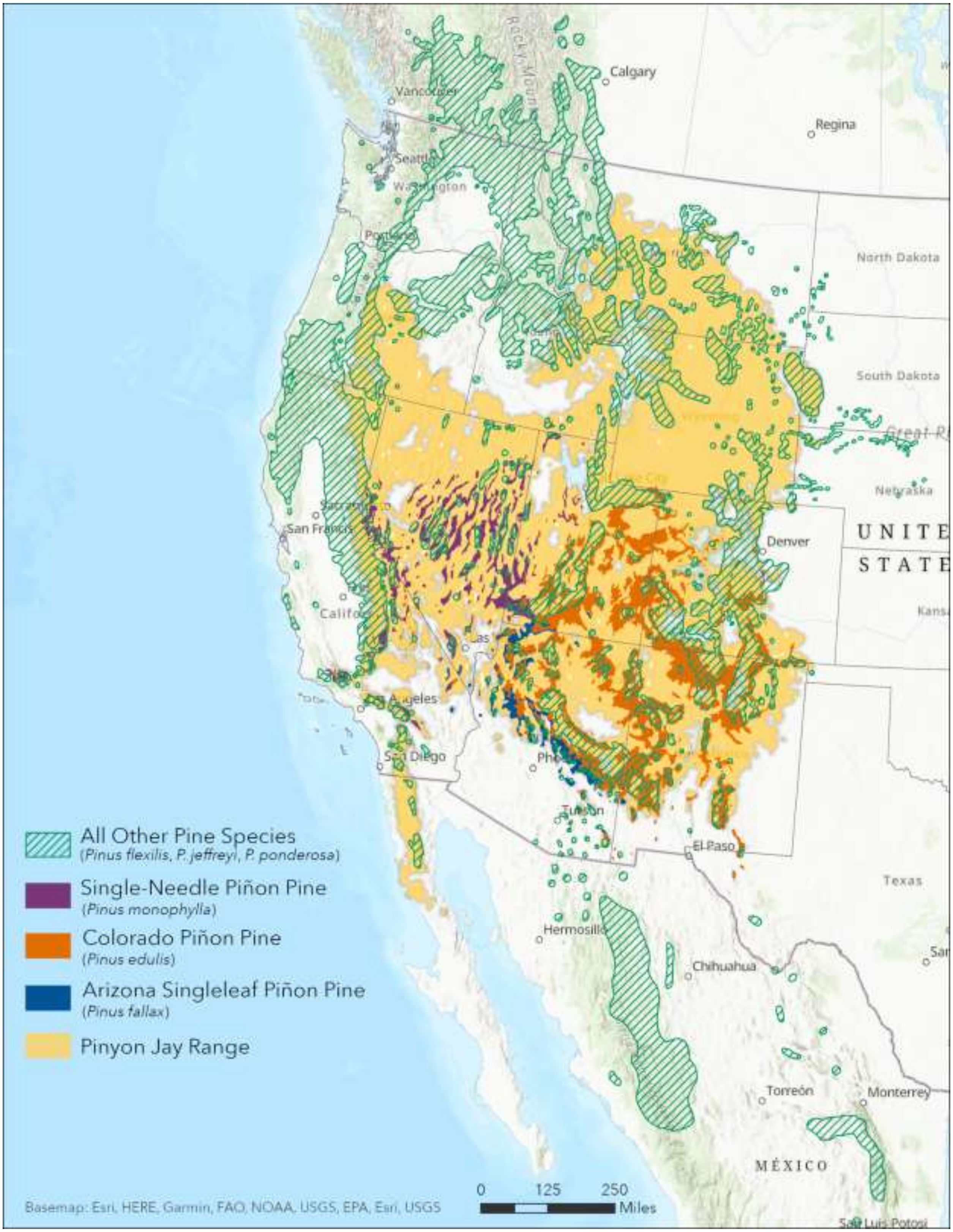

Figure 2. Primary pine species overlapping Pinyon Jay range. CC BY Defenders of Wildlife 2021. See Appendix 1 for metadata.

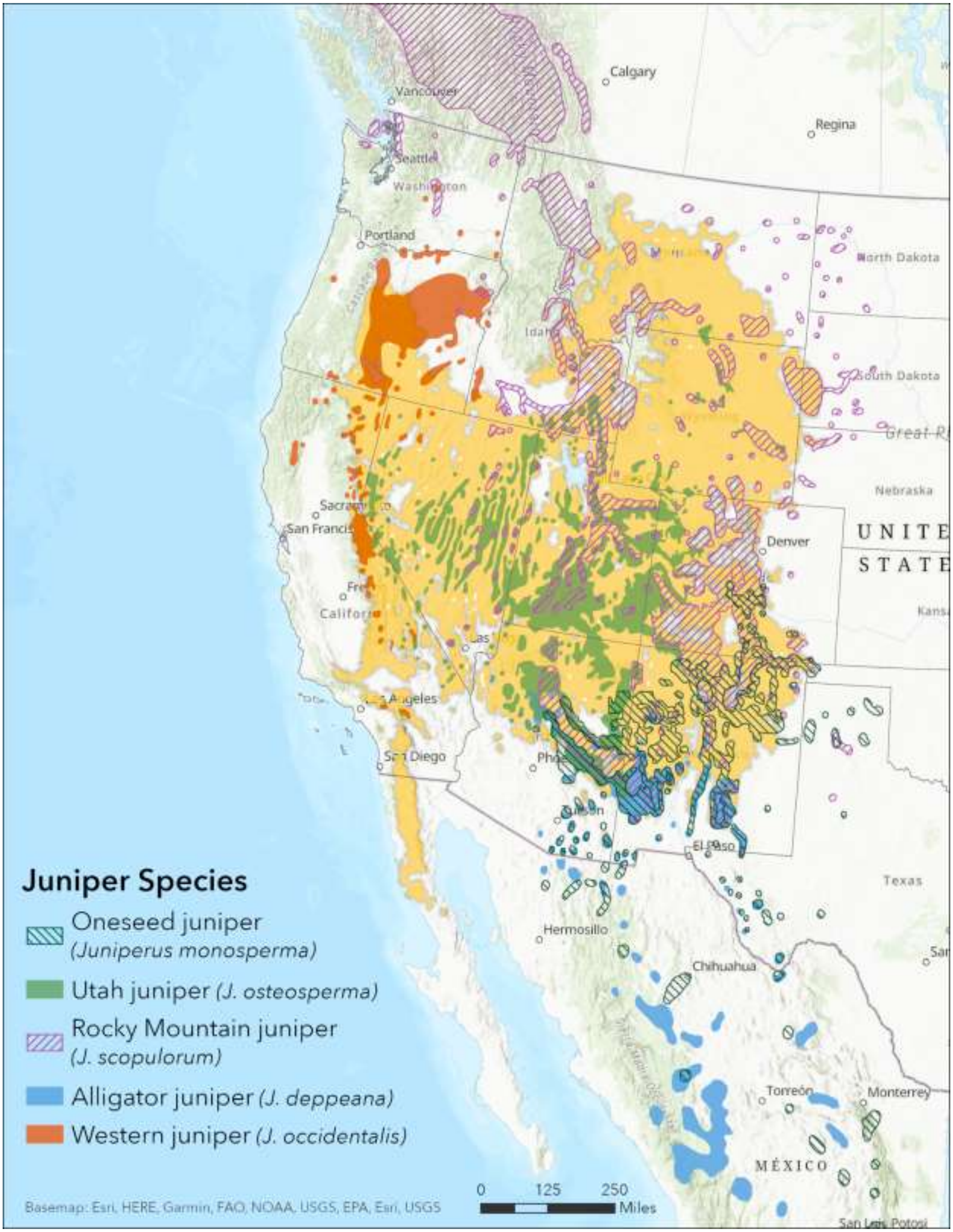

Figure 3. Primary juniper species overlapping Pinyon Jay range shown in yellow. CC BY Defenders of Wildlife 2021. See Appendix 1 for metadata.

Detailed studies of Pinyon Jay habitat use have not been conducted outside of areas of overlap between the Pinyon Jay range and that of piñon pines, and Pinyon Jay use of some piñon-juniper sub-types, such as juniper woodland and savanna, are less-studied than piñon-juniper woodland (but see Johnson et al. 2014, at 18, 2021a; Novak et al. 2021, at 4).

Based on historical disturbance, piñon-juniper woodlands have been described as three basic types, which vary in geography, site condition, and tree species (Romme et al. 2009, at 207–08). Persistent piñon-juniper woodlands have sparse to dense tree cover dominated by juniper, piñon, or both. They are typically in rugged areas with coarse soils and have minimal ground cover. Fires have always been infrequent in persistent piñon-juniper. Piñon-juniper savannas have low to moderate tree density of piñon, juniper, or both. They occur on coarse- to fine-textured soils, and understory is mainly grass with some forbs. Information on historical fire frequencies is scarce, but low severity fires may have maintained low tree densities before European settlement. Wooded shrublands have variable tree density of piñon and juniper and are characterized by a sparse to dense shrub understory, often consisting of sagebrush (*Artemesia* spp.). They are associated with a variety of substrates and geographic conditions and are prevalent in the Great Basin. Fire spread can be moderate to extensive depending on tree density.

Another approach classifies Great Basin vegetation in phases, based on successional stage (Miller et al. 2008, at 5). In this view, Phase I has trees present, but shrubs and forbs dominate. In Phase II, trees are co-dominant with shrubs and forbs, and in Phase III, trees are the dominant vegetation.

1. Southwest

Piñon-juniper vegetation in southern Colorado and northern and central New Mexico is classified as the Southern Rocky Mountain Piñon-Juniper Woodland Group (USNVC 2019). It is characterized by *P. edulis* and *J. monosperma*, with Rocky Mountain juniper (*J. scopulorum*) replacing *J. monosperma* at higher elevations. The understory may be dominated by shrubs or grasses or be absent. The *P. edulis-J. osteosperma* Group occurs in western Colorado, northwestern New Mexico, and northern Arizona. In northern Arizona and northwestern New Mexico, either juniper species or their hybrid may dominate. The understory may be dominated by shrubs or grasses or be absent (USNVC 2019). Both groups may contain juniper-dominated woodland or shrubland at lower classification levels.

Johnson and colleagues modeled Pinyon Jay habitat use in New Mexico at the landscape, nesting colony, and nest scales. Pairing radio telemetry data and GPS locations from direct observation with land cover maps, they created spatial models of landscape-scale habitat use. Breeding season home ranges were generally smaller than year-round ranges but varied widely across studies and locations (Table 2).

a) Non-breeding Season and Breeding Season

In the New Mexico landscape-scale studies summarized below, piñon woodland and piñon-juniper woodland types correspond to persistent piñon-juniper in the Romme et al. (2009, at 207) disturbance scheme. Juniper savanna would be classed as piñon-juniper savanna. A few sites in northwestern New Mexico (Johnson et al. 2017d, at 12–13) would correspond to wooded shrublands, but the majority of piñon-juniper in New Mexico falls into one of the first two types.

At Kirtland Air Force Base ("KAFB") in New Mexico, detections in each habitat type were compared to the availability of each habitat type (concentration of use, CU; Johnson et al. 2016, at 4). Pinyon Jays concentrated use in Piñon Pine Woodland, (CU=1.36) and Piñon-Juniper Woodland (CU=2.06) during the breeding season and spent more time in Grassland (CU=0.72) and Juniper Woodland and Savanna (CU=1.18) during the non-breeding season (Johnson et al. 2016, at 7). At another New Mexico site (White Sands Missile Range, "WSMR") in the same study, the jays spent much more time in Piñon Pine Woodland in both breeding (CU=1.47) and non-breeding seasons (CU=1.78), but Juniper Woodland and Savanna (CU=0.28) and Piñon-Juniper Woodland (CU=0.1) were used slightly more during the non-breeding seasons (Johnson et al. 2016, at 7). In that study, nonbreeding season CUs likely underestimated the use of Juniper Woodland and Savanna because of limited jay detections during winter. At a third site in the Farmington, NM area ("FARM"), Pinyon Jays spent the majority of time (74.5% of home range, CU=0.99) in Dense Piñon-Juniper Woodland, with less time (12.39 % of home range, CU= 0.38) spent in Sparse Piñon-Juniper Woodland (Johnson et al. 2017d, at 13).

Caching of piñon seeds occurs from August into the winter months, depending on the size of the piñon crop. Caching sites are typically open areas, often south-facing slopes which are snow-free in winter (Marzluff and Balda 1992, at 36–37) or previously burned areas (Johnson et al. 2010, at 11, 14), but the jays may also cache in dense piñon-juniper woodland (Johnson and Smith 2007, at 8; Johnson et al. 2014, at 84).

b) Breeding Season

Colony-scale

Predictive nesting-colony-scale models at KAFB contained 43.71% Piñon Pine Woodland, 47.32% Piñon-Juniper Woodland, and 7.16% Juniper Woodland and Savanna (Johnson et al. 2016, at 9). Elevation ranged from 1902-2334 m, and most colony model slopes faced north. At WSMR in the same study, a predictive colony scale model contained 100% Piñon Pine Woodland. Elevation ranged from 2086-2633 m, and most colony model slopes faced south (Johnson et al. 2016, at 8). In a study at FARM, Pinyon Jay nesting colonies were more likely to be within 50-100 m of a road, on more gradual slopes with low heat loads, where woodland was classified as dense and woodland patches were larger, and 300-400 m from surface water (Johnson et al. 2017a, at 27–28, 34). Low heat loads occurred primarily on north-facing slopes (Johnson et al. 2017a, at 28, 34).

Studies of Pinyon Jays in Arizona in the 1980s focused on behavior and did not model habitat use. However, they did describe nesting habitat, which was primarily in ponderosa pine (*Pinus ponderosa*) woodland. Two flocks studied near Flagstaff, Arizona nested in a "virtual monoculture" of high elevation ponderosa pines, though they foraged for piñon nuts in nearby piñon-juniper woodlands (Marzluff and Balda 1992, at 179). The Town Flock in those studies was supplemented at bird feeders, which could have influenced the placement of the colony.

The first systematic survey of Pinyon Jays in the Gila National Forest of west-central New Mexico found abundant Pinyon Jays in ponderosa pine woodlands in the northern part of the forest. During the breeding season, moderate numbers occurred in the middle of the forest, and very few were detected in the south, where Mexican Jays, Woodhouse's Scrub-Jays, and Steller's Jays dominated (Johnson et al. 2021b, at 9). The Mexican Jays appeared to replace Pinyon Jays in areas with higher oak concentrations.

Nest-scale

In New Mexico, Pinyon Jays nest primarily in various piñon-juniper habitats, including Piñon Woodland, Piñon-Juniper Woodland, and Juniper Woodland and Savanna (Petersen et al. 2014, at 5, 19; Johnson et al. 2014, at 75–76; Johnson et al. 2016, at 7, 9; Johnson et al. 2021a, at 8), and nest-scale modeling has been conducted in those habitats. However, the first systematic Pinyon Jay surveys in the Gila National Forest of west central New Mexico indicted a significant population of Pinyon Jays nesting in Ponderosa Pine Woodland (Johnson et al. 2021b, at 15), as in earlier studies in Arizona (see Marzluff and Balda 1992, at 179).

At WSMR and KAFB, New Mexico, Johnson and colleagues compared plots around nests to non-nest plots within seven nesting colonies. Pinyon Jays placed nests in Piñon Woodland and Piñon-Juniper Woodland, almost exclusively in piñon trees. Nest plots had higher total canopy cover, nest trees had larger diameters, and litter on the ground within 5 m of the nest tree was higher, compared to non-nest plots within the colony site (Johnson et al. 2014, at 93).

A separate study at KAFB conducted five to nine years later had notably different results. In that study, Pinyon Jays nested primarily in juniper trees. Although several covariates were modeled, the only significant difference between nest and random sites was that the number of dead juniper trees was lower at nest sites than non-nest sites (Novak et al. 2021, at 3). Differences in the two studies could have occurred because the second study did not attempt to repeat the earlier study, and the covariates significant in the earlier study were not measured. However, a significant piñon mortality event occurred between the two studies, and juniper mortality had apparently also increased by the second study, suggesting that the Pinyon Jays switched tree species and colony sites in response to drought-related piñon mortality (Novak et al. 2021, at 4–5). Colony movement associated with declining tree health and mortality was also observed at WSMR, where Pinyon Jays switched colony sites when piñon tree vigor declined with decreased winter precipitation (Johnson et al. 2017b, at 8). The Pinyon Jay flock at that site eventually abandoned the traditional nesting area in piñon woodland for at least two years when health of the woodland declined, and they may have joined a nearby flock nesting in juniper-dominated habitat (Johnson et al. 2021a, at 7–8).

In the Four Corners area, Pinyon Jays placed nests in piñon-juniper habitat, in both piñon and juniper trees. Utah juniper trees there typically have tall, tree-like growth patterns more similar to piñon trees than to other juniper species. The jays nested in taller, larger-diameter trees, compared to random trees within a colony site. However, they avoided nesting in the largest, most emergent trees (Johnson et al. 2015, at 19, 34–35). Large, old trees tend to be more open grown, with foliage less dense than younger trees, and emergent trees provide perches for avian predators such as raptors and ravens.

A study using data from all the above nesting colonies in New Mexico investigated whether the same habitat features were associated with nest sites across different colonies (Johnson and Sadoti 2019, at 2–3). The best models of nest-site selection were created for each colony, then those models were applied to the tree data from the other three colonies, to determine if models from one site could effectively predict nest-site selection from different sites. Under a hypothetical scenario of woodland thinning, the authors assessed using a covariate predictive at each site, tree diameter, to assess the effectiveness of managing one site based on models from the other sites. Some applications of thinning based on the critical model value from one site would retain as few as 21% of nest trees at another site, while allowing up to 100% of non-nest trees to be cut. Other transfers would retain a high proportion of nests at a second site (up to100%), while allowing up to 79% of non-nest trees to be removed. Hence, while some model transfers would have resulted in effective management for Pinyon Jays, others would have destroyed much of the birds' nesting habitat. No one-size-fits-all model of Pinyon Jay nest-scale habitat use emerged. The paper recommended caution when managing where information on nest-site use is lacking (Johnson and Sadoti 2019, at 1).

In the northern Arizona studies, Pinyon Jays nested primarily in ponderosa pine trees, preferring trees with high foliage density and avoiding trees with abundant pine cones, which may attract cone predators and their respective predators (Gabaldon 1979, at 86, 96–98, 128–32, 193). Nest trees were tall and surrounded by shorter trees that were taller than the nest site (Gabaldon 1979, at 109, 115–17). Most jays placed nests on the south-facing aspect of the tree, which would be warmer for early season nests but also be vulnerable to southwesterly winds. Surrounding trees could shelter the nest from wind (Marzluff and Balda 1992, at 180). The jays appeared to nest in more concealed locations lower in trees after their nests were depredated, in high, warmer locations after a shaded nest failed during snows, and at similar heights where nests were successful (Marzluff 1988, at 7).

In Colorado, nesting is primarily restricted to piñon-juniper woodlands, but adults feeding fledglings have also been observed in ponderosa pine, riparian and shrubland habitats (Wickersham 2016, at 362). In surveys in Colorado, "Pinyon Jay nests were found primarily in junipers within moderately dense to sparse piñon-juniper woodland/shrub areas" (L. Rossi, unpublished data, as cited in Somershoe et al. 2020, at 23).

2. Great Basin

Piñon-juniper vegetation in the Great Basin is classified as the *Pinus monophylla-Juniperus osteosperma* Woodland Group (USNVC 2019). It corresponds to the *P. monophylla*-dominated portion of the Persistent Pinon-Juniper Woodland of Romme et al. (2009). It is characterized by an open to moderately dense tree canopy comprising a mix of single-leaf piñon and Utah juniper. Shrubs such as big sagebrush (*Artemesia tridentata)* form a moderately dense shrub layer. This group may contain woodland or shrubland dominated by *J. osteosperma* (or *J. scopulorum* at higher elevations), with various sagebrush species forming a shrub understory (USNVC 2019), and corresponds to the Wooded Shrubland of Romme et al. (2009, at 208).

A landscape-scale study of Pinyon Jay habitat use at two sites in Nevada and one in southern Idaho found that Pinyon Jays used a subset of available piñon-juniper habitat. They were found in lower-elevation piñon-juniper close to the woodland-shrubland ecotone and used different but overlapping areas for different activities (Boone et al. 2021, at 18).

a) Non-breeding and Breeding Seasons

In this study, habitat use was analyzed for three main types of behavior: foraging, caching, and nesting at three sites in southern Idaho, eastern Nevada, and central Nevada. Behavior was not sorted by season, except that nesting behavior by definition occurs in the breeding season. At the southern Idaho study site, no breeding season data were collected. Only caching locations were recorded at all three study sites, and only in central Nevada were caching, foraging, and nesting recorded. Pinyon Jays cached in low-elevation, relatively flat areas with low tree cover. They foraged at slightly higher elevations with moderate, variable tree cover (Boone et al. 2021, at 17). They nested in higher elevation areas with higher tree and vegetation cover. This pattern is generally similar to that in New Mexico (Boone et al. 2021, at 18; Johnson et al. 2016), except in the Great Basin, jay activity was primarily in lower-elevation habitats, and Pinyon Jays at some New Mexico sites nested in higher-elevation, piñon-dominated woodlands with higher canopy cover (Johnson et al. 2016, at 9). Management in Great Basin piñon-juniper woodlands currently includes widespread removal of trees to create shrublands for the benefit of Greater Sage-Grouse (*Centrocercus urophasianus*) (Boone et al. 2018, at 191; see also Section III.A.6 Management for Other Wildlife Species, below).

3. Habitat Other Areas

Most reports of habitat use outside the range of piñon pine refer to the breeding season, though the season is unclear in some reports. Pinyon Jays use low-elevation pine-juniper or open pine woodlands and forage and cache in grassland or shrub-steppe (Somershoe et al. 2020, at 23). "A nesting colony site in Carbon County, Montana was dominated by Utah juniper (*J. osteosperma*), with a very low density of limber pine, and extensive bare ground" (J. Marks, pers. comm., as cited in Somershoe et al. 2020, at 23). In South Dakota, Pinyon Jays have nested in the southwestern Black

Hills in dry, sparse ponderosa pine woods and scrub habitat with interspersed grassland (Drilling et al. 2018), and they nested in ponderosa pine in western Nebraska (Silcock and Jorgenson 2018). In Oregon they occupy western juniper (*J. occidentals*) and ponderosa pine transition habitats (Somershoe et al. 2020, at 23). In southeastern Idaho, they nested in juniper woodlands with no piñon pines present (Brody 1992, at 134).

Habitat Use Summary
In summary, the Pinyon Jay range largely overlaps that of piñon pines (Figure 2), and in areas of overlap, they nest, forage, and cache mainly in piñon-juniper sub-types: Piñon Woodland, varying densities of Piñon-Juniper Woodland, and Juniper Woodland and Savanna. Outside the area of overlap, Pinyon Jays also inhabit Jeffrey pine, ponderosa pine, limber pine, Utah juniper, and western juniper habitats (Figure 3**Error! Reference source not found.**). In one study in the Great Basin, Pinyon Jays occupied low-elevation piñon-juniper habitats, and cached, foraged, and nested along a gradient of increasing tree density and elevation (Boone et al. 2021, at 17). In New Mexico, Pinyon Jays nested in higher-elevation areas with higher tree density, cached in more open habitats, and foraged in higher-elevation habitats in the breeding season and lower-elevation, more open habitats in winter. Nesting colonies tended to be on gradual slopes with low heat loads, in large patches of dense woodland, and 300-400 m from surface water. Nests were typically placed in larger trees, in patches with higher canopy cover (Johnson et al. 2014, at 93, 101–02; 2015, at 34). Pinyon Jay habitat requirements appear somewhat flexible, as they have moved from piñon and juniper to juniper when piñon mortality was high (Johnson et al. 2021a, at 8; Novak et al. 2021, at 4–5).

F. Reproduction and Lifespan

This section, except where noted, is summarized from the only detailed, long-term studies of Pinyon Jay reproduction and survivorship (Marzluff and Balda 1992). Given that those studies focused on only one flock in northern Arizona, and significant population declines have occurred since that study was conducted in the 1980s (Sauer et al. 2020), the specific results may not apply currently or to other populations.

1. Annual Reproductive Success

Age and experience of the parents had the greatest influence on offspring fledgling success. Helper lineages, lineages having helpers at the nest, had higher annual reproductive success. However, helpers did not increase their parents' productivity or survival, and helping did not increase the lifetime reproductive success ("LRS") or lifespan of the helpers. The authors concluded that helping is most likely a form of extended parental care for parents that produce more sons.

2. Lifetime Reproductive Success

As of their 1992 book, Balda and students had measured LRS for 48 male and 49 female Pinyon Jays. On average, male and female Pinyon Jays had similar LRS. Most birds did not breed until two years of age, though some females bred when they were one year old. About 10% of males and 3% of females did not breed until they were three years old. A breeding male lived an average of 5.5 years, bred for four, and fledged nearly one young per year, half of which survived, leaving 2.7 yearlings per his lifetime. For an average female, the respective numbers were the same, except she lived five years and produced 2.9 yearlings. However, not all Pinyon Jays are average, and considerable variation occurred in all components of LRS. Over one-third of individuals in the northern Arizona study failed to reproduce, while a few had outstanding LRS. One male lived 16 years and produced 28 crechlings and 10 yearlings. As expected for a monogamous species, male and female LRS was similar.

In that study, lifespan and number of years breeding were the main correlates of LRS, as measured by production of yearlings, i.e., LRS was a direct result of how long a Pinyon Jay lived. The main source of variation in LRS was variation among successful breeding birds, which resulted from variable lifespans and variable crechling survival. Heavier males produced many, poorly surviving crechlings. Heavier females produced fewer, better surviving crechlings. The authors concluded that a big female paired to a smaller male was the optimal pairing, as these pairs produced few, high-surviving offspring. Birds in helper lineages had slightly higher LRS than those in non-helper lineages.

3. Survivorship

Based on 11 years of juvenile and 13 years of yearling survival data, Pinyon Jay survival was found to be greatest at the end of the year, after fall dispersal and before spring dispersal and breeding. Mortality was highest in autumn, followed by breeding season, then winter. This may be an artifact, as individuals never seen again were considered mortalities, which may not always be accurate if they dispersed. Documented causes of mortality included incubating females taken by owls, teenagers with guns, and Northern Goshawk (*Accipiter gentilis*) predation on mobbing birds. Adult mortality was higher than yearling mortality during the breeding season, likely due to the costs of breeding.

The study found that 55% of eggs hatched, 56% of nestlings fledged, 32% of fledglings survived to the creche stage, resulting in only 10% of eggs becoming crechlings. Juvenile survival to age 9 months was 41.3%, 62.1% of yearlings survived to the next year, and 73.9% of birds two years old and older survived each year. Hence, of 1000 eggs, it was estimated that on average only one bird would survive to the age of 11 years.

The longest-lived Pinyon Jay in that study of the Arizona town Flock was a male at least 16 years old; the oldest female lived to be 14. Because survival of adults was 26% at all ages, senescence probably does not occur in this species. Juvenile survivorship was higher when cone crops were larger, and it is not surprising that adult survivorship was low when piñon crops were very small. However, adult survivorship was highest when the cone crop was intermediate in size, not in years of high cone crops. This is likely because harvesting cones requires increased activity and exposure to predators, and these costs increase with a longer harvest season. Warm, wet spring weather was also associated with high juvenile survival, probably due to increased insect availability. Male survivorship was higher over time than female survivorship, due to predation on incubating females and dominance of the larger males at winter food sources.

Expected fecundity peaked around age three, and reproductive value ("RV", current fecundity plus expected future fecundity) peaked at age two, declining subsequently. The RV curve may explain why Pinyon Jays provide extended parental care to their young male offspring by allowing them to help at the nest during a period when their RV is highest.

Mortality of Pinyon Jays was highest at fledging, stayed high in juveniles, and many additional birds died as six-year-olds. Analysis of life tables indicated that survivorship of crechlings, one-year-olds, and two-year-olds had the greatest influence on Pinyon Jay population growth, even more than fecundity. As early as 1992, life table analysis and three measures of population growth suggested that the Town Flock was declining in size. These studies were conducted before climate change had been identified as a potential factor impacting Pinyon Jay populations. It is important to understand how climate change is affecting both survival and reproduction of Pinyon Jays and their relative contributions to population viability.

G. Population Trends

1. Pinyon Jay Surveys

The most complete, long-term dataset of Pinyon Jay numbers is the BBS (Sauer et al. 2020). BBS data for Pinyon Jay include surveys from 1966 to the present. Because BBS is a long-term, rangewide monitoring program, it probably provides reliable long-term population trends for Pinyon Jay. However, BBS surveys are conducted by volunteers during the nesting season of most breeding bird species in the United States, typically two to three months after the normal peak Pinyon Jay nesting season (Somershoe et al. 2020, at 36). In some populations, Pinyon Jays also nest in April, May, and even June, apparently in response to abundant insects, when piñon crops in the previous autumn were small or non-existent (Balda and Bateman 1971, at 300; Ligon 1978, at 113–14; Johnson et al. 2020a, at 6). Therefore, a close match between the timing of Pinyon Jay nesting and BBS surveys is not guaranteed. Nesting colonies may move between years (Marzluff and Balda 1992, at 161; Johnson et al. 2017b, at 8), and except for a few seconds every several hours when males arrive to feed nesting females, a Pinyon Jay colony is typically very quiet; it is possible to walk through a colony of nesting females and not detect nesting birds (Petersen et al. 2014). These factors suggest that BBS data may not be as accurate for Pinyon Jays as for some other nesting birds. Integrated Monitoring in Bird Conservation Regions ("IMBCR"), another bird monitoring program which has been conducted annually in the western United States since 2008 (birdconservancy.org), shares similar features and issues to BBS (Somershoe et al. 2020, at 36).

Annual monitoring at nesting colonies allows for more accurate assessment of local population trends (Petersen et al. 2014, at 12). Currently, methods are being tested for surveys tailored to the specific biology of Pinyon Jays (Pinyon Jay Working Group 2021b, at 3). Two basic approaches were employed in the 2021 nesting season. New technology for telemetry studies holds promise for surveys and understanding Pinyon Jay movements and habitat use. However, potential exists for impacts to individual birds of capture, handling, and carrying transmitters, and these effects should be carefully balanced against benefits to the species. Researchers and surveyors are encouraged to note cautions and adhere to recommended survey protocols (Pinyon Jay Working Group 2021a, entire; 2021b, at 1–4).

For large survey areas where little information exists on Pinyon Jay occurrence, road surveys are the most practical approach. Recent surveys in the Gila National Forest, NM were conducted in 5.0 km x 5.0 km (25 km^2) blocks, along public roads through suitable Pinyon Jay habitat (Johnson et al. 2021b, at 7; Pinyon Jay Working Group 2021b, at 6). Each 25 km^2 block was divided into four equal sub-blocks. Surveyors conducted point counts on at least three points in each block; points were approximately 1 km apart. At each point, the surveyor listened for Pinyon Jays for six minutes and recorded minute detected, estimated distance, number of birds, behavior, and general woodland composition. When breeding calls or behaviors were detected, the surveyor attempted to find a nesting colony.

For smaller areas such as where treatments or management are planned, and where survey areas are small enough to be covered on foot, a smaller-scale approach has been employed (Pinyon Jay Working Group 2021b, at 3–5). This method was conducted on 2.5 km x 2.5 km plots. Surveyors made one to three visits to each plot. Surveys employed either an area search or point count approach. When point counts were employed, the covariates collected were similar to those in the road surveys, above. Additional detail is available in Pinyon Jay Working Group (2021b, at 3–5).

Occupancy modeling is a method which accounts for imperfect detection in surveys of birds and other animals by spatially or temporally repeated survey. It provides an estimate of the true occurrence in a surveyed area (Bailey and Adams 2005). Occupancy modeling has not previously been developed specifically for Pinyon Jays but was employed for the 2021 road surveys (Johnson et al. 2021b, at 5–6, 8, 10–11).

Region/State	BBS Sample Size (N)	BBS Trend 1967-2019 (%/y, 97.5% CI)	BBS Trend 2005-2019 (%/y, 97.5% CI)
Survey-wide	298	-2.0 (-1.98, -3.44)	-0.97 (-3.12, 1.39)
BCR			
S. Rockies/ CO Plateau	129	-1.99 (-3.59, -0.63)	-1.18 (-3.83, 1.61)
Great Basin	56	-2.14 (-4.57, -0.15)	-0.71 (-5.5, 4.18)
Sierra Madre Occidental	10	-0.72 (-4.45, 2.69)	-0.49 (-6.8, 6.46)
Northern Rockies	23	-1.44 (-4.66, 0.14)	-2.31 (-8.6, 3.29)
Shortgrass Prairie	7	-0.59 (-4.71, 2.71)	-2.47 (-10.24, 4.21)
Badlands and Prairies	14	-3.64 (-7.51, -0.66)	-6.05 (-15.61, 1.4)
Sierra Nevada	5	-0.5 (-4.74, 3.99)	-1.11 (-10.12, 8.16)
Coastal California	5	-0.38 (-5.24, 4.49)	3.15 (-7.47, 22.15)
Chihuahuan Desert	3	-2.06 (-7.33, 1.62)	-2.02 (-12.36, 7.05)
Sonoran & Mojave Deserts	6	-1.39 (-6.25, 3.13)	4.47 (-5.43, 28.29)
State			
CO	47	-1.73 (-4.06, 0.52)	-2.75 (-7.13, 1.28)
NM	35	-2.27 (-4.37, -0.44)	-1.42 (-5.11, 2.42)
UT	67	-1.82 (-4.06, 0.05)	-2.25 (-5.8, 1.03)
AZ	22	-0.53 (-3.16, 1.82)	-0.34 (-4.23, 6.03)
CA	26	-0.08 (-2.55, 2.38)	0.73 (-4.72, 7.98)
MT	10	-2.21 (-5.4, 0.98)	-4.03 (-12.97, 3.81)
NV	20	-2.28 (-4.93, 0.0)	-0.6 (-6.35, 5.27)
WY	16	-2.54 (-6.67, 0.58)	-4.17 (-11.98, 2.18)
OR	11	-1.55 (-6.44, 2.17)	1.48 (-6.33, 11.42)
SD	4	-4.25 (-11.42, 0.45)	-3.62 (22.27, 8.88)

Table 3. BBS estimated population trends, for two time periods, by survey-wide, Bird Conservation Region ("BCR"), and state. 97.5% confidence intervals are shown in parentheses. Blue indicates the highest credibility, yellow moderate credibility, and red low credibility in the population trend.

2. Trends

Breeding Bird Survey

BBS data (Sauer et al. 2020) indicate that Pinyon Jay populations have been declining rangewide over approximately the past 50 years (Table 3, Figure 4. Survey-wide population trajectories for the Pinyon Jay estimated from the BBS using the standard regression-based model (SLOPE) used for BBS status and trend assessments since 2011.). Data highlighted in red in Table 3 have an important deficiency, e.g., very low regional abundance, very small number of BBS routes, or imprecise modeling results. Yellow highlighted data have a deficiency, e.g., low abundance, small sample size, or imprecise results. Blue highlights reflect data with at least 14 long-term samples, moderate abundance on routes, and moderate precision. Even data falling in the blue category may not provide valid results (https://www.mbr-pwrc.usgs.gov/bbs/credhm09.html). However, BBS is a long-term, rangewide monitoring program, and therefore provides the most reliable and only long-term population trends available for Pinyon Jay.

Pinyon Jay populations have declined rangewide, in every Bird Conservation Region ("BCR"), and in every state (Table 3). These declines are clear even when considering only the highest-credibility data (blue highlighted, Table 3). The two BCRs with the highest credibility ranks, Southern Rockies/Colorado Plateau and Great Basin, also harbor 90% of the Pinyon Jay population and have declined at approximately 2% per year since 1967. States having the highest proportion of the Pinyon Jay global population show similarly high yearly declines over the long term (Table 3). However, within the Pinyon Jay range, BBS data suggest that some areas have more severe declines, while some areas may show population increases (Figure 5. Geographic variation in Pinyon Jay population trends. Data from BBS; trend map ending in 2019 not available. Numbers refer to Bird Conservation Regions listed in Figure 1. CC BY Defenders of Wildlife 2021. See Appendix 1 for metadata.).

Note that the annual population trends presented here are the most recent compiled by BBS. Some readers may note that earlier trend estimates for 1967-2015 indicated larger annual decline rates for Pinyon Jay than the ~2% rangewide estimate in Table 3. This discrepancy occurred when BBS changed the analysis methods it uses to calculate trends for some species, including Pinyon Jay, starting in 2019 (J. Sauer pers. comm. to C. Beidleman, 16 August 2021). Partners in Flight used the older trend numbers for the population decline and half-life estimates provided below. Hence, these estimates would be different if the latest trends from BBS were incorporated. Using the newer analytical methods, J. Sauer (pers. comm. to C. Beidleman) estimates that the Pinyon Jay population declined by 66.8% from 1967–2019, rather than 85%, as projected by Partners in Flight, below (Rosenberg et al. 2016, at 52).

Partners in Flight

Partners in Flight (PIF) finds the Pinyon Jay long-term (1970-2014) population has declined by 85%, and the short-term (2004-2014) population change has declined by 3.7% (Rosenberg et al. 2016, at 52). The population half-life is estimated at 19 years, meaning that an additional 50% loss of the global population is expected by 2035. PIF therefore considers the Pinyon Jay as a species with a short "half-life" and high urgency (Rosenberg et al. 2016, at 3, 34, 52).

The Partners in Flight Avian Conservation Assessment Database (Partners in Flight 2021a) provides ranks based on several component scores, which are added to produce a risk ranking. A total score for each landbird species then places each at-risk species in one of three categories: Red Watch List, Yellow Watch List, or Common Birds in Steep Decline. Species are included in the Watch List if they have a maximum combined score of ≥14, or 13 in combination with a population trend score of 5. Red Watch List species have a combined score >16 and are considered highly vulnerable and urgently in need of special attention. Yellow Watch List species are considered to have restricted ranges and small populations and are in need of constant care. These species are further divided into "R" Yellow Watch and "D" Yellow Watch species. "R" Yellow Watch species have high vulnerability scores for restricted ranges and small populations, with moderate threats and stable or increasing trends. "D" Yellow Watch species have declining populations, with high trend scores, moderate to high threats, and low vulnerability scores for range. Common Birds in Steep Decline are still numerous or widely distributed enough that they do not warrant Watch List status but are experiencing long-term declines. They have lost from 50%-90% of their populations since 1970 and most are projected to lose another 50% within 20-25 years. For detail on how these scores are calculated, see Panjabi et al. (2021, at 7–21).

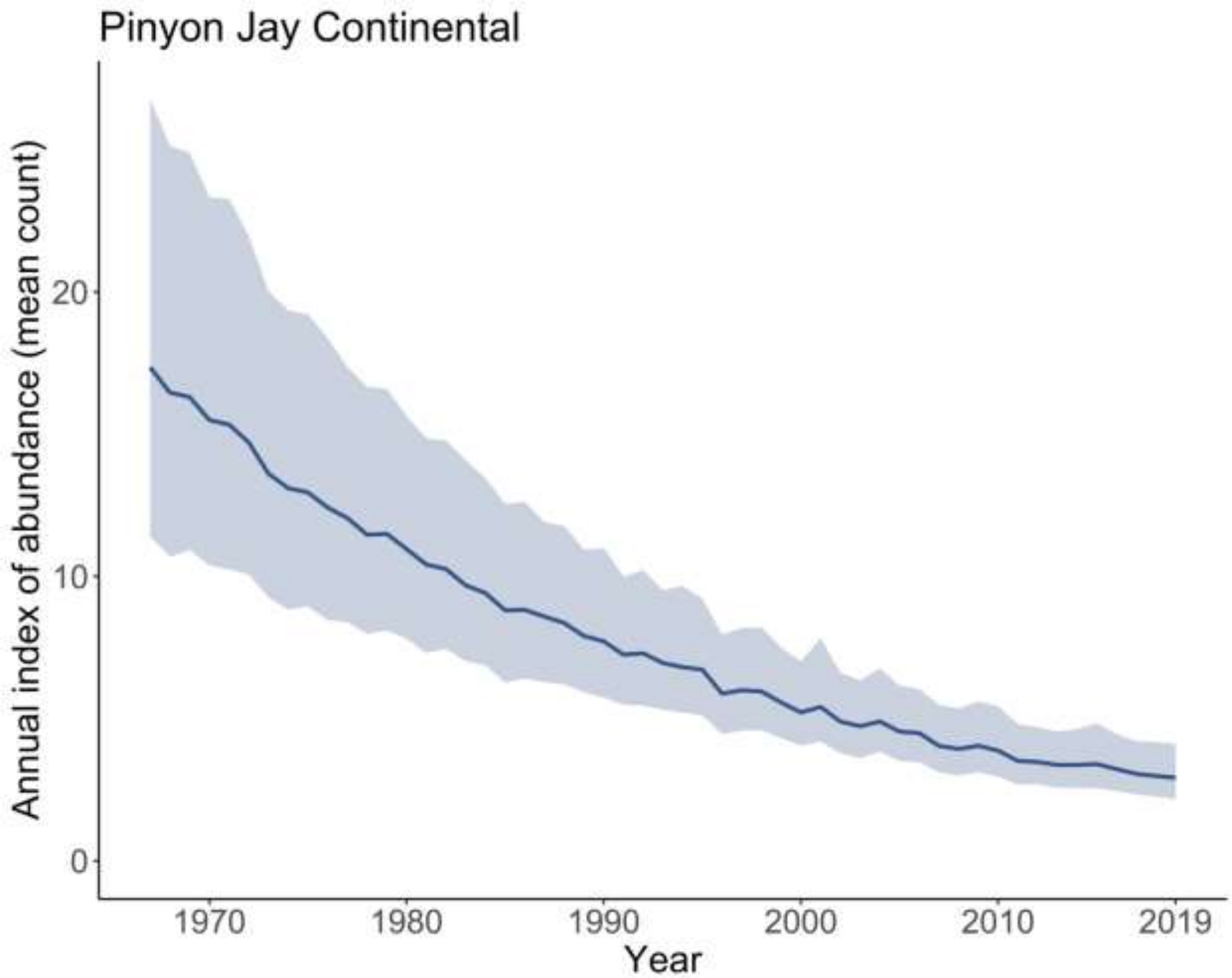

Figure 4. Survey-wide population trajectories for the Pinyon Jay estimated from the BBS using the standard regression-based model (SLOPE) used for BBS status and trend assessments since 2011.

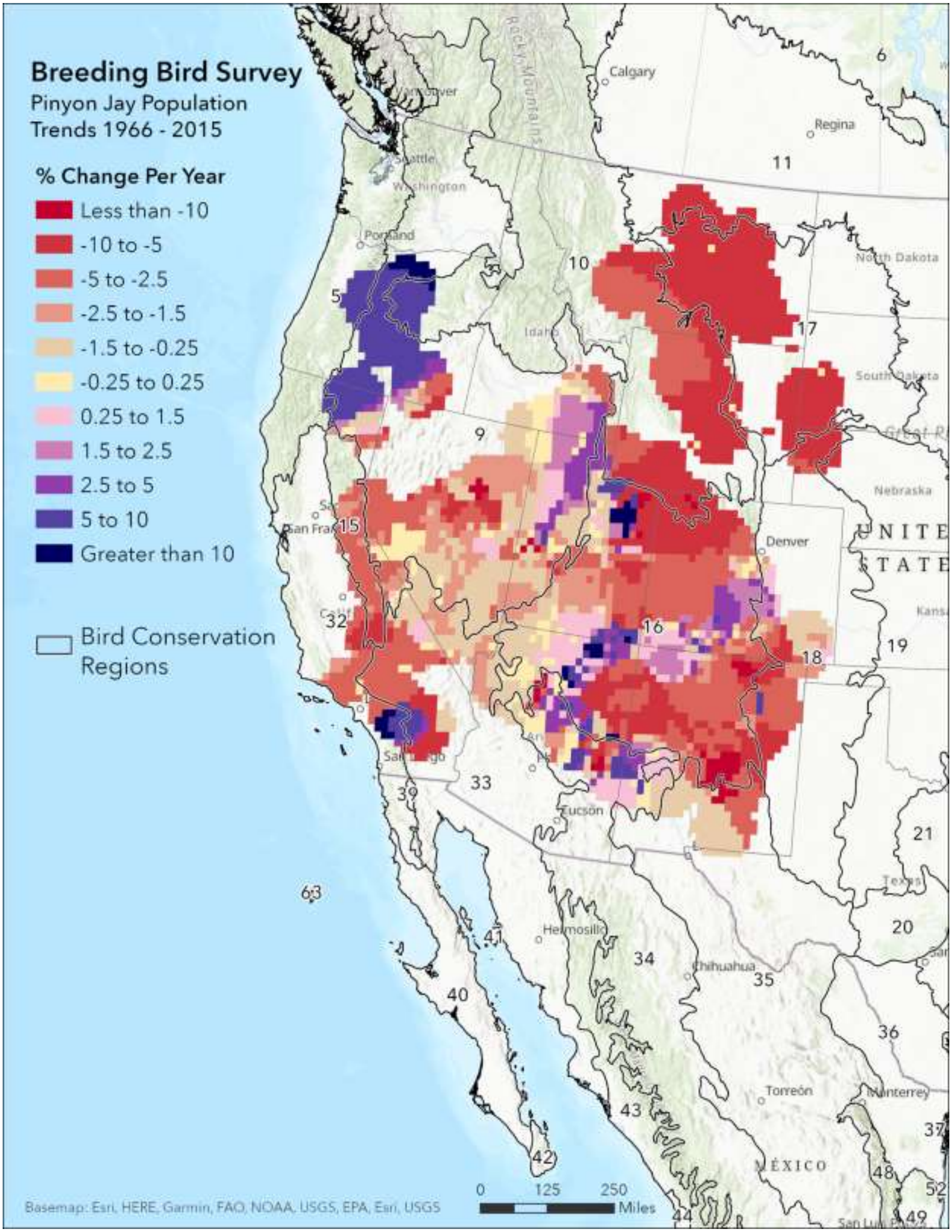

Figure 5. Geographic variation in Pinyon Jay population trends. Data from BBS; trend map ending in 2019 not available. Numbers refer to Bird Conservation Regions listed in Figure 1. CC BY Defenders of Wildlife 2021. See Appendix 1 for metadata.

Pinyon Jay is a "D" Yellow Watch List species, with a combined breeding season score of 14, based on the following sub-scores: global population size = 3; breeding season distribution = 2, threats to breeding = 4; continental population trend = 5. The total score for the nonbreeding season is 13, with the same sub-scores, except non-breeding threats = 3. Partners in Flight scores may range from 1 to 5, with 5 indicating the highest threat and 1 the lowest.

Region/State	Population Estimate	95% CI	% Global Population	% USA/Canada Population
Global	770,000	(530,000-1,100,000)		
BCR				
S. Rockies/ CO Plateau	380,000	240,000-580,000	49.64	50.41
Great Basin	310,000	140,000-560,000	39.93	40.54
Sierra Madre Occidental	27,000	6,100-62,000	3.56	3.61
Northern Rockies	17,000	4,900-35,000	2.21	2.25
Coastal California	7,600	0-27,000	1	1.01
Shortgrass Prairie	6,200	200-20,000	0.81	0.82
Chihuahuan Desert	5,600	0-16,000	0.73	0.74
Badlands and Prairies	2,700	620-5,800	0.35	0.35
Sierra Nevada	1,800	0-6,000	0.23	0.24
Sonoran & Mojave Deserts	200	0-880	0.03	0.03
State	**Population Estimate**	**95% CI**	**% Global Population**	**% USA/Canada Population**
NM	220,000	110,000-390,000	28.98	29.43
NV	210,000	63,000-460,000	27.52	27.95
UT	98,000	50,000-170,000	12.75	12.95
AZ	90,000	28,000-180,000	11.7	11.88
CO	57,000	28,000-100,000	7.77	7.59
CA	51,000	7,900-140,000	6.61	6.71
OR	11,000	190-30,000	1.4	1.43
WY	7,900	1,400-21,000	1.03	1.04
MT	5,100	580-16,000	0.67	0.68
ID	1,600	0-5,800	0.2	0.21
SD	1,000	0-3,400	0.13	0.14

Table 4. Partners in Flight population estimates for Pinyon Jay; global, by BCR, and by state, showing 95% confidence intervals and percent of global and US/Canada population, from Partners in Flight Population Estimates Database 2021.

The Partners in Flight Population Estimates Database (Partners in Flight 2021b) provides an estimate of Pinyon Jay populations by BCR and state (Table 4). As a complete census of Pinyon Jay population has not been conducted, these are estimates only and subject to error, as indicated by the wide 95% confidence intervals in Table 4. However, the population estimates are useful for comparative purposes. The regions of highest importance for the species are Southern Rockies/Colorado Plateau (BCR 16) and Great Basin (BCR 9). Together, these areas harbor an estimated 90% of the Pinyon Jay population (Table 4). According to these estimates, New Mexico and Nevada contain 29% and 28% of the global Pinyon Jay population, respectively; together the two states harbor 57% of the global population (Table 4). Even considering uncertainty in population estimation, these population estimates suggest that New Mexico and Nevada are the most important states for Pinyon Jay population and conservation.

3. Status

The Pinyon Jay is recognized by several agencies; international, national, and state; as a species of conservation concern. The International Union for the Conservation of Nature ("IUCN") identifies Pinyon Jay as Vulnerable on its Red List of Threatened Species, which means that it faces a high risk of extinction in the medium-term future (BirdLife International 2020). FWS includes Pinyon Jay on its Birds of Conservation Concern list, continentally and in all 10 BCRs where it occurs (FWS 2021). It is a Department of Defense ("DoD") Partners in Flight Mission Sensitive Species (DoD Partners in Flight Mission-Sensitive Species Working Group 2021, at 2).

The species is considered a Species of Greatest Conservation Need in several state wildlife action plans: Arizona, Colorado, Idaho, Montana, Nebraska, Nevada, and New Mexico (Somershoe et al. 2020, at 3).

It is a state Bureau of Land Management ("BLM") sensitive species in Idaho (https://www.blm.gov/sites/blm.gov/files/Programs_FishandWildlife_BLMIdaho%20Special%20Status%20Species%20Animals.pdf), New Mexico (https://www.blm.gov/sites/blm.gov/files/IB%20NM-2019-002_Attachment%201%20Animal.pdf), and Nevada (https://www.blm.gov/sites/blm.gov/files/policies/2017%20Final%20BLM%20NV%20Sensitive%20and%20Special%20Species%20Status%20List%20.pdf).

In New Mexico, the New Mexico Avian Conservation Partners has designated the Pinyon Jay as a "Species Conservation Level One" with an assessment score of 19 (out of 25), with only three species in the state having a higher score (more vulnerable: Bendire's Thrasher, Lesser Prairie-Chicken and Brown-capped Rosy-Finch). http://avianconservationpartners-nm.org/wp-content/uploads/2017/08/Revised-NM-Species-Assessment-Methodology-1.pdf.

The "Bring Back Three Billion Birds Road to Recovery" effort (https://www.3billionbirds.org/), an outcome of the 2019 Science paper, "Decline of the North American Avifauna" (Rosenberg et al. 2019, entire), has identified the Pinyon Jay as a Species on the Brink of Endangerment of Very High Urgency, one of only 22 bird species in that category in the United States and Canada (August 2021).

H. Associated Bird Species of Piñon-Juniper Woodlands

Piñon-juniper woodlands are rich in biodiversity. The National Park Service's Inventory and Monitoring program has documented hundreds of plant species in piñon-juniper woodlands in vegetation mapping projects. At Mesa Verde National Park, 256 vascular plant species, including several endemics, have been documented in old-growth woodlands, along with approximately 100 species of fungi, 165 known species of lichen, and 25 species of bryophytes. Soil microorganisms and over 10,000 insect species, 64 species of mammals, and at least 113 species of birds have been described in Mesa Verde's pinon-juniper woodlands (Floyd 2021, at 7–8). In addition to supporting high biodiversity, piñon-juniper woodlands make significant contributions to carbon sequestration (Floyd 2021, at 8).

At least 73 bird species breed in piñon-juniper woodlands, and over half are Neotropical migrants (Balda and Masters 1980, at 150–51). In one study in Utah, piñon-juniper bird communities ranked second in the percentage of obligate and semi-obligate species, third in total number of individuals counted, and fourth in species richness and diversity (Paulin et al. 1999, at 242). Total bird numbers and species were higher in every season in Rocky Mountain juniper stands than in grasslands (Sieg 1991, at 2–3). Piñon-juniper habitats also support high mammal, herpetofauna, and invertebrate diversity (Bombaci and Pejchar 2016, at 36).

In addition to Pinyon Jays, several other bird species of conservation concern breed in piñon-juniper habitats, including declining high priority obligates such as the Juniper Titmouse (*Baeolophus ridgwayi*) and Gray Vireo (*Vireo vicinior*). USFWS and PIF list several piñon-juniper species of conservation concern, and PIF conservation plans in several western states list priority species which breed in piñon-juniper. Because of the role of the Pinyon Jay as a long-distance seed disperser for piñon pines, the jay is crucial for the establishment and maintenance of piñon-juniper woodlands, and it is therefore key to the conservation of other birds and wildlife of these habitats.

Species	**USFWS BCC**	**PIF Red**	**PIF "R" Yellow**	**PIF "D" Yellow**
Gray Vireo			x	
Pinyon Jay	x			x
Woodhouse's Scrub-Jay	x			
Juniper Titmouse				
Mountain Chickadee				
Bushtit				
Bendire's Thrasher	x	x		
Virginia's Warbler	x			x
Black-throated Gray Warbler	x			
Black-chinned Sparrow	x			x

Table 5. USFWS Birds of Conservation Concern (USFWS 2021) and PIF priority species (Partners in Flight 2021a) breeding primarily in piñon-juniper habitats.

Species	Priority Species, State PIF Plan						
Ferruginous Hawk			ID		NV	UT	
Black-chinned Hummingbird		CO					
Gray Flycatcher	AZ	CO	ID		NV	UT	WY
Ash-throated Flycatcher							WY
Cassin's Kingbird		CO					WY
Gray Vireo	AZ	CO		NM	NV	UT	WY
Plumbeous Vireo			ID				
Pinyon Jay	AZ	CO	ID	MT	NE	NM	NV
Woodhouse's Scrub-Jay				NM			WY
Juniper Titmouse	AZ	CO		NM	NV		WY
Mountain Chickadee				NM			
Bushtit				NM			WY
Western Bluebird					NV		WY
Bendire's Thrasher			ID	NM	NV	UT	
Virginia's Warbler							
Black-throated Gray Warbler	AZ	CO	ID	NM	NV	UT	
Black-chinned Sparrow				NM			
Scott's Oriole		CO			NV	UT	

Table 6. Piñon-juniper priority bird species, from PIF state conservation plans.

III. IDENTIFIED THREATS TO THE PETITIONED SPECIES: FACTORS FOR LISTING

As demonstrated below, substantial scientific and commercial information indicates that listing the Pinyon Jay as endangered or threatened in all or in any significant portion of its range may be warranted. *See* 16 U.S.C. § 1533(b)(1)(3)(A). The species is declining throughout its range and faces threats including habitat loss and degradation, climate change, and more. Existing regulatory mechanisms have proven inadequate to protect the Pinyon Jay. Without adequate protections, the species' limiting life history characteristics, in combination with the other threats discussed, cause the Pinyon Jay to be in danger of extinction throughout all or a significant portion of its range or likely to become so within the foreseeable future.

A. Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

1. Historical Woodland Dynamics and Disturbance Regimes

To assess, understand, and manage the condition of forests and woodlands, scientists and managers wish to know their pre-historical/historical range of variation ("HRV"), which is influenced by natural disturbances such as climate and fire. When disturbances that have long shaped these vegetation communities are altered, woodlands depart from their pre-historical conditions. For example, prior to Euro-American settlement, many ponderosa pine forests were open, parklike savannas maintained by frequent, low-intensity fires. Grazing, timber harvesting, and fire suppression since the 19th century led to increased tree and shrub density, allowing increased fire severity (Waring et al. 2016, at 3). Management in ponderosa pine now aims to restore natural conditions with the use of thinning and prescribed fire. However, piñon-juniper woodlands have their own unique historical disturbance regimes (see Section II.E Habitat and Range), and ponderosa-appropriate management approaches such as thinning and prescribed burning are often inappropriate for piñon-juniper woodlands (Floyd 2021, at 27).

Pre-historical distributions of piñon and juniper vegetation types have been changing for centuries. During the Wisconsin glaciation, the three piñon species of interest here (*P. edulis*, *P. monophylla, P. fallax*) pushed south but grew on portions of their current southern ranges (Floyd 2021, at 6). *P. fallax* occupied the current Sonoran Desert areas. About 11,700 years ago, increased warming and precipitation (120-150% of today's precipitation), resulted in migration of piñons northward 300-500 km to their current occurrences. Movement rates varied across the three piñon species: from 21-60 m/year in *P. monophylla* to 43 m/year in *P. edulis* (Cole et al. 2013, at 108). *P. fallax* once covered a wide geographic area, but its northern migration resulted in a compressed range below the Mogollon Rim and into southwestern New Mexico (Floyd 2021, at 6). *P. monophylla* and *J. osteosperma* migrations into the Great Basin following the drying and warming trends after the Holocene are documented for specific mountain ranges and drainages (Miller et al. 1999, at 381–83).

Many current approaches to piñon-juniper management are based on recent movements of piñon and juniper at woodland edges and assumptions about historical conditions. It is important to recognize that these woodlands have occupied their current ranges only recently and that movement occurs today at ecotones. Under climate change, both piñon and juniper are experiencing significant mortalities which will affect their distributions (see Floyd 2021, at 24–26).

2. Woodland Management

The practice of clearing or reducing density of piñon and juniper woodland stands ("woodland reduction" *sensu* Bombaci et al. 2017, at 363) is commonly used to improve habitat for wildlife species of conservation concern (Boone et al. 2018, at 190–191) or economic importance (Bergman et al. 2014, at 449, 453–54; Kramer et al. 2015, at 30, 33), increase forage for livestock (Aro 1971, at 188), improve watershed function and reduce soil erosion (Jacobs 2015, at 1427), reduce fuels under fire mitigation plans (Schoennagel and Nelson 2011, at 273–75), and/or increase plant community heterogeneity (Miller et al. 2014, at 479).

Chaining on the western slope of Indian Peak in Utah's West Desert.
Photo: ©Southern Utah Wilderness Alliance/ TWIG Media Lab

Extensive destruction of native pinyon and juniper by chaining at Utah's Indian Peak range.
Photo: ©Ray Bloxham/Southern Utah Wilderness Alliance

3. Documented Impacts to Pinyon Jays

Few studies have addressed specific impacts of woodland reduction on Pinyon Jays. In a study of the effects of chaining, hydro-ax, or roller-chop treatments on piñon-juniper birds and small mammals, Bombaci and Pejchar (2016, at 369–70) found that, for birds of open woodland and dense woodland habitats, habitat use was significantly lower in all woodland reduction treatment plots than in control plots. Pinyon Jays were not identified as a focal species in this study, perhaps due to their large home ranges and challenges they present for surveying (see Table 2 and Pinyon Jay Surveys, above).

One study in Colorado assessed multi-scale avian occupancy on paired treatment-control sites in piñon-juniper woodlands (Magee et al. 2019, at 4). Treatments were partial thinning, a "slightly more nuanced tree reduction approach than clearcuts" (Magee et al. 2019, at 2). Occupancy of two piñon juniper specialists, Virginia's Warbler (*Oreothlypis virginiae*) and Gray Flycatcher (*Empidonax wrightii*), decreased at the landscape scale (Magee et al. 2019 at 6). Pinyon Jay occupancy was significantly reduced at the local scale (Magee et al. 2019, at 10).

In a treatment of persistent piñon-juniper woodlands in New Mexico, 87% of trees were removed from a traditional Pinyon Jay nesting colony site (Johnson et al. 2018 at 4–6). The Pinyon Jays avoided nesting within the thinned area but continued to occupy untreated areas.

In New Mexico, Bird Conservancy of the Rockies is conducting a three-year study involving federal, state, and county land and a collaboration of partners to provide more data on the impacts of piñon-juniper woodland management on the Pinyon Jay and associated priority bird species.

a) Extent of Piñon-Juniper Woodland Reduction in Pinyon Jay-Occupied Areas

Regardless of the various purposes for woodland reduction in piñon-juniper habitats, treatments are extremely widespread and ongoing (Smith 2021, at 4). Complete information on past, present, and planned piñon-juniper woodland reductions is often not readily available because federal land management agencies do not have a central database of land management projects (Smith 2021, at 1–2). A preliminary—and incomplete—review of federal planned projects affecting piñon-juniper suggests that land managers are targeting piñon-juniper for removal.

Bureau of Land Management: BLM has completed, ongoing, or planned woodland reduction treatments in piñon-juniper woodlands in at least six states (Appendix 2). The largest number (24) of BLM treatments, totaling 79,968 acres, 18,718 of those in piñon-juniper, is in Colorado, a state which has an estimated 7.8% of the Pinyon Jay's global population (Table 4). Utah follows Colorado, with 19 completed, in progress, or planned treatments totaling approximately 734,738 acres, 239,334 acres in piñon-juniper. Utah harbors an estimated 13% of the Pinyon Jay global population. Hence, Utah BLM has fewer individual treatments than Colorado but many more total acres and higher responsibility for Pinyon Jays. Nevada, with an estimated 28% of the global Pinyon Jay population, reportedly has nine treatments totaling 8,334,895 acres, of which at least 13,400 acres are piñon-juniper woodland reduction treatments. New Mexico, with the largest share of the global Pinyon Jay population (29.4%), has five reported treatments totaling 3,726 acres (total treatment areas were not available). Even states with fewer treatments, e.g., Arizona, with four, may be targeting large areas (1,830,859 acres total; 80,669 acres in piñon-juniper; Appendix 2).

U.S. Forest Service: Smith (2021) (Appendix 3) was able to identify five USFS woodland reduction treatments in New Mexico, for a total of 522,885 acres, 52,843 acres in piñon-juniper. Utah had five projects (1,289,996 acres, 15,823 acres in piñon-juniper). California had three projects (15,437 acres, 4,876 acres in piñon-juniper). Nevada had two projects (6,103 acres, piñon-juniper projects not broken out), and Colorado had one (34,000 acres; piñon-juniper projects not broken out).

Taken together, the total acreages of treated piñon-juniper reported by Smith (2021) suggests extensive loss of suitable Pinyon Jay habitat on federal lands. The estimated total acres of BLM treatments in all states are as much as 10,984,360 acres, of which at least 360,678 acres are piñon-juniper woodland reduction projects (Appendix 2). USFS total treatments in all states total as much as 1,868,421 acres, of which 79,645 acres are in piñon-juniper (Appendix 3). These projects represent potentially significant impacts to at least 440,000 acres of Pinyon Jay habitat.

b) Authorities for Treatments

Under various laws, regulations, policies, and procedures, both BLM and USFS have established procedures that allow sizable vegetation treatment projects to be approved without National Environmental Policy Act ("NEPA") documentation (an Environmental Assessment ("EA") or Environmental Impact Statement ("EIS")), through use of a categorical exclusion ("CE"). The following information is from Smith (2021, at 5–7), except where noted:

1. 2018 Omnibus Appropriations Act, Pub. L. 115-141, Division O, Title II, added section 505 to the Healthy Forest Restoration Act ("HFRA"). This allows a CE of up to 3,000 acres for wildfire resilience projects. Projects must be in wildland-urban interface ("WUI") areas.

2. 2018 Agricultural Improvement Act, better known as the Farm Bill (Pub. L. 115-334), in Title VIII, subtitle F Part I (section 8611) added a new Section 606 to HFRA. The amendment allows for the use of a CE for "[c]overed vegetation management activities, including those that prevent the expansion into greater sage grouse or mule deer habitat of . . . juniper, pinyon pine, or other associated conifers" on up to 4,500 acres.

3. National Environmental Policy Act Implementing Procedures for the Bureau of Land Management, 85 Fed. Reg. 79,504, December 10, 2020, amending 516 DM 11. A recent change to the Department of Interior's Department Manual ("DM") allows use of a CE for: "Covered actions on up to 10,000 acres (contiguous or non-contiguous) within sagebrush and sagebrush-steppe plant communities to manage pinyon pine and juniper trees for the benefit of mule deer or sage-grouse habitats." Covered activities include, but are not limited to, manual and mechanical cutting, mastication, yarding and piling, and pile burning. Some restrictions on use of the CE include: no cutting of old growth, no chaining, no herbicide or pesticide use, and no construction of new permanent or temporary roads. The amended provision also requires the inclusion of measures to protect various resources.

4. In late 2020, the USFS revised its NEPA procedures to allow use of a CE for projects up to 2,800 acres "with a primary purpose of meeting restoration objectives or increasing resilience" (85 Fed. Reg. 73,632, November 19, 2020).
Activities that can be approved and implemented include invasive species control and reestablishment of native species, prescribed burning, pruning, timber harvesting, and vegetation thinning. This authority does not specifically mention piñon-juniper; however, presumably it could be used in that cover type.

5. The recently passed infrastructure bill authorizes "$500 million over five years for prescribed burns, $500 million for mechanical tree harvesting and clearing in an ecologically appropriate manner, and $500 million for developing fuel breaks and control locations" (Infrastructure Investment and Jobs Act, Pub. L. 117-58, Sec. 40803(c)). Much of these funds will be used for vegetation treatment or grants to tribes and state and local governments for such treatment. Although piñon-juniper is not specifically targeted, it is likely that a sizable amount of money will be

directed at treating this cover type. Sec. 40806 creates a categorical exclusion from NEPA for the creation of fuel breaks on up to 3,000 acres of federal lands without detailed environmental analysis and public input. Under this provision, prescribed management activities such as vast timber cuts could occur without public disclosure and scrutiny. Despite the theory of utilizing these projects to reduce wildfire risk, in practice these projects are often more likely to increase fire risk. Sec. 40807 circumvents significant portions of the normal review process by broadly applying the Forest Service's "Emergency Situation Determination" authority. The provision grants "emergency" legal authority for potentially harmful activities, including salvage logging operations up to 10,000 acres, the removal of hazardous fuels, and reforestation projects. Unlike existing USFS regulations, which require the Chief or Associate Chief of the Forest Service to make an emergency situation determination, Sec. 40807 allows any Forest Service official with delegated decision-making authority from the Secretary of Agriculture to make an emergency situation determination. Both Sec. 40806 and Sec. 40807 can and likely will be used to remove more piñon-juniper habitat throughout the Pinyon Jay's range.

c) Management Responsibility for Pinyon Jays

Federal agencies have jurisdiction over the largest proportion of Pinyon Jay occupied habitat in the United States. BLM lands cover 32.28 % of the Pinyon Jay range, not accounting for habitat occupancy (Figure 6, Table 7). BLM is the primary land manager in Nevada. BLM manages 69% of the Pinyon Jay range within Nevada, or 61.27% of the entire state (Appendix 4). BLM also manages significant portions of the Pinyon Jay range in Wyoming and Utah, with 27.83% and 40.18% of each state, respectively, within the Pinyon Jay range. BLM responsibility significantly overlaps the Pinyon Jay range in all other states within the Pinyon Jay range except South Dakota, Nebraska, and Oklahoma (Appendix 4). USFS manages significant portions of the Pinyon Jay range in Colorado, New Mexico, Utah, and Wyoming (Figure 6**Error! Reference source not found.**, Appendix 4).

Together, these two agencies manage 48.9% of Pinyon Jay habitat within the bird's range (Table 7). The same two agencies operate under several authorities which allow sizable vegetation treatment projects to be approved via CE (See Section III.A.3.b) Authorities for Treatment, above). Other entities with significant management jurisdiction overlapping the Pinyon Jay range include state, private, and Tribal (Table 7).

d) Management Recommendations

Researchers are just beginning to understand negative and positive effects of management actions on Pinyon Jays and their habitats. Most published papers and reports include recommendations for management, based on current knowledge, and managers are encouraged to consult these sources, as no one-size-fits-all set of recommendations is appropriate for Pinyon Jay management in all areas (Johnson and Sadoti 2019, at 8). General management recommendations are provided in the Conservation Strategy for the Pinyon Jay (Somershoe et al. 2020, at 38–44), the Birds of the World Pinyon Jay account (Johnson and Balda 2020), the New Mexico Bird Conservation Plan Pinyon Jay account (Johnson et al. 2020b, at 7–11), and other sources. The above sources recommend against treating (thinning, burning, herbicide application, etc.) at Pinyon Jay nesting colony sites and foraging areas containing mast-producing piñon trees within the home ranges of Pinyon Jay flocks. In addition, knowledge of individual Pinyon Jay flocks, their home ranges, and habitats is necessary for designing site-specific effective management (Johnson and Sadoti 2019, at 8).

e) Woodland Management Summary

In summary, woodland reduction treatments affect extremely large swaths of piñon-juniper habitat across the Pinyon Jay range. These treatments are allowed under several authorities which exempt the BLM and USFS, the largest landholders, from NEPA documentation (EA or EIS). Several studies have documented direct impacts to Pinyon Jays and other piñon-juniper species. Although studies documenting woodland reduction impacts on Pinyon Jay populations are few, it is apparent that hundreds of thousands of acres of Pinyon Jay habitat are being significantly altered or destroyed by these management practices.

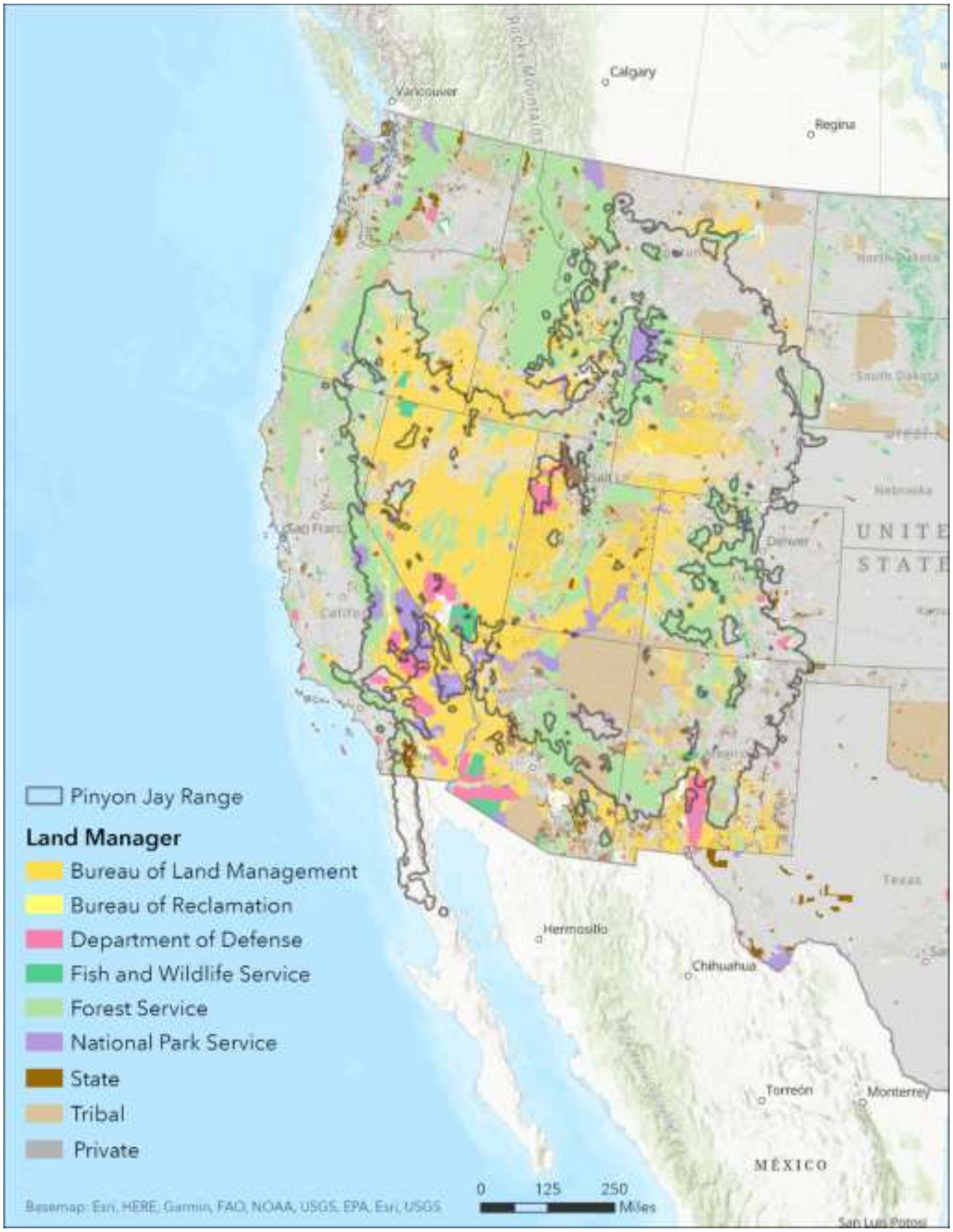

Figure 6. Management responsibility across Pinyon Jay range. CC BY Defenders of Wildlife 2021. See Appendix 1 for metadata.

4. Wildfire

In piñon-juniper systems in the Southern Rocky Mountain geographic region, a significant increase in annual area burned, number of fires per year, fire season length, and fire size have occurred from

1984 through 2013 (Board et al. 2018, at 42). Projected changes in precipitation regimes are likely to increase fire season length and tree mortality in piñon-juniper in that region (Board et al. 2018, at 40, 44–45). In the Northern and Southern Intermountain geographic regions, the size of the largest fires increased over the same period, and in the Northern Intermountain and Central Rocky Mountain geographic regions, the area of piñon-juniper burned increased significantly.

	Total Land Area in Pinyon Jay Habitat (acres)	% of Pinyon Jay Habitat (acres)
Bureau of Land Management	49,523,398	32.27
Bureau of Reclamation	357,771	0.23
Department of Defense	1,720,950	1.12
Fish and Wildlife Service	1,303,922	0.85
Forest Service	25,461,032	16.59
National Park Service	4,091,295	2.67
State	8,202,024	5.35
Tribal	13,364,696	8.71
Private	48,981,369	31.93

Table 7. Agency responsibility for management of Pinyon Jay range.

Although historical and modern fire regimes in piñon-juniper are not thoroughly understood, recent studies are increasing knowledge of this important subject. A key question is whether high intensity, stand replacing fires or low intensity surface fires are characteristic of the natural history of piñon juniper woodlands. If surface fires have decreased in piñon-juniper, as in ponderosa, then management using thinning and burning might return them to natural conditions (Floyd 2021, at 17). Recent studies, however, have concluded that evidence for frequent, low-intensity, surface fires in persistent piñon-juniper and wooded shrublands is lacking (Baker and Shinneman 2004, at 14; Romme et al. 2009, at 207–08 and references therein). In persistent piñon-juniper stands, fire rotations of 230 y to >1000 y have been reported, and fires, when they occurred, have typically been large, stand-replacing fires (studies reviewed in Floyd 2021, at 17–19). Observed fire return intervals in the Southern Rocky Mountain geographic region averaged 702 years (range 105-7000 years) from 1984-2013, (Board et al. 2018, at 39). Additional studies report fire return intervals in piñon-juniper of 290-600+ years (Romme et al. 2009, at 211), 290-340 years (Huffman et al. 2008, at 2106), and >250 years (Huffman et al. 2008, at 2103; Shinneman and Baker 2009a, at 1240).

The fuel structures of piñon and juniper savannas, however, with their grass component, could support low severity, spreading fires (Romme et al. 2009, at 210), and recent evidence supports this idea (Margolis 2019, at 26). Fire return intervals in wooded shrublands are shorter than in persistent piñon-juniper and likely longer than in savannas, about 100 years (Floyd et al. 2000, at 1678–79; 2004, at 282), but are still longer than in ponderosa pine woodlands.

Regeneration after stand-replacing wildfires in these cover types occurs very slowly, over decades or centuries, and the original communities may not return (Floyd 2021, at 18). At Mesa Verde National Park, in burned areas where shrubs were previously common, communities stabilized soon after fire; however, they lacked piñon and juniper elements. In old growth stands having species that regenerate after fire via seeding, climatic changes resulted in the post-fire establishment of novel plant communities dominated by invasive species (Floyd et al. 2021, at 36). In summary, recent drought conditions have been associated with increased severity and frequency of wildfires in piñon-juniper cover types, which have pushed them away from their native disturbance regimes. As a result, these cover types may regenerate only very slowly, or in some cases not at all.

Current management typically aims to reduce wildfire risk or return piñon-juniper woodlands to a presumed natural condition. Thinning methods include "chaining treatments (dragging a boat anchor chain attached to two bulldozers across a stand, which uproots and kills trees) . . . [h]ydro-ax (full mastication of trees using an articulating mower)[,] and roller-chop (crushing of trees with a heavy bladed drum attached to a bulldozer)" (Bombaci and Pejchar 2017, at 364). Thinning treatments are sometimes combined with burning. Although severe thinning may reduce the spread of wildfire, these cover types have never had frequent fire as a natural disturbance, and it does not result in a return to natural condition in persistent piñon-juniper woodlands (Romme et al. 2009, at 203, 214).

The few studies aimed at understanding the impact of wildfire mitigation practices on wildlife have found various taxa, including Pinyon Jays, to be affected. In Colorado, a study of bird and small mammal habitat use in areas treated with chaining, roller-chop, and hydro-ax, found that habitat use by dense and open woodland bird species was significantly lower in all woodland reduction treatment plots than in control plots, and that use was positively associated with tree cover. No bird or small mammal species responded positively to all woodland reduction treatments, and some birds responded negatively (Bombaci and Pejchar 2016, at 39–40). In part of a traditional Pinyon Jay nesting colony site in persistent piñon-juniper woodland in New Mexico, 87% of trees were removed. Pinyon Jays abandoned former nest sites in the thinned area, but continued to nest in surrounding, un-thinned areas (Johnson et al. 2018, at 4–6). In Colorado, thinning treatments reduced occupancy of conifer obligates. Occupancy of two piñon-juniper specialists decreased at the landscape scale, while Pinyon Jay occupancy was reduced at the local scale (Magee et al. 2019, at 6, 10). These studies emphasize that piñon-juniper treatments impact wildlife and their habitats, including Pinyon Jays.

5. Invasive Species

Disturbances such as wildfire, grazing (Shinneman and Baker 2009b, at 191, 200), and fuels reduction (Havrilla et al. 2017, at 617), can create conditions for invasive species such as cheatgrass (*Bromus tectorum*) and musk thistle (*Carduus nutans*) to establish in piñon-juniper woodlands (Floyd 2021, at 20–21). "Cheatgrass, a non-native annual grass, dominates [approximately 20] million[] hectares in semiarid ecosystems of the Inter mountain West" (Shinneman and Baker 2009, at 191). It alters disturbance, hydrology, and nutrient dynamics (Melgoza et al. 1990, at 11–12; D'Antonio and Vitousek 1992, at 74–75; Evans et al. 2001, at 1306) and can out compete native plants for water and nutrients (Booth et al. 2003, at 41–42, 44–45; Melgoza et al. 1990, at 11–12). Perhaps most threatening to piñon-juniper vegetation, it is an annual that dies by late spring to early summer, leaving highly flammable litter and standing dried biomass, which increases fire size and shortens fire rotation intervals. This can create a cycle by which cheatgrass invasion is further encouraged, leading to additional fire risk, and so on (D'Antonio and Vitousek 1992, at 74–75). Increased wildfire incidence can prevent normal recovery of piñon-juniper vegetation and cause habitat fragmentation, replacing once-continuous stands with smaller stands separated by openings dominated by cheatgrass (Gillihan 2006, at 13).

6. Management for Other Wildlife Species

Management of piñon-juniper habitats for other wildlife species such as the mule deer (*Odocoileus hemionus*; Kramer et al. 2015, at 30, 33) and Greater Sage-Grouse is becoming common (Bombaci and Pejchar 2016, at 40). Management for Greater Sage-Grouse in the Great Basin is an example of how management for other species can affect Pinyon Jay conservation (Boone et al. 2018, at 190–191). While the Pinyon Jay's rate of decline exceeds that of the Greater Sage-Grouse (Boone et al. 2018, at 190), management of piñon–juniper woodlands in the Great Basin is currently driven by the prioritization of protecting and creating sagebrush shrublands to benefit the sage-grouse. "Where piñon–juniper woodland mixes with sagebrush, the predominant management is the removal of trees from selected areas, most typically along the woodland's lower margin where it abuts or intergrades with sagebrush shrubland" (Boone et al. 2018, at 191). Pinyon Jays in the Great Basin typically concentrate their activities in these wooded shrublands; hence tree removal significantly impacts their habitat (Boone et al. 2021, at 20).

Pinon-juniper is also managed to increase habitat for big game species (Kramer et al. 2015, 30, 33). Thinning piñon-juniper is thought to improve mule deer habitat (Bender et al. 2013, at 55–56) and increase preferred forage species (Kramer et al. 2015, 30, 33).

7. Development

a) Historical Mining and Farming

Some types of historical human development may have greatly impacted Pinyon Jay populations. An estimated 400,000 to 525,000 acres of piñon woodlands were consumed for mine construction and charcoal production during the Nevada silver mining boom of 1859-1880 (Lanner 1981, at 180–81). Clearcutting of these woodlands slowed after the decline of the mining industry, and many areas have recovered, but millions of Pinyon Jays may have died because of these policies (Johnson and Balda 2020). In the 1950s, large areas in southwestern Colorado were clearcut for farming of pinto beans, and these areas remain in cultivation (Lanner 1981, at 131–32).

b) Oil and Gas

Recent and current oil and gas development may affect Pinyon Jays. Although they appear to be tolerant of some noise near nesting colonies, Pinyon Jays avoid nesting close to oil and gas wells, which produce constant noise that may interfere with vocal communication crucial to this highly social species (Johnson et al. 2013, at 30; Kleist et al. 2018, at E649, E653–54). Noise from natural gas wells in a piñon-juniper woodland in northern New Mexico produced PTSD-like symptoms in cavity-nesting birds, increasing stress hormones and reducing fitness (Kleist et al. 2018, at E650).

c) Urban Development

The WUI is an area where urban development expands into private and public woodlands. Since the 1970s, low-density residential development at the WUI has expanded, with accompanying challenges, including increases in invasive species, loss of wildlife habitat, and water and air pollution (Theobold and Romme 2007, at 340). The estimated WUI area nationwide in 2000 was 465,614 km^2 and was predicted to grow to 513,670 km^2 by 2030. The top six states of greatest predicted WUI expansion from 2000 to 2030 were Nevada, Arizona, Colorado, Montana, Utah, and Idaho (Theobold and Romme 2007, at 349), all states inhabited by Pinyon Jays. Given wildfire threats to human infrastructure in WUI areas, wildfire mitigation treatments such as those described above are bound to increase as climate change increases wildfire frequency and severity.

d) Renewable Energy

Wind turbines can impact birds both directly, through fatalities due to collisions with turbines, and indirectly, through habitat loss, avoidance behavior, and increased predation (Schuster et al. 2015, at 308, 310–11). Most direct impacts of wind turbines to birds have been documented in large-bodied orders such as Accipitriformes (hawks, eagles, vultures), Falconiformes (falcons), Strigiformes (owls), and Ciconiiformes (herons), but some studies have documented impacts to other orders in shrublands and woodlands, e.g., mortalities from collisions with turbine blades, altered flight behavior, and impacts to habitat use and bird abundance (Schöll and Nopp-Mayer 2021, at 6–8).

A study using BBS data and USGS data on wind turbines in fixed effects models assessed the effects of wind turbines on bird abundance across the United States. The study found that establishment of one additional wind turbine leads to the disappearance of about three breeding birds with an aggregate annual impact on 151,630 birds (Miao et al. 2019, at 364). An estimated 134,000 to 230,000 annual mortalities of small passerines occur in the United States and Canada from collisions with wind turbines, including 25 among small corvids (Erickson et al. 2014, at 12, 8). Another study estimated wind energy developments are responsible for annual avian mortalities of 140,000-573,000 (Walston et al. 2016, at 411). Although impacts of wind turbines on Pinyon Jays have not been specifically documented, the evidence for impacts to woodland birds and small corvids suggests that such impacts are likely in Pinyon Jays, as in other woodland species. Given that Pinyon Jays range widely over very large home ranges covering a variety of habitats and all seasons, the potential impact of wind turbine arrays on Pinyon Jays should be considered. However, more data is necessary to evaluate the possible effects of wind energy.

Solar power plants also result in avian mortality, primarily from collisions. In a study of five concentrating solar power plants in three countries, the highest levelized avian mortality rate for the first year of operation, before mitigation measures and deterrents were implemented, was 0.7–3.5 fatalities per GWh. This is less than the levelized avian mortality reported for fossil fuel plants but greater than that for nuclear and wind power plants (Ho 2016, at 070017-7). Utility-scale solar energy ("USSE")-related annual avian mortality in southern California was estimated to be from 16,200–59,400 birds. The estimate extrapolated to all USSE facilities in the United States installed or under construction was 37,800–138,600 (Walston et al. 2016, at 411). Unmitigated solar plants may pose a potential threat to Pinyon Jays, as well as to other bird species.

e) Various Infrastructure

Walston et al. (2016, at 411) also provided annual avian mortality estimates in the United States from various other sources: fossil fuel power plants, 14.5 million; communication towers, 4.5–6.8 million; roadway vehicles, 89–340 million; and buildings and windows, 365–988 million. These reviews provided no specific mortality rates for Pinyon Jay (or other bird species), but estimates of avian mortalities from collisions with many types of human infrastructure are extremely high.

8. Agricultural Practices

Clearing piñon-juniper woodlands to make way for agricultural crops has historically removed hundreds of thousands of acres of Pinyon Jay habitat. "In the 1920s and 1930s, about 200,000 acres (89,000 ha) of piñon-juniper woodland in southwestern Colorado and an adjacent part of Utah were converted to farmland" (Gillihan 2006, at 7–8).

a) Grazing

A larger agricultural impact on piñon-juniper habitats has been management for the livestock industry. Livestock grazing began to drive management in piñon-juniper woodlands in the 1950s. Practices such as chaining and hydro-ax-type machines were used to remove trees on a massive scale. Between 1950 and 1964, an estimated "three million acres of woodland were converted to pasture[, and] between 1960 and 1972, over a third of a million acres were chained by [USFS and BLM] in Utah and Nevada alone" (Lanner 1981, at 132–33).

A hypothesis of region-wide invasion of piñon and juniper trees has been cited as justification for removal of these trees, but this idea has been challenged (Lanner 1981, at 133–35, Romme et al. 2009, at 215). The invasion argument has been supported by old photographs showing treeless areas. However, these photos may record slopes previously deforested for lumber, firewood, etc. Only when the extent of early deforestation has been established will it be possible to know if young stands of piñon and juniper are the result of reestablishment or invasion into new areas (Lanner 1981, at 135). Infill and expansion of juniper into shrublands has been attributed to grazing legacies (Floyd 2021, at 22–23), but few studies directly test that assumption in different types of piñon-juniper woodlands that vary in understory components (Floyd 2021, at 23; Romme et al. 2009, at 214–16).

Grazing can result in trampling, reduced capacity for water infiltration, and destruction of biological soil crusts in piñon-juniper woodlands (Fleischner 1994, at 633–34). When trees are removed to increase livestock forage on sites that lack a viable seed source, cheatgrass or other exotics can more easily invade. "Cutting followed by pile burning leads to dead zones in the soil [which can be] easily invaded by exotics" such as cheatgrass (Gillihan 2006, at 11).

Cheatgrass is a fine surface fuel, which may make fires in piñon-juniper woodlands more likely to spread, thus shortening fire intervals. Shorter-than-historical fire intervals can reduce the likelihood that piñon and juniper re-establish (Floyd 2021, at 23–24) and cause habitat fragmentation, replacing once-continuous stands with smaller stands separated openings dominated by cheatgrass (Gillihan 2006, at 13). This can lead to a cycle by which cheatgrass invasion is further encouraged, causing additional fire risk, and so on (D'Antonio and Vitousek 1992, at 74–75).

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There is little or no evidence that overutilization of Pinyon Jays occurs from commercial, recreational, scientific, or educational purposes.

C. Disease or Predation

1. Disease

West Nile Virus ("WNV") is a mosquito-borne virus that infects over 300 bird species, causing some individuals, especially crows and jays, to sicken and die. WNV has been detected in dead Pinyon Jays (https://www.cdc.gov/westnile/dead-birds/index.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fwestnile%2Ffaq%2FdeadBirds.html). Little is known about the incidence of WNV in wild Pinyon Jays or how much the virus might have contributed to Pinyon Jay population declines (Johnson and Balda 2020), but it appears to be a potential risk factor which should be investigated.

A few external parasites have been collected when Pinyon Jays were dusted prior to entering the laboratory (Johnson and Balda 2020), and the species has been identified as a host for the chewing louse *Philopterus phillipi* (Johnson and Balda 2020). Nesting females often probe the nest, possibly to remove larvae of a blood-sucking fly in the family *Calliphoridae*. These flies lay their eggs in the nostrils of nestlings and obtain their first blood meal from the nestling's nasal tissues. The larvae eventually drop to the nest floor and burrow up to attach to the nestlings' bellies to obtain blood meals, then drop back into the nest lining. Nesting females capture these larvae and presumably eat them. Johnson and Balda (2020) speculate that the effect of these parasites on growth and development must be substantial.

2. Predation

Predation was a major cause of nest failure in a Pinyon Jay population (Marzluff 1985, at 558). American Crow (*Corvus brachyrhynchos*) and Common Raven (*C. corax*) are significant predators on Pinyon Jay nestlings (Johnson and Balda 2020). Incubating and brooding females are taken off the nest at night by Great Horned Owls (*Bubo virginianus*). Northern Goshawks (*Accipiter gentilis*) also take adults and fledglings (Marzluff and Balda 1992, at 46), as do Peregrine Falcons (*Falco peregrinus*, K. Johnson pers. comm.).

D. The Inadequacy of Existing Regulatory Mechanisms

BBS and PIF assessments indicate that the Pinyon Jay is the fastest-declining bird species of piñon-juniper habitats (Boone et al. 2018, at 190). Although the Pinyon Jay's rate of decline exceeds that of the Greater Sage-Grouse, which is a target of significant conservation efforts, no comprehensive effort has been implemented to conserve the Pinyon Jay (Boone et al. 2018, at 195).

1. Federal Regulations

a) The Migratory Bird Treaty Act

The Pinyon Jay is federally protected under the MBTA (50 C.F.R. §10.13(c)(1)). The MBTA prohibits the hunting, killing, capturing, trading, and incidental taking of the species (16 U.S.C. § 703)(a)). However, the MBTA does not provide protection for the Pinyon Jay's habitat.

b) Other Federal Protections

Several federal agencies recognize Pinyon Jay as a species of conservation concern or priority (See Section II.G.3, Status, above, for details). The FWS includes the Pinyon Jay on its Birds of Conservation Concern 2021 list, both continentally and in all 10 BCRs where it occurs (USFWS 2021). This list identifies the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities for FWS. Bird species of conservation concern are those that "without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973" (16 U.S.C. § 2912(a)(3)). For bird species of conservation concern, FWS must "identify conservation actions to assure that species, subspecies, and populations of migratory nongame birds [of conservation concern] do not reach the point at which the measures provided pursuant to the Endangered Species Act of 1973 . . . become necessary" (16 U.S.C. § 2912(a)(4)). However, conservation actions are not mandatory.

The Pinyon Jay is a DoD Partners in Flight Mission Sensitive Species (DoD Partners in Flight Mission-Sensitive Species Working Group 2021, at 2) and a state-level BLM sensitive species in Idaho, New Mexico, and Nevada (See link in II.G.3 Status, above).

Most agencies are required to consider species of conservation concern in their management planning, but these species have no legal protections. Federal land managers have been known to violate their agency's policies regarding these species. For example, a BLM Field Office in New Mexico severely thinned the site of a traditional Pinyon Jay nesting colony, despite the species status as a New Mexico BLM Sensitive Species (Johnson et al. 2017c). The Pinyon Jays abandoned the treated site but continued to nest in the surrounding, untreated area (Johnson et al. 2018).

Smith (2021, at Appendix 1) summarized 64 BLM and 17 USFS past, ongoing, or planned treatments in piñon-juniper woodlands. All except two or three of the projects examined were documented or were proposed to be documented with an EA or CE. Many BLM projects were documented with a Determination of NEPA Adequacy ("DNA"). A DNA certifies that the responsible official believes the impacts of the project have been adequately disclosed in an existing EA or EIS, obviating the need to prepare a new NEPA document. Even very large projects were conducted or proposed to be conducted with only a programmatic EA. The inconsistency in environmental reviews of these projects suggests that either national environmental review policies may be unclear/imprecise or agencies may not be adhering to them. See also Section III.A.3.b) Authorities for Treatments, below.

2. State Regulations

Despite negative population declines in every state (Table 3), Pinyon Jays are not legally protected in any state. The species is listed as a Species of Greatest Conservation Need ("SGCN") in seven states, but six state wildlife agencies within its regular range (excluding vagrants) do not officially recognize its need for conservation (Table 8**Error! Reference source not found.**). Species listed as SGCN are recognized as declining or otherwise vulnerable, but they are not legally protected in any state.

3. International Protections

Pinyon Jays are listed as Vulnerable on the IUCN Red List of Threatened Species, which means that it faces a high risk of extinction in the medium-term future (Birdlife International 2020). However, no legal protection comes with this international recognition. Pinyon Jays are not listed on Appendix I, II, or III of the Convention on International Trade in Endangered Species (CITES 2021).

The Pinyon Jay is internationally protected under the Convention for the Protection of Migratory Birds and Game Mammals between Mexico and the United States (Mexico Treaty Webpage 2022), which is implemented in the United States by the MBTA. Like the MBTA, the treaty does not protect the Pinyon Jay's habitat.

State/Region	SGCN	NatureServe State Rank
Global		Vulnerable
Arizona	x	Vulnerable
California		No State Rank
Colorado	x	Vulnerable
Idaho	x	Vulnerable
Montana	x	Vulnerable
Nebraskia	x	Vulnerable
New Mexico	x	Imperiled
Nevada	x	Vulnerable
Oklahoma		Imperiled
Oregon		Vulnerable
South Dakota		Apparently Secure
Texas		No State Rank
Utah		Apparently Secure
Washington		No State Rank
Wyoming		Secure

Table 8: State conservation priorities for Pinyon Jay (Somershoe et al. 2020). SGCN=Species of Greatest Conservation Need. NatureServe ranks from NatureServe (2021).

E. Other Natural or Manmade Factors Affecting Continued Existence

Which threat factors are the most influential in the Pinyon Jay's decline is unclear, but two appear to have the greatest potential impact. Both are primarily impacts to Pinyon Jay habitat: climate and woodland management (see Section III.A Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range, above).

1. Climate Change

The United Nations Intergovernmental Panel on Climate Change's special report on global warming demonstrated that we are already seeing the consequences of 1°C of global warming above preindustrial levels (IPCC 2018). Such consequences include more extreme weather and temperatures; droughts, wildfires, and flooding; on land, impacts on biodiversity and ecosystems, including species loss and extinction; and other changes (IPCC 2018, at 7–10). Continued warming of 1.5°C or higher will cause long-lasting or irreversible changes to natural habitat and ecosystems

(IPCC 2018, at 5). Limiting global warming would require a rapid and significant decline in human-caused greenhouse gas emissions as well as the removal of carbon dioxide from the air (i.e., carbon capture and storage) (IPCC 2018, at 15). While some nations are taking actions to reduce emissions, there is no imminent solution to global climate change or the negative effects of global warming on the Pinyon Jay. Climate change represents a significant manmade threat to piñon and juniper species that will increase the likelihood of the Pinyon Jay extinction.

a) Direct Effects on Habitat

i. Climate Effects on Piñon-Juniper

The majority of piñon trees die when precipitation drops below a threshold of 600 mm and vapor pressure deficits are greater than 1.7kPa (Clifford et al. 2013, at 418–19). A combination of carbon starvation, hydraulic failure (Plaut et al. 2012, at 1610), and insect infestations have caused piñon death (Gaylord et al. 2015, at 814). Piñons and junipers respond differently to drought and temperature impacts. Piñon stomata respond by closing when soil water potential becomes too low or when the atmosphere is too dry, a response called isohydry. Juniper, in contrast, exhibits anisohydry, where stomata can remain open despite extreme drought stress. Open stomata are required for carbon uptake and growth, hence closure due to drought can result in carbon starvation, affecting piñon growth and potentially resin production. Hotter droughts have affected the two trees differently. Until recently, piñon trees appeared to be most affected by climate changes, causing shifts from piñon to juniper dominance in some areas (Mueller et al. 2005, at 1091; Clifford et al. 2011, at 950; Redmond et al. 2015, at 7). However, junipers (*J. monosperma*, *J. osteosperma*, *J. deppeana*) are increasingly showing uncharacteristic decline after the 2018 drought in southeastern Utah (Kannenberg et al. 2021, at 5–6) and more recently in southwestern Colorado, northeastern Arizona, north of Flagstaff Arizona (Floyd 2021, at 26), and New Mexico (Campos-Marquetti and Ginter 2016).

Recent climate models predict distributional changes of piñon-juniper woodlands (Thompson et al. 1998, at 16–18; Cole et al. 2008b, at 327) and widespread mortality among needleleaf evergreen trees is predicted across the southwestern United States by 2100 (McDowell et al. 2015). Large-scale increases in piñon pine mortality rates over the last 20 years have been associated with climate change (Mueller et al. 2005, at 1086, 1090; Breshears et al. 2005, at 15147; 2008, at 188; Adams et al. 2009; Clifford et al. 2013, at 413; Meddens et al. 2015, at 96; see Shaw et al. 2005). Also reported are climate-associated reductions in canopy cover (Clifford et al. 2011, at 953–56), declines in piñon nut production (Redmond et al. 2012, at 6–11; Wion et al. 2019, at 6), and reductions in piñon tree vigor (Johnson et al. 2017c). Larger piñon trees and trees in higher stand densities appear to be more susceptible to drought (Mueller et al. 2005 at 1087; Greenwood and Weisberg 2008, at 2134; Johnson et al. 2017b, at 8).

Drought-induced mortality of larger piñon trees results in "increased juniper dominance and a shift in age structure of the remaining pinyon pines" (Mueller et al. 2005, at 1091). Because piñon trees are slow growing, these changes in stand dynamics may be long-term and may prevent or delay return to pre-drought conditions (Mueller et al. 2005, at 1091).

In addition to mortality of individual trees and entire stands, climate affects the reproductive success of remaining trees, and piñon cone production has apparently declined in recent decades (Wion et al. 2019, at 3, 10). Mast crops in piñon trees have historically occurred one to three times in ten years and have been associated with cool late summer temperatures (Forcella 1981, pg. 488–89). Masting events have also been attributed to the preceding years having low vapor pressure deficits and high precipitation, while low cone production apparently occurs in drier years (Wion et al. 2019, at 6–7).

Masting has declined by 40% since 1974 in stands in New Mexico, in association with rising temperatures (Redmond et al. 2012, at 7–9).

An additional threat to piñon sustainability of these woodlands is a precipitous decline in seedling recruitment since the early 1990s, likely an outcome of lower cone and seed production. Seedling densities were significantly lower on drought versus pre-drought samples on historical plots at Mesa Verde National Park, Colorado (Floyd et al. 2015, at 24). A study near Flagstaff, AZ found declines in piñon juvenile densities after a multiyear drought, due to limited new recruitment and greater than 50% juvenile mortality (Redmond et al. 2015, at 2, 5–6).

ii. Climate Effects on Other Woodland Types

Other woodland types inhabited by Pinyon Jays have experienced the impacts of climate change. In New Mexico, significant mortality increases occurred in un-thinned ponderosa pine woodlands, associated with lack of rain and snow and increases in daily minimum temperatures (Oswald et al. 2016, at 11–13). Ponderosa pine seedlings may be sensitive to temperature fluctuations (Petrie et al. 2016, at 334). Climate changes reduce suitability for ponderosa pine recruitment, such that warming combined with increased fire frequency may impact species distributions through fire-catalyzed vegetation shift (Davis et al. 2020, at 8–9). In one modeling study, post-fire ponderosa pine woodlands on the dry end of the climate envelope were predicted to experience severe reduction in regeneration (Feddema et al. 2013, at 64). In a study of Jeffrey pines in western Nevada, climate correlated with small tree size, slow growth rates, and higher insect seed predation. Filled seeds per cone and seedling survival were greater at higher elevations. These demographic patterns predict a Jeffrey pine distribution shift up slope, driven by climate change (Gworek et al. 2007, at 66).

b) Indirect Effects on Habitat

Increased frequency and severity of wildfire is a major indirect effect of climate change on piñon-juniper ecosystems (Floyd et al. 2004, at 286; Miller et al. 2019, at 69–70, 80–81). Impacts of wildfire on these habitats are discussed in III.A.4 Wildfire, above.

Prolonged drought facilitates outbreaks of Ips beetles (*Ips confusus*) causing mortality of *P. edulis* and *P. monophylla* (Shaw et al. 2005, at 283; Clifford et al. 2008, at 39). Recent outbreaks in northern New Mexico killed over 90% of piñon trees in some stands (Breshears et al. 2005, at 15146–47). Larger, older piñon trees, which generally produce more piñon cones, are more susceptible to mortality by Ips beetles (Clifford et al. 2008, at 43; Greenwood and Weisberg 2008, at 2134), and greater stand density and tree diameter are predictive of Ips-related crown mortality (Greenwood and Weisberg 2008, at 2134).

Piñon trees have biotic associations with many other species: seed dispersers such as the Pinyon Jay and other bird and mammal species, mutualism with ectomycorrhizas, and protection by nurse plants (Mueller et al. 2005, 1089–91). First, the loss of avian seed dispersers can negatively affect piñon recruitment. When cone crops were reduced by 57% due to chronic insect infestations, bird dispersers abandoned individual piñon trees and stands (Christensen and Whitham 1993, at 2270). Second, piñon trees require a mutualism with ectomycorrhizal fungi for successful establishment. Juniper dominated sites have lower levels of soil ectomycorrhizae than co-dominant and piñon-dominated sites (Haskins and Gehring 2005, at 126), and mature piñons in high-mortality sites supported 50% lower levels of ectomycorrhizal colonization and fungal species richness than low-mortality sites (Swaty et al. 2004, at 1077, 1080–81). Reduced fungal recruitment will likely limit recruitment of piñon seedlings in sites where piñon density has been reduced by climate-related mortality (Mueller et al. 2005, at 1091). Finally, nurse plants facilitate piñon establishment in harsh environments (Chambers 2001, at 27). Tree fall in areas of high piñon mortality or extensive thinning could reduce facilitation of piñon seedlings (Mueller et al. 2005, at 1091; see Redmond et al. 2015, at 6–9).

c) Climate Effects on Pinyon Jays

i. Food Acquisition

Pinyon Jay reproductive success is tied to piñon pine mast crops. In a study in Magdalena, NM, Pinyon Jay reproductive success was very high when piñon seeds were abundant and much lower at other times (Ligon 1978, at 113). In Arizona, large pine crops significantly increased Pinyon Jay productivity at several stages of the nesting cycle: number of nestlings, number of fledglings, hatching success, fledgling success, and juvenile survival (Marzluff and Balda 1992, at 209–10, 262–66). A more recent study in New Mexico found a similar relationship between size of cone crops and nesting success (Johnson and Smith 2008, at 15). Given the clear relationship between Pinyon Jay reproductive success and piñon seed availability, the significant decline in cone crops (see III.E.1.a) Climate Change, Direct Effects on Habitat, above) has likely affected Pinyon Jay populations in areas of declining piñon productivity.

ii. Nesting

Drought and increased temperatures also reduce vigor and increase mortality of piñon trees, which can severely reduce suitability of nesting habitat. Larger piñon trees and areas with higher stand densities tend to have higher drought-related mortality and lower vigor (Greenwood and Weisberg 2008, at 2134; Johnson et al. 2017b, at 8). As Pinyon Jays nest in larger than average trees within patches of higher tree density (see Section II.E Habitat and Range, above), drought-related tree mortality particularly reduces the availability of the most suitable nest sites. In response to recent piñon tree mortality in traditional nesting areas, Pinyon Jays have abandoned traditional piñon-juniper sites and nested instead in juniper woodland and savanna sites (Johnson et al. 2021a, at 8; Novak et al. 2021, at 4–5).

Trees with higher vigor, defined as foliage lushness and greenness, provide better cover for nests and are preferred Pinyon Jay nest sites. Reduced winter precipitation is associated with lower tree vigor. Pinyon Jays in an area of New Mexico that experienced reduced winter precipitation and associated reductions in tree vigor twice moved their colony site from areas of declining tree vigor to areas of higher vigor (Johnson et al. 2017b, at 8).

iii. Water Availability

Pinyon Jays have been documented using wildlife waterers and other water sources, and some recent evidence suggests that Pinyon Jays nest near water sources (Petersen et al. 2014, at 17; Johnson et al. 2017a, at 28, 33; Johnson et al. 2021a, at 9). The decline of surface water sources in the Southwest under climate change (Seager et al. 2013, at 485) could require Pinyon Jays to fly farther for water or reduce the number of suitable nesting areas with access to water.

2. <u>Additional manmade factors</u>

Extensive piñon seed harvesting, especially for commercial use, could impact this important food source for Pinyon Jays (Somershoe et al. 2020, at 27). Piñon seeds are highly sought after because of their high commercial value, and overharvest may reduce piñon seed availability for Pinyon Jays.

Additionally, commercial harvest methods may damage trees and soil in piñon-juniper woodlands, reducing overall piñon pine productivity.

F. Synergistic Effects

The synergistic effects of the threats discussed above could cause the extinction of the Pinyon Jay. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction" (Brook et al. 2008, at 457). The Pinyon Jay, as a habitat obligate, is particularly vulnerable to the synergistic impacts of threats affecting its habitat. Although some stressors in isolation may not, on their own, significantly increase the extinction pressure that the Pinyon Jay faces, the synergistic impacts of multiple threats to the species likely increase the extinction pressure that it faces.

While Pinyon Jay population declines are well documented, the exact cause of declines remains unclear. In the Pinyon Jay's case, multiple threat factors interact to cause negative impacts on the species. Not only is it difficult to tease apart the effects of interacting factors, together they create even greater threats through positive feedbacks. Several examples, based on the threats detailed and referenced above, follow. Individual threats are underlined.

1. Treatments open the woodlands to cheatgrass invasion, which increases fire severity and frequency in former persistent piñon-juniper woodlands. Fire allows further increases in cheatgrass, which leads to increased fire risk. Increased fire frequencies can slow or prevent woodland recovery.
2. Grazing, likewise, can allow for cheatgrass invasion, increased fire, additional cheatgrass, increased fire, and so on.
3. Wildfire leads to cheatgrass invasion, increased fire potential, and so on.
4. Drought and increased temperatures lead to lowered piñon reproduction (smaller, infrequent piñon crops). Lower piñon reproduction affects Pinyon Jay populations, which negatively affects potential for piñon seed dispersal and woodland establishment.
5. Thinning treatments reduce the number of seed producing piñon trees, which affects Pinyon Jay population viability, and negatively affects potential for piñon seed dispersal and woodland establishment.
6. Climate change negatively impacts piñon reproduction (seed crops), and Pinyon Jays shift their nesting activities to later in the spring when insects become available. Juveniles must enter winter, when flocks travel widely, at a younger age and without seed caches to sustain them.
7. Climate change negatively impacts piñon seed crops, and adults already weakened by breeding may experience food shortage and suffer greater post-breeding mortality.
8. Climate change reduces tree vigor, reducing suitability of nesting habitat, and increasing nest predation. Decreased reproductive success is a component of population viability.
9. Thinning treatments and drought reduce piñon tree density, which affects stand structure, which can reduce piñon establishment by seed dispersers, ectomycorrhizae, and nurse plants.

As these examples demonstrate, successful conservation of the Pinyon Jay requires addressing and ameliorating multiple threats simultaneously.

IV. CRITICAL HABITAT DESIGNATION

This Petition requests that FWS designate critical habitat, to the extent prudent and determinable, for the Pinyon Jay concurrently with a final ESA listing pursuant to 16 U.S.C. § 1533(b)(6)(C); 50 C.F.R.§ 424.12. The definitions of the terms "critical habitat" and "conservation" indicate that, in designating critical habitat, FWS must consider these species' ultimate recovery, and not just survival, as a primary purpose of critical habitat designation. *See* 16 U.S.C. § 1532(5)(A) (defining critical habitat to include both occupied and unoccupied habitat that is "essential for the conservation of the species"); 16 U.S.C. § 1532(3) (defining "conservation" as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are longer necessary"). Accordingly, if critical habitat is designated for the Pinyon Jay, it should include all the areas currently or potentially inhabited by the species, and a sufficient amount of other potentially suitable habitat in the United States, to allow the species to recover from its endangered, or threatened, status.

V. PROTECTIVE REGULATIONS FOR THREATENED SPECIES

Pursuant to 50 C.F.R. § 424.14(j), if FWS determines to list the Pinyon Jay as threatened, we petition the agency to promulgate a 4(d) rule to confer full take protections on the species concurrent with final listing. Given the Pinyon Jay's declining status, the existing regulatory mechanisms that have proven inadequate to conserve the species, and with the increasing threats facing the species, in particular habitat destruction and modification, the Pinyon Jay should receive full protection under the ESA to ensure its conservation.

Take protections are paramount to the Pinyon Jay's recovery. Take, as defined by the ESA, "means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. § 1532(19). FWS further defines "harm" to mean "an act which actually kills or injures wildlife . . . include[ing] significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 C.F.R. § 17.3). As mentioned above, habitat modification and degradation are the largest threats facing the Pinyon Jay. While federal agencies manage a majority of the lands within the Pinyon Jay's range, more than 31% of the lands within the Pinyon Jay's range are privately owned and managed (Table 7). Therefore, reducing habitat loss on private lands is vitally important for conserving the Pinyon Jay. A 4(d) conferring full take protections on the Pinyon Jay would prevent non-federal landowners from significantly modifying Pinyon Jay habitat without a permit. Therefore, if the Pinyon Jay or any DPS thereof is listed as threatened, the species will require a 4(d) rule that confers full protections under the ESA. Those protections are necessary and advisable to provide for the conservation of the Pinyon Jay.

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APPENDICES

Appendix 1. Metadata for figures. Figures CC By Defenders of Wildlife.

BCRs on Figures 1 and 5:

- BCRs Shapefile
  Bird Studies Canada and NABCI. 2014. Bird Conservation Regions. Published by Bird Studies Canada on behalf of the North AMericn bird conservation Initiative. https://www.birdscanada.org/bird-science/nabci-bird-conservation-regions Accessed 20 July 2021.

Pinyon Jay range on Figures 1, 2, 3, and 8:

- Pinyon Jay Range
  - eBird Status and Trends Products: Used smoothed range map at 9 km resolution
    - Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, O. Robinson, S. Ligocki, W. Hochachka, C. Wood, I. Davies, M. Iliff, L. Seitz. 2020. eBird Status and Trends, Data Version: 2019; Released: 2020. Cornell Lab of Ornithology, Ithaca, New York. https://doi.org/10.2173/ebirdst.2019
  - Modified based on occurrence point data downloaded from eBird on 7/21/2021

Pine species map, Figure 2:

- Pine Species:
  - *Pinus flexilis:* Little, E.L., Jr., 1971, Atlas of United States trees,volume 1, conifers and important hardwoods: U.S. Department of Agriculture Miscellaneous Publication 1146, 9 p., 200 maps.
  - *P. jeffreyi:* Little, Elbert L., Jr. 1971. Atlas of United States trees. Volume 1. Conifers and important hardwoods. Miscellaneous Publication 1146. Washington, DC: U.S. Department of Agriculture, Forest Service. 9 p., illus. [313 maps, folio].
  - *P. ponderosa:* Little, Elbert L., Jr. 1971. Atlas of United States trees. Volume 1. Conifers and important hardwoods. Miscellaneous Publication 1146. Washington, DC: U.S. Department of Agriculture, Forest Service. 9 p., illus. [313 maps, folio].
  - *P. monophylla:* Kenneth L. Cole, George Ferguson, John Cannella, Richard Spellenberg, Andrew Sanders, Samantha Arundel, and James Riser. (2003). Range Map of Single-Needle Pinyon Pine (Pinus monophylla)
  - *P. edulis:* Kenneth L. Cole, John Shaw, John Cannella, Kirsten E. Ironside. (2006). Range Map of Colorado Pinyon Pine (Pinus edulis), Edition 2
  - *P. fallax:* Kenneth L. Cole, George Ferguson, John Cannella, Richard Spellenberg, Andrew Sanders, Samantha Arundel, and James Riser. (2003). Range Map of Arizona Singleleaf Pinyon Pine (Pinus edulis var. fallax-type)

Juniper species map, Figure 3:

- Juniper Species: Little, Elbert L., Jr. 1971. Atlas of United States trees. Volume 1. Conifers and important hardwoods. Miscellaneous Publication 1146. Washington, DC: U.S. Department of Agriculture, Forest Service. 9 p., illus. [313 maps, folio].
  - *Juniperus monosperma:* Little 1971
  - *J. osteosperma:* Little 1971
  - *J. scopulorum:* Little 1971
  - *J. deppeana:* Little 1971

- *J. occidentalis:* Little 1971

- Note: Defenders tried to pull the most recent data possible for the pine and juniper species, however Little (1971) was frequently the best available dataset for the entire study area. Many of the Little (1971) layers were cross-referenced with more recent basal area data for tree species from USFS.

Figure 4 approximately replicates the earlier USGS status and trend estimates of Pinyon Jays using 2011-2017 data versions.

The USGS analysis, from 2011 through 2017, uses the SLOPE model.

The slope option estimates the time series as a log-linear regression line. It is the model used by the USGS and CWS to estimate BBS trends since 2011. The basic model was first described in 2002 (Link and Sauer 2002) and its application to the annual status and trend estimates is documented in Sauer and Link (2011) and Smith et al. (2014).

Link, W. A. and J. R. Sauer. 2002. A hierarchical analysis of population changed with application to Cerulean Warblers. Ecology. 83:2832-2840.

Sauer, J. R. and W. A. Link. 2011. Analysis of the North American breeding bird survey using hierarchical models. The Auk. 128:87-98.

Smith, A. C., M. R. Hudson, C. Downes, and C. M. Francis. 2014. Estimating breeding bird survey trends and annual indices for Canada: how do the new hierarchical Bayesian estimates differ from previous estimates? The Canadian Field-Naturalist. 128:119-134.

Figure 5 was developed using the 1966 – 2015 trends analysis shapefile at this link: https://www.mbr-pwrc.usgs.gov/bbs/shape_tr15.shtml Citation information:

- BBS Trends Data (1966-2015)
  - *Originator:* USGS Patuxent Wildlife Research Center
  - *Publication_Date:* 20150122
  - *Title:* Breeding Bird Survey Grid for Lower 48 States, Alaska and Southern portion of Canada
  - *Publication_Place:* Laurel, Maryland
  - *Publisher:* USGS Patuxent Wildlife Research Center
  - *Online_Linkage:* <http://www.mbr-pwrc.usgs.gov/bbs>.

Land manager map, Figure 6 and Table 7, agency responsibility:

- Land Manager: PAD-US
  - U.S. Geological Survey (USGS) Gap Analysis Project (GAP), 2020, Protected Areas Database of the United States (PAD-US) 2.1: U.S. Geological Survey data release, https://doi.org/10.5066/P92QM3NT.

Figure 6, Land manager responsibility:

Below are methods for calculating land manager responsibility numbers:

These values were derived from the PAD-US 2.1 dataset. The data are not "flat" to begin with, meaning polygons overlap with one another, which can cause area calculations with the raw data to be somewhat inaccurate. To resolve this, the data were first broken out by GAP status codes, which are "a measure of management intent to conserve biodiversity". These codes are defined below, with 1 having the greatest biodiversity protections and 4 having the least. Overlapping areas were addressed by prioritizing them in order of GAP status code. Therefore, all GAP 1 areas were retained. Each subsequent GAP status area would have areas overlapping with higher GAP status codes removed. This translates to:
GAP 1 = GAP 1
GAP 2 = GAP 2 – areas within GAP 2 that overlap with GAP 1
GAP 3 = GAP 3 – areas within GAP 3 that overlap with GAP 1 and/or 2
GAP 4 = GAP 4 – areas within GAP 4 that overlap with GAP 1, 2, and/or 3
These four datasets were then combined and all polygons were summarized by land manager type and land manager name for each state as well as within the entire pinyon jay range. Land manager type includes state, tribal, and private management within the protected areas database and land manager name includes specific agency and other group names, including BLM, USBR, DOD, FWS, USFS, and NPS. All raw values are included in the attached spreadsheet under the tabs "Pinyon Jay Range Summary" and "State by State Summary" if you want to take a look. You'll also see there are more land manager types and names that are not included in my summary tables, such as unknown, joint management, NGO, city, county, etc. (the domain codes for each of these is explained in the PAD-US manual if you want to take a deeper dive). The total land area for private management was calculated as "total land area within each state or the pinyon jay's range – all land managers *except* for private", which effectively calculates all land area considered private within the protected areas database plus all remaining land area outside the database. Values are provided in hectares and as a percentage of either each state or of the pinyon jay's range.

Gap status definitions from the PAD-US Data Manual (more info here as well):
GAP Status Code Definitions
Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.
Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance (for example, wildland fire or native insect outbreaks).
Status 3: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, lowintensity type (for example, logging, OHV recreation) or localized intense type (for example, mining). It also confers protection to federally listed endangered and threatened species throughout the area.
Status 4: There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout or management intent is unknown.

Appendix 2. Estimated BLM vegetation treatment areas (acres) for each state, showing those identified as piñon-juniper treatments. Actual acres in piñon-juniper are not always specified; these areas are likely under-estimated. Table format modified from Smith (2021).

STATE	BLM ADMIN UNIT	PROJECT NAME	PROJECT AREA ACRES	P-J TREATMENT ACRES	STATUS	PROJECT DESCRIPTION	RELATED PROJECTS
AZ	Safford FO	Safford Field Office Vegetation Plan	1,370,092	treat 25,372, maintain 167, 082	EA 12/20; amendments comment period ended 7/18/21	Keep tree and shrub cover <30%	
AZ	GCPNM	Shivwits Plateau Landscape Restoration Project	318,000	28,050	EA comment period expired 6-30-21	Reduce vegetation, mainly juniper, to favor other vegetation	
AZ	Arizona Strip FO	Shuttleworth-Suicide Vegetation Treatments	14,267	4281 lop-scatter, 4288 masticate	DR April, 2019 (version on web not signed)	Complete removal of p-j in treatment units. Project is in two grazing allotments	
AZ	GCPNM/Arizona Strip FO	Unikaret Mountains Landscape Restoration Project	128,500	18,648	DR 9/19/19	Treat 55% of project area in the next 30 or more years	
AZ Total			1,830,859	80,669			
UT	Kanab FO/GSENM	Pariah River Watershed Habitat Improvement Project	565,237	93,363 over 15 years	"Cancelled-Withdrawn" on project web page	Decrease p-j that is expanding and infilling shrub and other vegetation. Not all treatment is necessarily p-j.	
UT	Cedar City FO	Hamlin Valley Resource Protection and Habitat Improvement Project	21,998	7977	DR 6/11/14	Treat with mechanical, hand, and prescribed fire to thin or remove dense p-j stands. P-J treatment includes rangeland improvement.	Antelope Lop and Scatter tiers to this; other projects likely do so also.

UT	Cedar City FO	Hamlin Valley Habitat Improvement Project			"Analysis and document preparation". Page last updated 2/1/19	Includes p-j treatment, as shown on map. Not sure how it is connected to the Hamlin Valley project described above.	
	Vernal FO	Augusi Ridge Bulldog Thinning Project		695 acres	DR 8-3-18	In grazing allotment	
UT	Cedar City FO	Bear Valley Vegetation Treatment	2,596	540	EA 3-10-21	reduce p-j expanding into sage	
UT	Vernal FO	Big Wash Five Mile Mastication	14,479		DR 12-17-15	Mastication	
UT	Richfield FO	Cedar Mountain Fuels Reduction and Habitat Improvement		up to 16,431 acres	DR 1-26-18	Sage habitat threatened by p-j. Also treat to reduce fire risk.	
UT	Cedar City FO	Chipman Peak Vegetation Enhancement Project	136,987 BLM acres	3000-4000 per year for 10 years	DR 12/13/16	Reduce fuels, enhance habitat and watershed. 250-500 acres minimum treatment for Utah prairie dog	Little Valley Habitat Improvement Project - DNA 8/1/17. Glenwood Addition noticed 6-4-21
UT	Vernal FO	Clay Basin/Brown's Park Sagebrush Treatment/Fuel reduction		3695	DR 7-29-14	remove encroaching p-j	
UT	Vernal FO	Diamond Rim Sagebrush Treatment/Fuel reduction		1287 mastication, 2486 chainsaw	DR 7-14-14	Remove p-j encroaching into sagebrush	
UT	Kanab FO	Glendale Bench Vegetation Project			DNA 9-18-17	Part of Kanab Creek Vegetation, approved 10-7-09	

UT	Fillmore and Salt Lake FOs	Greater Sheeprock Sage Grouse Habitat Restoration	508,273 BLM		DR 8/17/17	Primarily removal of p-j for sage grouse and fuel breaks over next 15 years	Onaqui East Bench Habitat Improvement - remove 100% of p-j. on 1262 acres. DNA 11/20/18. Railroad Springs 1,965 acres BLM and other land
UT	Cedar City FO	Indian Peak and Stateline Vegetation Treatments	4159		DNA 8/1/17	Remove p-j from sagebrush-dominated areas.	
UT	Cedar City FO	Long Hollow Sheep/Lizzies Hill (Upper Long Hollow)	3481		Last update 8/1/17. No documents available		In 4 BLM grazing allotments
UT	Fillmore FO	Long Knowle Vegetation Treatment	261	261	Last update 11/12/15	Chain p-j, then aerially seed	
UT	Cedar City FO	Parawan Front Habitat Restoration Project	up to 16000	1000 ac per year	DR 3/29/18	Lop, scatter, and chip to reduce p-j	
UT	Kanab FO	South Canyon VEP	121,327	15,000	EA 2/10	Treat over next 10 years	South Canyon/ Dickinson Hill 570 acres, DNA 10/28/20
UT	Color County DO, GSENM	Upper Kanab Creek Watershed Vegetation Project	89900 BLM	51,599	FONSI 4/27/11	Remove 100% of p-j. Retreat areas treated over last 40-50 years.	

UT	Kanab FO	Farm Canyon	1200		DR 10/27/20	Adds to treatment approved in Yellowjacket VEP, 2012. Treat 2 allotments	
UT Total			734,738	239334			
NM	Carlsbad FO	Border Patrol Juniper Treatment FY 20		3674	DNA 11/22/19	Herbicide treatment in four allotments	Tiers to May, 1991 EIS Vegetatio n Treatmen t on BLM Lands in Thirteen States
NM	Carlsbad FO	CFO Restore NM PUP			DNA 6/15/20 or earlier	Herbicide treatment against native and non-native plants, including juniper.	
NM	Roswell FO	Clarification of Mechanized Vegetation Treatment Methods			DNA 8/27/19	Adds mechanical treatment to herbicide treatment of juniper and other vegetation for 10 projects approved 2006-2009.	Tiers to: Vegetatio n Treatmen t using Herbicide on BLM Lands in 17 Western States, approved 10/2/17.
NM	Farmington FO	Gallina PJ Thin		52	DR 11/3/15	Remove live and dead p-j for fuelwood. Improve watershed and vegetation, provide forage.	
NM	Caliente and Bristlecone FOs	Cave and Lake Valley Lop and Scatter			CE 5/28/21	Remove p-j invading sagebrush areas, improve sage grouse and mule deer habitat	

NM Total				3726			
NV	Bristlecone FO	Douglas Canyon Restoration and Fuels Project	20,867	3000	DR 5/19/20	Restore historic vegetation community structure	
NV	Wells FO	Long Canyon Mitigation Restoration	923		Notice of proposed decision 10/30/17	Restore sage grouse and mule deer habitat, including a lek, near a mine.	
NV	Sierra Front FO	Pine Nut Land Health Project	4215		DNA 8/7/20	Remove encroaching p-j, "restore ecologically diverse, properly functioning and resilient native plant communities".	
NV	Winnemucca DO	Programmatic District-wide Vegetation Management Plan	8300000		DR 1-/31/17	Widespread treatment of vegetation, including p-j, over 15 years	
NV	Battle Mountain DO	Sagebrush Ecosystem Management			Proposed action 9/8/16	Thin p-j to reduce hazard fuel, sustain and improve sagebrush plant communities. But also "protect pinyon-juniper woodland health" ?	
NV	Tuscarora FO	Sherman Creek Lek Juniper Removal	1000	100	DR 6/15/16	Create buffer around lek to eliminate sage grouse predators' perching sites	Conforms with NV and NE CA Greater Sage-Grouse Approved RMP Amendment,

							approved 9/21/15
NV	Bristlecone FO	Spring Valley-Majors Hand Thinning	1890		DR for CE 2/24/21	Thin p-j in sagebrush, improve grouse habitat	
NV	Elko DO	Spruce Mountain Restoration		up to 10,000	DR 2012, I think	Reduce expansion of p-j, reduce fuels. Use chemical, mechanical and fire. Over 5-10 years	
NV	Tuscarora FO	Toole Sprong Lek Juniper Removal	6000	300	Notice of propsed decision 8/24/17	Protect 3 grouse leks by creating "juniper free" areas around them	
NV Total			8,334,895	13400			
CO	Colorado River Valley FO	Big Cedar Hill Sagebrush Restoration		158	DNA 6/8/21	"Remove encroaching pinyon and juniper trees and increase sagebrush age class diversity to improve wildlife habitat conditions and reduce hazardous fuels."	

CO	Royal Gorge FO	Booger Red Thinning and Maintenance		219	Unsigned DNA posted on or before 5/13/19	Thin understory in p-j and ponderosa stands. Maintain earlier treatments. Not clear if the latter involves p-j
CO	Grand Junction FO	Colorado Book Cliffs Restoration Project			EA issued 6/13	"Suitable treatment areas are dominated by late seral stages of pinyon/juniper…" where shrubs and grass/forb are decreasing
CO	Grand Junction FO	Cruse Wash Vegetation Treatment		340	in progress as of April, 2019	remove encroaching p-j to improve Gunnison sage grouse habitat
CO	White River FO	Dragon Road Mechanical Landscape Enhancement		359	DNA 2/20/19	Grind p-j in sagebrush parks
CO	Colorado River Valley FO	East Eagle ACEC Vegetation Treatment	462		DR 5/18/18	Remove encroaching p-j in sagebrush. Remove competition for a sensitive pant. Retreats areas treated in late 1980s-early 90s.
CO	Dominguez-Escalante NCA	Farmers Canyon-Wagon Park Restoration	11,000	3,700 mechanically	DR 6/24/16	Remove encroaching p-j and oak, improve Gunnison sage grouse habitat. Burn also.

CO	Grand Junction FO	Glade Park Maintenance Treatments		2560	DNA 3/12/14	Use hand crews. Decrease fuels, convert areas to sagebrush/grass. Improve Gunnison sage grouse habitat.
CO	Colorado River Valley FO	Greenhorn Sagebrush Restoration	2385		DNA 9/16/19	Hand cut p-j encroaching into sagebrush, improve wildlife habitat
CO	White River FO	Hot Lot Landscape Enhancement Project		500	DR 2/21/19	Masticate encroaching p-j, reduce fuels
CO	Royal Gorge FO	Huerfano County Habitat Enhancement and Fuel Reduction			DNA 8/17/17	Reduce fuels, maintain meadows, improve winter range. In an allotment
CO	Royal Gorge FO	Iron Dollar Draw Habitat Improvement		248	DNA 11/26/18	Reduce fuels, improve forage and diversity
CO	Little Snake	Juniper Mountain Fuels Project		492	DR 8/15/19	Remove encroaching p-j via mastication to improve mule deer winter habitat
CO	Grand Junction FO	Lands End Mechanical Vegetation Treatment		125	DR 9/1/17	Reduce fuels, protect municipal watershed
CO	Uncompahgre FO	Mailbox Park Lop and Scatter		865	DR 6/18/20	reduce fuels, improve big game winter range

CO	Kremmling FO	McCoy Mechanical, Hand Treatment and Jackpot Burn		1680	in progress as of July 2, 2021	"remove encroaching pinyon/juniper from sage parks"
CO	Royal Gorge FO	Midland Hills Healthy Land Initiative			DNA 7/8/16	Reduce tree density to "improve habitat, forage for wildlife and livestock,and [] improve forest health". Doesn't mention veg types but some, if not most, of this is in p-j.
CO	Royal Gorge FO	Mt. Shavano Vegetation Management			DNA 3/27/19	In grazing allotment. Maintain previous p-j treatments. Mastication, hand thin, commercial harvest.
CO	San Luis Valley FO	Poncho Villa Landscape Vegetation Treatment	64,742	3126	ROD 6/23/21	Various treatments, including up to 10-acre cuts in p-j.
CO	Colorado River Valley FO	Pump Gulch II Sagebrush Restoration		50	DNA 8/27/20	Specifically targets p-j "expansion" areas and not persistent woodlands. In sage grouse priority habitat
CO	Kremmling FO	Ranch Del Rio Hand Thinning and Jackpot Burn		97	DR 3/10/21	"selectively removeencroaching juniper from sagebrush parks"

CO	Grand Junction FO	Seeber-Snyder Pinon and Juniper Removal	1379	300 per phase, unknown number of phases	DR 5/15/19	"sustaining, restoring and rehabilitating the integrity of the sagebrush biome"	
CO	Uncompahgre FO	Sims Mesa Sagebrush Restoration		220	DNA 7/31/19	Masticate encroaching p-j	
CO	Bishop FO	Bodie Hills Upland Vegetation Restoration Project	16930 treated maximum	at least 2600	DR 3/31/15	"Maintain and improve the ecological condition and resiliency of the most ecologically departed and at risk upland vegetation systems". Includes removing and/or thinning p-j	
CO Total			79968	18718			
CA	Applegate FO	Dry Cow and Thomas Creek Sage-Steppe Restoration		3626	DR 8/7/18	Reduce juniper encroachment, restore sage grouse habitat	
CA	Applegate FO	FY 19 Sage-steppe, Aspen Release, and SpringRestoration Projects		4931	DNA 7/1/19	Remove juniper, restore sage grouse habitat	Does not appear to include Dry Cow-Thomas Creek project
CA	Eagle Lake FO	Fredonyer Peak Stewardship	3900		FONSI undated; page last updated 7/18/18	Removal of dense Jeffrey pine, white fir, and juniper to reduce fire risk	
CA total			3900	8557			
TOTAL			10,984,360	360,678			

Appendix 3. Estimated U.S. Forest Service vegetation treatment areas (acres) for each state, showing those identified as piñon-juniper treatments. Actual acres in piñon-juniper are not always specified; these areas are likely under-estimated. Data from and table format modified from Smith (2021).

STATE	NATIONAL FOREST	RANGER DISTRICT	PROJECT NAME	PROJECT AREA ACRES	P-J TREATMENT ACRES	STATUS	PROJECT DESCRIPTION
UT	Ashley	Flaming Gorge	West Northwest D1 Wildlife Habitat Improvement	19,216	I unit (size not stated)	DM 5/5/21	remove conifer
UT	Dixie	Pine Valley	Pine Valley Wildlife Habitat Improvement	320,000 considered, 250,000 in IRAs	106,336 considered	Scoping notice issued 11/13/19	Trend vegetation toward NRV. P-j said to be 83% departed from NRV
UT	Manti-LaSal	Moab/Monitcello	Maverick Point Forest Health Project	17,000	400 burn, 2040 mechanical	Scoping letter issued 1/16/13	Create mosaic for wildlife, increase forest resilience
UT	Fishlake	All	Forestwide Prescribed Burn Restoration Project	1,000,000	40,000 annually, not all p-j	Scoping 4/21	Burn in various vegetation types to reduce fire risk, improve ecological functioning
UT	Uinta-Wasatch-Cache	Logan	Mahogany Ridge Juniper Mastication	3780	2747	Scoping 5/14/20	Remove juniper encroaching on sagebrush. Reduce fuels. Retain oldest 10% of juniper
UT Total				1,289,996	15823		
NV	Humboldt-Toiyabe	Bridgeport	Bodie Hills Sage-Grouse Habitat Improvement Project	4682, 1466 in 2 IRAs	up to 4682	Scoping document 8/17	Increase sage grouse habitat quality. Retain old trees.
NV	Humboldt-Toiyabe	Spring Mountain NRA	Mack, Champion, and Lovell Canyon Habitat Improvement and Fuels Reduction	1421	1421	Scoping 3/20	Reduce fuels, protect public, "improve watershed vitality"
NV Total				6103	6103		
NM	Carson	Jicarilla	Ponderosa Pine Restoration Project	33,272		Scoping Letter 12/17/18	Remove p-j, oak, and brush understory from ponderosa stands, then burn. Document with CE.

NM	Lincoln	Sacramento	South Sacramento Restoration Project	140,000	53,910 total treatment, 10,000 acres in p-j	DEIS issued 2/19	Thinning and burning in various vegetation types to improve forest health and resiliency over next 10-20 years.
NM	Santa Fe	Coyote	Encino Vista Landscape Restoration Project	119,767 NF acres	22,200	Scoping document 11/19	Cut and burn to improve forest health, watershed, and wildlife habitat, and reduce fire risk
NM	Santa Fe	Espanola	Cerro Pelon Timber Stand and Wildlife Habitat Improvement Project	315	315	On hold. Web page last updated 3/28/19	Thin p-j to improve forest health and fire resilience
NM	Santa Fe	Pecos-Las Vegas	El Pueblo/Anton Chico Small Products			On hold. Last updated 6/3/19. Will be CE.	Thin dense, small p-j, and burn
NM	Santa Fe	Pecos-Las Vegas	Rowe Mesa II			Under analysis. Last updated 6/30/20. Will be CE.	Thin and burn p-j and ponderosa pine encroaching into woodlands and meadows
NM	Santa Fe	All	Santa Fe Mountains Forest Resiliency Project	50,000		Draft Purpose and Need 3/26/19	Move forests and woodlands to characteristic composition and structure, reduce fuels, improve habitat, soils, watershed
NM	Gila	Quemado	Luna Restoration Project	171,331	20,328	ROD signed 11/21/19	Reduce fire impact, restore separated landscapes
NM	Cibola	Mt Taylor	Timberlake Restoration	8,200		scoping set to start 7/21. No documents available	"Restore the ecosystem to desired conditions through timber harvest and prescribed burning", create fuelbreaks. In ponderosa- and p-j - dominated areas

NM total				522,885	52,843		
CO	San Juan	Columbine	Southern HDs Landscape Restoration Project	34,000		Scoping document September 2020	Reduce fuels and fire threat, increase wildlife and livestock forage, improve habitat diversity. Mostly via prescribed fire.
CA	Los Padres	Mount Pinos	Mount Pinos Forest Health Project	1,682	up to 1543 with some p-j	Scoping document 4/7/21	Reduce forest density, remove dead trees, increase resiliency
CA	Los Padres	Ojai and Mount Pinos	Reyes Peak Forest Health and Fuels Reduction Project	755	up to 423 with some p-j	Scoping document 5/8/20	Reduce density and fire risk, increase resiliency, protect Calif spotted owl
CA	San Bernardino	Mountaintop	North Big Bear Landscape Restoration Project	13,000	2910	Scoping document 9/2/2020	Hand and mechanical thinning, and prescribed fire to reduce fire threat
CA Total				15,437	4876		
TOTAL				1,868,421	79,645		

Appendix 4. Percent of Pinyon Jay range managed by each agency in each state within the Pinyon Jay range. Top half of the table is percent of only the Pinyon Jay range within the state; bottom half is percent of the entire state area.

% Pinyon Jay Range within State Falling in Each Land Management Category

	Bureau of Land Management	Bureau of Reclamation	Department of Defense	Fish and Wildlife Service	Forest Service	National Park Service	State	Tribal	Private
Arizona	12.63	0.00	0.08	0.00	20.16	4.81	8.30	41.99	12.08
California	23.90	0.04	4.19	0.27	33.07	18.69	2.08	0.68	18.98
Colorado	24.68	0.01	1.08	0.59	22.17	1.28	4.71	3.25	39.95
Idaho	36.12	0.12	0.00	0.19	19.38	0.61	6.46	4.11	30.39
Montana	7.75	0.08	0.02	1.20	12.51	0.26	6.69	7.87	59.73
Nebraska	0.23	0.00	0.00	0.00	8.52	0.00	6.83	0.00	83.66
Nevada	69.09	0.06	2.88	3.00	9.17	0.41	0.14	1.52	15.41
New Mexico	10.95	0.00	0.92	0.48	17.95	0.51	8.42	16.10	45.25

Oklahoma	0.00	0.00	0.00	0.00	0.00	0.00	87.27	0.00	12.73
Oregon	50.10	0.13	0.00	2.24	19.78	0.02	1.73	0.30	25.09
S Dakota	0.83	0.51	0.04	0.00	56.93	1.89	5.18	0.00	33.53
Utah	44.97	0.00	1.18	0.07	16.67	4.24	7.64	6.86	19.30
Wyoming	31.15	1.35	0.08	0.13	12.17	1.19	6.94	3.62	42.37

% of Total State Land Falling In Each Land Management Category Within Pinyon Jay Range

	Bureau of Land Management	Bureau of Reclamation	Department of Defense	Fish and Wildlife Service	Forest Service	National Park Service	State	Tribal	Private
Arizona	6.11	0.00	0.04	0.00	9.76	2.33	4.02	20.33	5.85
California	5.75	0.01	1.01	0.07	7.96	4.50	0.50	0.16	4.57
Colorado	12.25	0.00	0.54	0.29	11.00	0.63	2.34	1.61	19.83
Idaho	10.28	0.03	0.00	0.05	5.52	0.17	1.84	1.17	8.65
Montana	2.89	0.03	0.01	0.45	4.66	0.10	2.49	2.93	22.26
Nebraska	0.00	0.00	0.00	0.00	0.09	0.00	0.07	0.00	0.85
Nevada	61.27	0.06	2.55	2.66	8.13	0.37	0.13	1.35	13.67
New Mexico	6.30	0.00	0.53	0.27	10.34	0.29	4.85	9.27	26.05
Oklahoma	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.02
Oregon	13.17	0.03	0.00	0.59	5.20	0.00	0.45	0.08	6.60
S Dakota	0.03	0.02	0.00	0.00	2.22	0.07	0.20	0.00	1.31
Utah	40.18	0.00	1.06	0.06	14.89	3.79	6.83	6.13	17.24
Wyoming	27.83	1.21	0.07	0.11	10.87	1.06	6.20	3.23	37.85