Certified Mail # 7020 3160 0001 9453 7240

May 8, 2023

Helena-Lewis and Clark National Forest

C/O Emily Platt

2880 Skyway Drive

Helena, MT 59601

RE: SCOPING COMMENTS FOR THE PROPOSED HELENA-LEWIS AND CLARK NATIONAL FOREST FORESTWIDE PRESCRIBED FIRE PROJECT

Hello,

We would like to submit the following joint scoping comments being submitted by Native Ecosystems Council, the Alliance for the Wild Rockies, Council on Wildlife and Fish, Yellowstone to Uintas Connection, and Center for Biological Diversity in regards to the proposed Forestwide Prescribed Fire Project. Please note that these comments include 2 appendices with additional information. Appendix A includes 3 tables that summarize expected bird species present within 3 general habitat conditions on the Helena-Lewis and Clark National Forest: forests, woodlands-wooded shrublands-shrublands, and deciduous/riparian areas. Appendix B includes some references we are providing in support of our comments.

1. **The Helena-Lewis and Clark National Forest (HLC) Revised Forest Plan (RFP) is a violation of the 2012 Planning Rule for a failure to contain conservation strategies for "at risk" species; the HCL needs to amend this RFP to meet this requirement.**

The HLC RFP claims that most wildlife on the forest will have adequate habitat management in the face of vegetation treatments, including prescribed burning, because of the desired conditions established for vegetation. This is the complete analysis of this claim in the RFP Final Environmental Impact Statement (FEIS), except for a brief analysis of 3 "at risk" species, the flammulated owl, Lewis woodpecker, and Canada lynx. There is no analysis provided in the FEIS as to how these at-risk species were selected. This selection is a violation of the NEPA because there are many, many bird species that are in need of conservation management, which is the definition of an at-risk species (i.e., special management attention is needed to ensure further declines do not occur). There are 29 "at risk" bird species on the HLC. These are summarized in Appendix A, Tables 1-3. These include 14 "at risk" forest bird species, 10 "at risk" woodland, wooded-shrubland or shrubland species, and 5 "at risk" birds associated primarily with riparian/aspen communities. Only 2 of these species, the flammulated owl and Lewis woodpecker, are identified as "at risk" species in the HLC RFP. This leaves 27 additional "at risk" species that have no conservation measures, including habitat standards, on the HLC. An example as to why these 27 "at risk" bird species are threatened with continuing declines, declines that may be significant on a forest-wide level, is demonstrated by the proposed Forestwide Prescribed Burning Proposal. The entire HLC is potentially going to have the understory and partial overstory burned in conifer forests, the entire woodlands, wooded-shrublands, and shrublands slashed and burned, and all riparian areas burned as a part of this programmatic proposal. The lack of any conservation strategies in the HLC RPF include several "tipping point" species identified in the 2022 State of the Birds Report. These include the Greater Sage-Grouse, Evening Grosbeak, Pinyon Jay, Olive-sided Flycatcher, Red-headed Woodpecker, and Rufous Hummingbird. Although there is some Forest-wide direction for conserving Greater Sage-Grouse habitat (sagebrush), this direction does not actually prevent intensive prescribed burning of sagebrush given it is allowed

simply by claims that this burning and killing sagebrush will "improve" sage grouse habitat (2015 Record of Decision and Approved Resource Management Plan Amendments for the Great Basin Region, including the Greater Sage-Grouse Sub-Regions of Idaho and Southwestern Montana, Nevada and Northeastern California, Region and Utah). In addition, we note that this 2015 sage grouse management direction has now been in effect for almost 8 years, but has not prevented continued declines of sage grouse. As is noted in the 2022 State of the Birds report, the sage grouse is identified as a "tipping point" species; this species has showed a continued steep decline that warrants increased voluntary habitat conservation incentives and renewed strong federal and state protections. A Tipping Point species are those that are on a trajectory to lose another 50% of their populations in the next 50 years, or already have perilously small populations and continue to face high threats. These protections on the HLC need to include no further burning of sagebrush habitat in occupied sage grouse habitat.

Another Tipping Point species present on the HLC is the Pinyon Jay. This species was recently petitioned for listing under the Endangered Species Act (ESA) by Defenders of Wildlife (Associated Press 2022). The proposed unlimited slashing and burning of woodlands and wooded-shrublands in the HLC prescribed burning proposal will clearly cause further declines of this species due to habitat loss and degradation. Two other conifer forest species identified as having lost 50% of their populations since 2010 include the Olive-sided Flycatcher and Red-headed Woodpecker (State of the Birds Report 2022).

Two other Tipping Point species that occur on the HLC include the Rufous Hummingbird and Evening Grosbeak (State of the Birds 2022). Both species depend upon coniferous forest habitat (Scoping comments Appendix A). The effect of removal of forest understories on these species is unknown, but is likely a highly adverse habitat loss. There is also another at-risk bird noted in the State of the Birds Report (20220, which is the Sage Thrasher, which has exhibited accelerated declines since 2010. This at-risk species is strongly associated with wooded-shrublands and shrublands.

In spite of recent (Rosenberg et al. 2019) and current reports (North American Bird Conservation Initiative 2022), the HLC is proposing a massive habitat removal program for 27 at-risk bird species. This is a violation of the National Environmental Policy Act (NEPA) as well as the National Forest Management Act (NFMA), in addition to the Migratory Bird Treaty Act (MBTA). This massive proposal to remove habitat for at least 27 at-risk bird species will occur due to the total lack of any conservation strategies in the HLC RFP, as well as the complete lack of any analysis as to how a massive forest-wide prescribed burning and slashing program will impact these 27 species. Until the HLC RFP is amended to include habitat protections for thee 27 at risk species, no prescribed burning and slashing programs can legally go forward.

The HLC RFP also needs to be amended to include general habitat protection measures for all forest birds. AS is noted in the Rosenberg et al. (2019) report, as well as the 2022 State of the Birds Report, it is not just at-risk species that require conservation measures. As we summarized in Tables 1-3 in Appendix A, the HLC includes approximately 107 birds associated with conifer forests, woodland, wooded-shrublands and shrublands, and riparian/aspen vegetation communities. All these forest habitat include North American landbirds that have lost over 3 billion birds in their populations since the mid-1970s (Rosenberg et al. 2019). That paper shows that of 67 western forest birds, 64.5% are in decline. The 2022 State of the Birds notes that roughly half of western forest birds are in decline. The Rosenberg et al. (2019) report states that their study has documented a long-developing but overlooked biodiversity crisis in North America – the cumulative loss of nearly 3 billion birds across the avifauna; pervasiveness of avian loss across biomes and bird families suggest multiple and interacting threats; isolating spatio-temporal limiting factors for individual species and populations will require additional study; targeted research to identify limiting factors must be coupled with effective policies to identify limiting that emphasize reducing threats and m minimizing avoidable anthropogenic mortality year-round; our results signal an urgent need to address the ongoing threats of habitat loss, and direct anthropogenic mortality to avert continued biodiversity loss and potential collapse of continental avifauna.

2. **<u>The HLC RFP is a violation of the MBTA due to a almost complete lack of any habitat protection measures for forest birds, which include mostly neotropical migratory birds.</u>**

The Memorandum of Understanding (MOU) between the Forest Service and the U.S. Fish and Wildlife Service addressing protections of migratory birds includes the following requirements:

-Support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.

-Restore and enhance the habitat of migratory birds, as practicable.

-Ensure that environmental analysis of Federal actions required by the NEPA or other established environmental review processes, evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

-Identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations, focusing first on species of concern, priority habitat, and key risk factors; with respect to those actions so identified, the agency shall develop and use principles, standards, and practices that will lessen the amount of unintentional take, developing any such conservation efforts in cooperation with the Service; these principles, standards and practices shall be regularly evaluated and revised to ensure that they are effective in lessening the detrimental effect of agency actions on migratory bird populations; the agency shall also inventory and monitor bird habitat and populations within the agency's capabilities and authorities to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts.

On clear display for the proposed Forestwide Prescribed Burning Project which is undergoing scoping right now, there are no requirements for the agency to

complete any surveys for neotropical migratory birds, even though from 21,900 to 26,750 acres per year may be treated with burning and/or slashing and burning. We could find no requirements in the HLC RFP for even a single wildlife survey to be done for any project, including where thousands of acres per year are to be treated. Over a 10-year period, this program could remove and/or degrade up to 267,500 acres of migratory bird habitat without an single survey being required.

3. **The HLC RFP is a violation of the NEPA because it contains no criteria for determining when significant adverse impacts are triggered on migratory birds; as such, any massive project that degrades hundreds of thousands of acres of migratory bird habitat can be claimed to have no significant adverse impacts, as witnessed by the Forestwide Prescribed Burning Proposal.**

It defies logic that the HLC can claim that burning up to 267,500 acres of migratory bird habitat in even 10 years (the time line is not actually clear, but we will address at least the first 10 years) will have no significant adverse impacts. This proposal is being planned as an Environmental Assessment, it appears. One of the functions of a RFP is to ensure that limits to wildlife habitat are not exceeded where significant adverse impacts are triggered. Without any actual criteria as to where or when these thresholds of significance occur, a RFP cannot provide the required function of a Forest Plan, which is to ensure that a diversity of wildlife are maintained. Until the HLC RFP is amended to include criteria for habitat maintenance for migratory birds, the agency has no basis for evaluating project impacts. Even if this is done at a site-specific level, it cannot address forest-wide cumulative effects.

4. **The Forestwide Prescribed Burning Proposal on the HLC is a violation of the NEPA because the agency is not providing the public "high quality" information on habitats and wildlife that will be affected by the project.**

It will be impossible for the HLC to complete any valid wildlife surveys on over the entire HCL before the project is implemented in a decision. This would require a massive, multiple-years inventory effort to cover almost all of the HCL. Of course, this is not actually planned. This entire project will be presented to the public, and a decision implemented, without a single wildlife survey having been completed. The public will never have any information to understand how the proposed vast treatment acres are going to be designed with respect to wildlife. This is essential information to the public, and is required by the NEPA. The agency is required to provide high quality information to the public so that the public can understand how the project will be implemented. As is planned, the Forestwide Prescribed Burning Proposal is intentionally excluding the public from having any information as to how wildlife is being coordinated with burning. In essence, the HLC has relieved themselves of the necessity of doing any wildlife surveys by implementing a huge project where surveys are not even possible.

The HLC is also violating the NEPA by failing to specifically identify which habitats will be treated per year, and what wildlife species will suffer habitat losses as a result. All that is provided is a forest-wide map, any of which could be treated in an unidentified time frame – potentially for 20 or more years. The public will never have any idea as to what wildlife habitats will be treated for any given locale, or what level of reduced carrying capacity this will have on wildlife. This proposal is clearly a violation of the NEPA as a result.

In order to comply with the NEPA, the agency needs to limit the size of any specific project to that which high quality information can be provided to the public. This high quality information needs to include the results of wildlife surveys, what the habitat requirements of a species are, and a summary of each habitat category that will be degraded as a result. It is essential as per the NEPA that the agency demonstrate to the public how wildlife habitat requirements were integrated into any vegetation treatments. A project area needs to be the size which valid high quality wildlife surveys can be conducted DURING project planning, so that the project design is based on wildlife habitat requirements. The Forestwide Prescribed Burning Proposal clearly cannot meet NEPA.

5. **As per the MBTA MOU, the agency needs to define what mitigation measures are being applied to the Forestwide Prescribed Burning Proposal to both measure and minimize "take" of migratory birds.**

The HLC is required by the MBTA and associated MOU to estimate the direct, indirect and cumulative mortality that will be created on migratory birds with treatment of the entire HLC over an undisclosed number of years. Direct mortatlity will include killing of nestlings when nest sites are cut down or burned up during slashing and/or burning activities. Direct mortality will also include direct deaths of nestlings and fledglings due to smoke toxicity (Defiance Canyon Raptor Rescue 2022). Indirect mortality will include abandonment of fledged birds due to associated treatment disturbances. It will also include reduced health of birds exposed to toxic smoke. And it will include the loss of hiding cover for all birds, both young and adults, with increased predation. And it will include the loss of thermal cover for all birds, due to the increased exposure they will have to adverse weather, from rain to snow to winds and cold events. And it will include indirect impacts due to the loss of forage resources that have been burned up, or slashed, including juniper berries and pine nuts, as well as insects. Overall, the planned reduction in the carrying capacity of treatments in the 3 general bird habitats as per Tables 1-3 (Scoping comments Appendix A) need to be estimated due to the proposed treatments. This is essential high quality information that needs to be provided to the public. This needs to be provided on a per-acre basis for the 3 general habitats.

6. **The Scoping Notice did not address how prescribed burning and slashing will maintain old growth forests.**

The burning out of understories in old growth forests, or slashing of conifers in limber pine old growth stands, will directly degrade their values to wildlife. Although the HLC RFP uses an invalid measure of old growth, as per the minimum criteria for old growth as per the Green definitions, the FEIS for the RFP did not define why logging, slashing, and/or burning in old growth stands will maintain

values for wildlife. There was no such analysis provided in the RFP FEIS. We note that another Region description of old growth (USDA 1990) defines old growth as per the entire Green definition. The RFP FEIS did not address this contradiction between 2 Region 1 reports which were released at similar times. The acres of old growth forests, including woodlands, needs to be clearly identified and mapped for the public, and an analysis provided as to why these treatments will not impact associated species. This analysis is essential as there is no such analysis in the RFP FEIS.

7. **Please define how prescribed burning will not adversely impact whitebark pine, a threatened species, and define (map and acres) where it will be burned.**

It is clear that prescribed burning will kill unlimited numbers of whitebark pine seedlings and saplings, or the young trees that are essential for long-term persistence of whitebark pine. The agency needs to map all areas where whitebark pine will be prescribed burned, and identify the estimated number seedlings and saplings that will be destroyed. Given that this tree species can live up to 1,000 years, these young seedlings and saplings can survive for long periods of time until some disturbance, typically bark beetles, creates temporary openings in a mixed conifer forest that allows growth spurts to occur. When these seedlings and saplings are burned, this eliminates the potential for them to eventually grow into the canopy, and thus maintain this threatened species.

8. **We are requesting that all mule deer winter range and fawning habitat be mapped for the project area, and habitat criteria amended into the RFP to define management for these key areas.**

The CG RFP does not map mule deer winter range, nor does it map mule deer fawning areas. Nor does it have any habitat management criteria for these areas. As such, the agency has no basis for "treating" mule deer winter ranges and fawning habitats, or measuring impacts of prescribed burning and/or slashing.

Until this problem is addressed in a Forest Plan amendment, the agency cannot legally treat mule deer winter range and fawning habitat, as it is random habitat removal without any criteria for measurement of impacts.

9. **We are requesting that all pine marten and snowshoe hare habitat be mapped for the Project Area, and RFP habitat criteria be implemented via an amendment to the RFP to maintain adequate levels of pine marten and snowshoe hare habitat well distrusted across the landscape.**

We note that USDA (1990) defines "well distributed" wildlife habitat as every 10,000 acres. We note that currently, the HLC RFP violates both the NEPA and the NFMA by a failure to include any conservation measures for the pine marten and the snowshoe hare. The former was previously identified as a Management Indicator Species in pervious forest plans. And the snowshoe hare is an important if not key, prey species for many forest carnivores, from the lynx to the wolverine to the fisher to the pine marten to the goshawk to the great gray owl. Viability of these forest carnivores has to address their prey, including the snowshoe hare. Forest underburning will eliminate snowshoe hare habitat, and thus coordination with hares is essential in order for the agency to meet the requirements of the NFMA. Please map and define acres of pine marten and snowshoe hare habitat in the project area, and define what habitat measures are required to maintain these species "well distributed" across the HLC (every 10,000 acres). Specifically in regards to old growth management, please define how removal of the understory, as well as many logs, will affect the pine marten and snowshoe hare.

10. **The HLC is violating the NEPA and Administrative Procedures Act (APA) by failing to address the considerable volume of new science that contradicts the agency claim that logging, slashing and/or burning is necessary to prevent uncharacteristic fires on the HLC.**

There is an abundance of current science that shows that forest thinning will actually increase the potential for fire spread and intensity, rather than reduce it. It is also known that weather, not fuels, are the major trigger of forest fires. There is no actual science that shows that somehow, forests have grown "too dense," due to a lack of fire, and are thus "uncharacteristic," which requires restoration thinning. Finally, it is noted that fuels reduction activities are "temporary," and that repeated treatments are necessary in order to maintain low fuels. The entire premise of the proposed forestwide prescribed fire program is based on science that has been extensively challenged. Yet the scoping notice does not address these contradictions. This is an important issue, because the use of faulty science to justify a massive treatment program across the entire HLC, a program that will inflict not only massive mortality on forest birds, but trigger a massive loss in wildlife carrying capacity. The agency needs to demonstrate why the proposed massive treatment program is based on current science, and the end results will justify the massive impacts on wildlife. Also, the agency needs to demonstrate why forest fires need to be prevented. Why is this necessary for wildlife?

Regards,

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Phone 406-544-9863. kakland@biodiversity.org.

Appendix A for the scoping comments for the Helena-Lewis and Cark Forestwide Prescribed Fire Project submitted by NEC, AWR, CWF, Y2U, and CBD on May 8, 2023.

Appendix A contains 3 tables summarizing approximate bird species that occur within three board habitat conditions on the Helena-Lewis and Clark National Forest, including conifer forests, woodlands, wooded-shrublands, and shrublands, and riparian habitats. These distributions are "approximate" as there can be considerable overlap between bird use in these 3 broad habitat categories, especially in riparian/aspen forests intermingled with conifer forests. Bird distributions and habitat associations are based on (1) P.D. Skaar's Montana Bird Distribution, Fifth Edition March 1996; (2) Neotropical migrant landbirds in the Northern Rockies and Great Plains by D. Dobkin, developed by USDA Forest Service Northern Region, and (3) USFS Northern Region songbird monitoring program: distribution and habitat relationships, developed by USDA Northern Region USFS.

Table 1. Forest birds likely present on the Helena-Lewis and Clark National Forest, including 49 estimated species, 14 which are species of concern. Bird distribution is based on the Fifth Edition, March 1996, Montana Bird Distribution by P.D. Skaar.

Brown Creeper*	Evening Grosbeak*	Pileated Woodpecker*
Cassin's Finch*	Varied Thrush*	Black-backed Woodpecker*
Clark's Nutcracker*	Olive-sided Flycatcher**	Rufous Hummingbird*
Northern Goshawk*	Great Gray Owl*	Williamson's Sapsucker*
Flammulated Owl*	Olive-sided Flycatcher*	Sharp-shinned Hawk
Northern Pygmy-Owl	Red-tailed Hawk	Northern Saw-whet Owl
Golden-crowned Kinglet	Solitary Vireo	Three-toed Woodpecker
Ruby-crowned Kinglet	Swainson's Thrush	Hermit Thrush
American Robin	Mountain Chickadee	Red-breasted Nuthatch
Gray Jay	Stellar's Jay	White-breasted Nuthatch
Pine Grosbeak	Hairy Woodpecker	Dusky Flycatcher
Hammond's Flycatcher	Townsend's Solitaire	Pine Siskin
Northern Flicker	Townsend's Warbler	Dark-eyed Junco
Purple Finch	Red Crossbill	Northern Flicker
Brown-headed Cowbird	Common Raven	Yellow-rumped Warbler
American Kestrel	Western Tanager	Orange-crowned Warbler
Cooper's Hawk		

*Montana Species of Concern and/or USFWS Bird of Conservation Concern

Table 2. Birds associated with woodlands, wooded-shrublands, and shrublands that likely occur on the Helena-Lewis and Clark National Forest, including 23 total estimated species of which 10 are a species of concern. Bird distribution is based on the Fifth Edition, March, 1996, Montana Bird Distribution by P.D. Skaar.

Pinyon Jay*	Brewer's Sparrow*	Sharp-tailed Grouse*
Sage Thrasher*	Loggerhead Shrike*	Greater Sage-grouse*
Golden Eagle*	Long-eared Owl*	Ferruginous Hawk*
Green-tailed Towhee*	Turkey Vulture	White-crowned Sparrow
Lark Sparrow	Chipping Sparrow	Rufous-sided Towhee
Mourning Dove	Swainson's Hawk	Mountain Bluebird
Merlin	Northern Harrier	Short-eared Owl
Clay-colored Sparrow	Western Bluebird	

*Montana Species of Concern and/or USFWS Bird of Conservation Concern

Table 3. Birds associated with deciduous/riparian forest areas that likely occur on the Helena-Lewis and Clark National Forest, including 35 total species of which 5 are a species of concern. Bird distribution is based on the Fifth Edition, 1996 Montana Bird Distribution by P.D. Skaar.

Red-headed Woodpecker*	Lewis Woodpecker*	Calliope Hummingbird*
Broad-tailed Hummingbird*	Veery*	McGillivray's Warbler
Wilson's Warbler	Downy Woodpecker	House Wren
Song Sparrow	Lincoln's Sparrow	Fox Sparrow
Northern Oriole	Cedar Waxwing	Western Wood-pewee
Warbling Vireo	Yellow Warbler	Black-headed Grosbeak
Willow Flycatcher	American Redstart	Red-naped Sapsucker
Northern Waterthrush	American Dipper	American Goldfinch
Western Screech Owl	Lazuli Bunting	Violet-green Swallow
Tree Swallow	Common Grackle	Black-capped Chickadee
Gray Catbird	Belted Kingfisher	Red-winged Blackbird
Red-eyed Vireo	Yellow-breasted Chat	

*Montana Species of Concern and/or USFWS Bird of Conservation Concern

Appendix B for the Scoping comments for the Helena-Lewis and Clark Forestwide Prescribed Fire Project submitted by NEC, AWR, CWF, Y2U and CBD on May 8, 2023.

Appendix B contains hard copies of several reports and/or publications cited in the scoping comments, including:

Associated Press. 2022. Protections sought for western bird linked to pinon forests amid deforestation. Great Falls Tribune April 27, 2022.

Defiance Canyon Raptor Rescue. 2022. Cal Fire burns next to Bald Eagle nest, eaglets die. Daily Kos April 15, 2022.

North American Bird Conservation Initiative. 2022. The state of the birds, United States of America, 2022. StateoftheBirds.org.

Rosenberg, K., A. Dokter, P. Blancher, J. Sauer, A. Smith, P. Smith, J. Stanton, A. Panjabi, L. Helft, M. Parr, and P. Marra. 2019. Decline of the North American avifauna. Science 10.1126science.aaw1313(2019).

USDA. 1990. Old-growth habitats and associated wildlife species in the Northern Rocky Mountains. Ed. Nancy Warren. USDA, Forest Service Northern Region Wildlife Habitat Relationships Program, R1-90-42.

Protections sought for Western bird linked to piñon forests amid deforestation

From: Michael Garrity (wildrockies@gmail.com)

To: sjjohnsonkoa@yahoo.com; katie@wildlandsdefense.org

Date: Wednesday, April 27, 2022, 11:38 AM MDT

Protections sought for Western bird linked to piñon forests amid deforestation

https://www.greatfallstribune.com/story/news/2022/04/27/endangered-species-protections-sought-western-bird-pinon-jays-linked-pinon-forests-new-mexico-nevada/9553646002/

Associated Press

April 27, 2022

ALBUQUERQUE, N.M. — Collecting piñon nuts has been tradition for Native American and Hispanic families in the Southwestern U.S. for generations.

But environmentalists are concerned that without the pinyon jay — a very social bird that essentially plants the next generation of trees by stashing away the seeds — it's possible the piñon forests of New Mexico, Nevada and other Western states could face another reproductive hurdle in the face of climate change, persistent drought and more severe wildfires.

The Washington, D.C.-based group Defenders of Wildlife filed a petition Monday with the U.S. Fish and Wildlife Service to protect the bird under the Endangered Species Act, saying the once common species plays an integral role in the high desert ecosystem.

The group points to research that shows pinyon jay numbers have declined by an estimated 80% over the last five decades, a rate even faster than the greater sage grouse.

Patricia Estrella, who represents the group in New Mexico, said that while population declines are well documented, the exact cause remains unclear as multiple threats are at play.

"Not only is it difficult to tease apart the effects of interacting factors, together they create even greater threats through

Not only is it difficult to tease apart the effects of interacting factors, together they create even greater threats through positive feedbacks," Estrella wrote in the petition. "Successful conservation of the pinyon jay requires addressing and ameliorating multiple threats simultaneously."

Piñon-juniper forests cover more than 75,000 square miles (194,249 square kilometers) in the United States, and wildlife managers in Arizona, Colorado, Idaho, Montana, Nebraska, Nevada, and New Mexico already have classified the bird as a species of greatest conservation need.

Nearly 60% of the jay's remaining population can be found in New Mexico and Nevada, but its range also includes central Oregon and parts of California, Utah, Wyoming, Oklahoma and Mexico's northern Baja California.

Pale blue with a white bib, the pinyon jay typically mates for life. When food is abundant, they can nest more than once a year.

Their home range can be large, with the birds fanning out over hundreds of miles when food is scarce.

Research highlighted in the petition notes that more piñon and juniper woodlands are being cleared around the West for housing developments, agriculture, and solar and wind energy projects, and as land managers look to reduce the threat of wildfire.

The Biden administration's infrastructure push includes $500 million over five years for prescribed burns, $500 million for mechanical tree harvesting and another $500 million for clearing fuel breaks. Defenders of Wildlife and others are concerned that managers will be able to move ahead with many projects without public input or more detailed environmental reviews.

The petition states that studies documenting the effects of woodland reduction on pinyon jay populations are few, but some scientists are recommending that land managers avoid nesting and foraging sites.

More: These remarkable species were saved from the brink of extinction

When the piñon crop is good, jays start the morning by eating seeds. Then they collect seeds, congregate in the tree tops and depart together to caching areas that are usually open spaces where less snow accumulates in the winter.

Research has shown they have excellent memory and recover more cached seeds than other types of jays or nutcrackers, but the seeds that go uncollected are left to germinate.

According to the petition, the loss of piñon trees would disproportionately affect Native American and Hispanic communities in the Southwest. Each fall, families make the trek to the forest to harvest the seeds.

The nuts are usually roasted and salted, but their popularity now extends beyond Southwest cuisine, including

The nuts are usually roasted and salted, but their popularity now extends beyond Southwest cuisine, including pancakes, brownies, pizza and salad toppings.

It will be up to the Fish and Wildlife Service to determine whether there's enough information in the petition to warrant further review. That could take months.

Cal Fire burns next to Bald Eagle nest, eaglets die (/stories/2022/4/15/2092201/-Cal-Fire-burns-next-to-Bald-Eagle-nest-eaglets-die)

Defiance Canyon Raptor Rescue (/users/defiance canyon raptor rescue)
Community (This content is not subject to review by Daily Kos staff prior to publication.)

Friday April 15, 2022 · 3:51 PM MDT

★ Recommend 22 f Share

Tweet (https://twitter.com/intent/tweet?url=https%3A%2F%2Fwww.dailykos.com%2Fstory%2F2022%2F4%2F15%2F2092201%2F-Cal-Fire-burns-next-to-Bald-Eagle-nest-eaglets-die&text=Cal+Fire+burns+next+to+Bald+Eagle+nest%2C+eaglets+die)

5 Comments 5 New (https://www.dailykos.com/story/2022/4/15/2092201/-Cal-Fire-burns-next-to-Bald-Eagle-nest-eaglets-die#comments)

TRENDING LIST (/USER/TRENDING/HISTORY)

Liz Cheney: The House Jan. 6 committee has uncovered a 'broad,' 'well-organized' conspiracy
by Aldous J Pennyfarthing
★262 💬188

One More Dead Russian General in Ukraine
by GaryNaham
★156 💬92

Tweets of the Week May 29-Jun

Bald eagle chick, dead in nest tree after Cal Fire control burn next to the nest in 2021. Cal Fire has not committed to stop burning by the nest this year. Who would think it would be a problem for public agencies to adhere to laws that protect wildlife?

RSS (/user/Defiance Canyon Raptor Rescue/rss.xml)

PUBLISHED TO

Defiance Canyon Raptor Rescue (/blogs/Defiance%20Canyon%20Raptor%20Rescue)

TAGS

#Birdwatching (/tags/Birdwatching)

#ClimateChange (/tags/ClimateChange)

#Eagles (/tags/Eagles)

#Environment (/tags/Environment)

#Fire (/tags/Fire)

#Nature (/tags/Nature)

#Raptors (/tags/Raptors)

#Wildlife (/tags/Wildlife)

Climate change impacts have been worsening for years, raising temperatures and exacerbating fire danger in California and the world. In many cases though, trees and other plants are being treated as enemies to be annihilated, rather than as the ecosystems that enable life on earth to exist.

In California, both Cal Fire and PG&E are being given exemptions from any environmental review for their "fuel reduction" or "vegetation [redacted]" programs. In this time when thousands of scientists worldwide are screaming and waving red flags about biodiversity and climate catastrophe, the impacts of these projects are being ignored, particularly to wildlife and habitat.

4 2022
by oldhippiedude
★44 💬26

"School lunch isn't cost effective for taxpayers."
by SquireForYou
★244 💬123

And this is freedom? Are they completely insane? Time to lock THEM up.
by Vetwife
★155 💬114

A Dad's Abortion Story...
by ExPatDanBKK
★218 💬83

The Voting System WAS Tampered With In Georgia And Raffensperger Covered It Up
by deltopia
★344 💬169

Sekrit Armee Sundai — Nashunal Adopt A Sheltur Kitteh Munf
by FosterMomInCA
★75 💬151

Political Christianity has killed biblical Jesus and replaced him with the Fascochrist.
by TheCriticalMind
★218 💬306

Let's start assigning blame for mass shootings where it really belongs: "A well regulated Militia..."
by integrate
★61 💬44

I think Russia is being enveloped right now in that triangle
by Joe Pac
★229 💬81

PRESIDENT JOE BIDEN—DAY501--SECOND YEAR DAY138—Evening Shade-Sunday
by hpg
★18 💬137

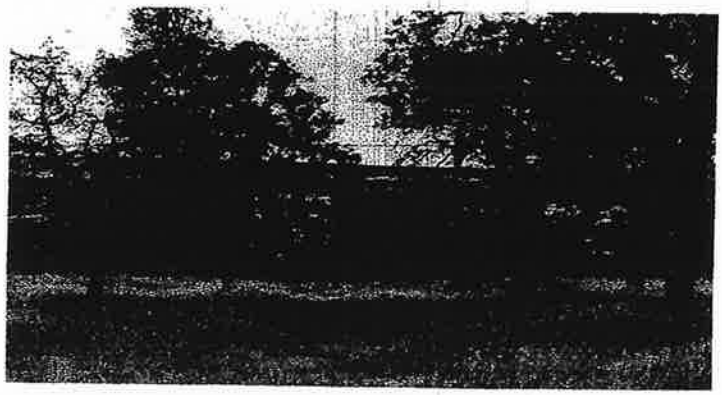
Is the fertilized egg, blastocyst, zygote, embryo a person, a separate self? I argue it cannot be.
by novapsyche
★78 💬128

CRYBABY TRUMP Bashes FOX News, 'Perverts' and 'RINOS' Who 'Didn't Have the Guts' to Impeach Him
by News Corpse
★52 💬32

Ukraine Invasion Day 102: Putin on foreign weapons supplies,

What has happened over the past several years to a bald eagle nest east of Red Bluff, California illustrates what is occurring because of these exemptions from any oversight. The fear of fire is being exploited to the detriment of the natural world, rather than substantive actions being implemented to reduce the emissions which are causing climate disaster.

Hwy 36, east of Red Bluff. The eagle nest is to the right (south side). This is the roadside Cal Fire has burned in 2020 and 2021 when the eagle nest was occupied. There is little reason to burn here, and many reasons not to.



The eagles' nest to the south of the highway, circled in red.

Parent eagle with young eaglet in front (little grey head) in nest tree, April 2022.

Local residents have been watching this nest since 2020. A photographer from Red Bluff was going out to the nest every day in 2021. At the end of May, the photographer saw a notice that there was going to be a control burn by the nest in a few days. She contacted a local eagle group, who

called Cal Fire to tell them about the nest which was occupied by two young eaglets. The eagle group left a message and received a message back from Cal Fire saying their biologist said it was fine to be burning near the nest. The eagle group called back to get the biologist's name, but received no answer then or later. It wasn't "fine".

The burn was done on June 1st. This nest is approximately 100 feet down a ravine from the highway. The eaglets were probably only 6-7 weeks old, 4 or 5 weeks from being able to fly.

The photographer was standing next to the nest during the burn and taking photographs. The Cal Fire people were slightly to the east of the nest. The smoke and flames can be seen on the south side of the highway, on the same side as the nest.

Cal Fire burning next to eagle nest, 2021. How much extra CO2 is being emitted by extra equipment use and burning unnecessarily?

The photographer went to check the nest a few days later and saw one adult perched above the nest, but could see no eaglets.

The next morning, the photographer took a photo which shows a dead eaglet hanging from the nest. The photographer contacted me (Marily Woodhouse from Defiance Canyon Raptor Rescue). We went to search for the other eaglet, in the hope it was still alive.

Dead eaglet hanging from the nest.

Both the adults were at the top of the tree, above the nest. I went down the ravine to the nest tree to walk around beneath it to search for the second eaglet and the adults stayed in the tree top. I walked to the southeast side of the tree and looked up and saw the other eaglet hanging dead in the tree, below the nest about 10'.

The second eaglet, dead below the nest.

We reported the deaths to US Fish and Wildlife and CA Department of Fish and Wildlife, but never received any notification of any action taken.

A State Wildlife Health Lab biologist wrote to us later that:

"A bird's respiratory system is more sensitive to toxins, including smoke, than a mammal's respiratory system. This is because birds have a higher oxygen demand than mammals and a bird's lungs are 10 times more efficient at capturing oxygen. The rapid efficiency of gas exchange in bird lungs makes them more susceptible to inhaled toxic agents, including smoke. Inhaled toxins, such as smoke, can cause irritation and damage the respiratory system. It also can

compromise the immune system, making the bird more susceptible to infections. This is especially true in young birds in the nest that are unable to escape the smoke. Smoke inhalation toxicity in birds is caused by irritant gases (aldehydes, hydrogen chloride, and sulfur dioxide), particulate matter, and nonirritant gases (carbon monoxide, carbon dioxide, and hydrogen cyanide) released by combustion."

There was a burn done next to the Dales Station nest in 2020 also. I was called upon to rescue an eaglet who got out of the nest before he could fly that year. It was several days before the burn was done that year, so he was away from the nest when the burn occurred. His sister was still in the nest during the burn. I received a call from Dales Station, less than a mile from the nest, in August, 2020 about an eaglet who had been on the ground for 3 days, standing next to a shallow pool of Paynes Creek. My determination was that it was the female from the nest. She was open-mouthed breathing with a raspy noise. She died a few hours after she was caught and transported. The Wildlife Lab report said: "This was a juvenile female in poor nutritional condition with no fat reserves and minimal pectoral muscle development. Internally, there was evidence of an extensive infection. The visible infection resembled avian tuberculosis which is caused by the bacterium Mycobacterium avium. It's widespread in the environment in soil and dust and is usually an opportunistic infection. Depending on where the lesions are in the bird, gives an idea of how it entered the body. The lesions in this bird were primarily in the air sacs suggesting it was inhaled."

The male who had been in care was released in 2020. A first year eagle was seen back at the nest in 2021. Judging by his and the adults' behavior, it was the male who was in care away from the nest during the burn in 2020.

I had occasion to contact Cal Fire in February 2022 about another issue. I had just been informed that the Dales Station bald eagle nest was occupied, so mentioned it in the hope of preventing another burn next to the nest. Cal Fire and its employees are public servants. It is their job to uphold state and federal laws, which include protection of wildlife, but the answer from a Cal Fire employee contained only dismissive, condescending remarks, clearly refusing to take steps to ensure any protections were implemented.

2020 bald eaglet being released. He was away from the nest in rehab care during Cal Fire's control burn in 2020, which probably saved his life.

Many letters, calls, and emails have ensued since February (most unanswered). I made maps from Cal Fire's own fire database showing how rarely the area around the nest has burned. The ravine area there is extremely rocky and is grazed by cattle. And then there are the State and Federal laws that protect nesting birds. Still, Cal Fire will not commit to refrain from burning by the nest again this year.

Last week a biologist from a PG&E contractor company working in Greenville (a town that burned in the Dixie fire last year) called Raptor Rescue because they wanted us to take eggs from a nest in a tree they wanted to cut down. I explained the multitude of reasons that was a bad idea, along with it being illegal for them to do. The man said "We have an exemption". How many nesting birds are being destroyed in California due to these stupid, thoughtless exemptions and the complete lack of oversight which is occurring?

There have got to be protections enforced. Apparently that won't happen without widespread public outrage.

Here are some state employees to contact if you will help tell them there is a problem with their practices:

George Morris, Cal Fire Northern Region Unit Chief (530) 224-2445 (They would not give out his email address)

Dave Russell, Cal Fire Tehama/Glenn Unit Chief (530) 528-5199 dave.russell@fire.ca.gov

Tina Bartlett, Regional Manager CDFW, (530) 225-2300 tina.bartlett@wildlife.ca.gov

People often focus on individual species, but we believe every species is important, whether it is on a man-made list or not. Habitat fragmentation and loss have significant impacts on wildlife. Defiance Canyon Raptor Rescue works to rescue, rehabilitate, and return raptors to their wild lives, along with our work to protect watersheds and forests of California.

www.thebattlecreekalliance.org (http://www.thebattlecreekalliance.org/)

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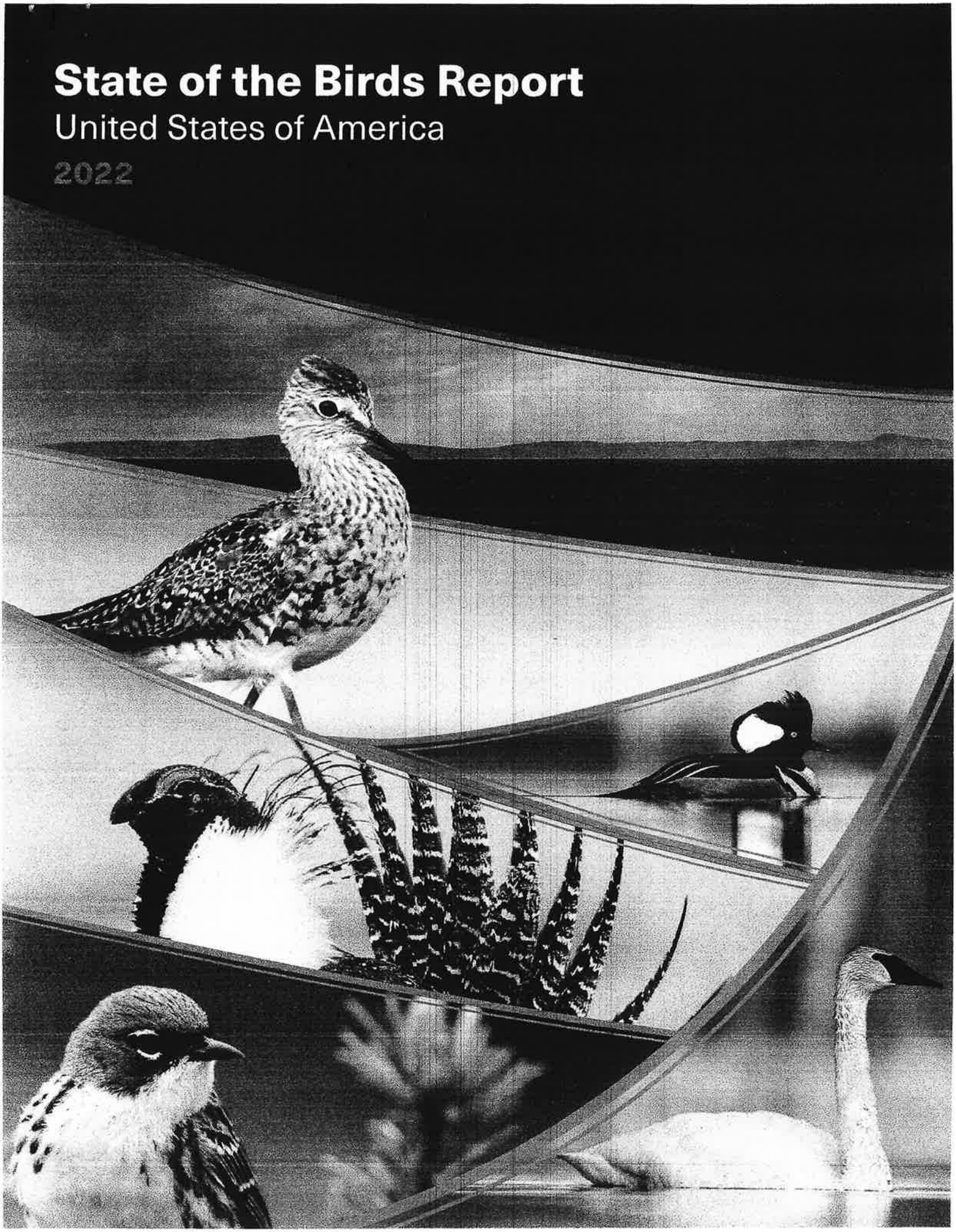
State of the Birds Report

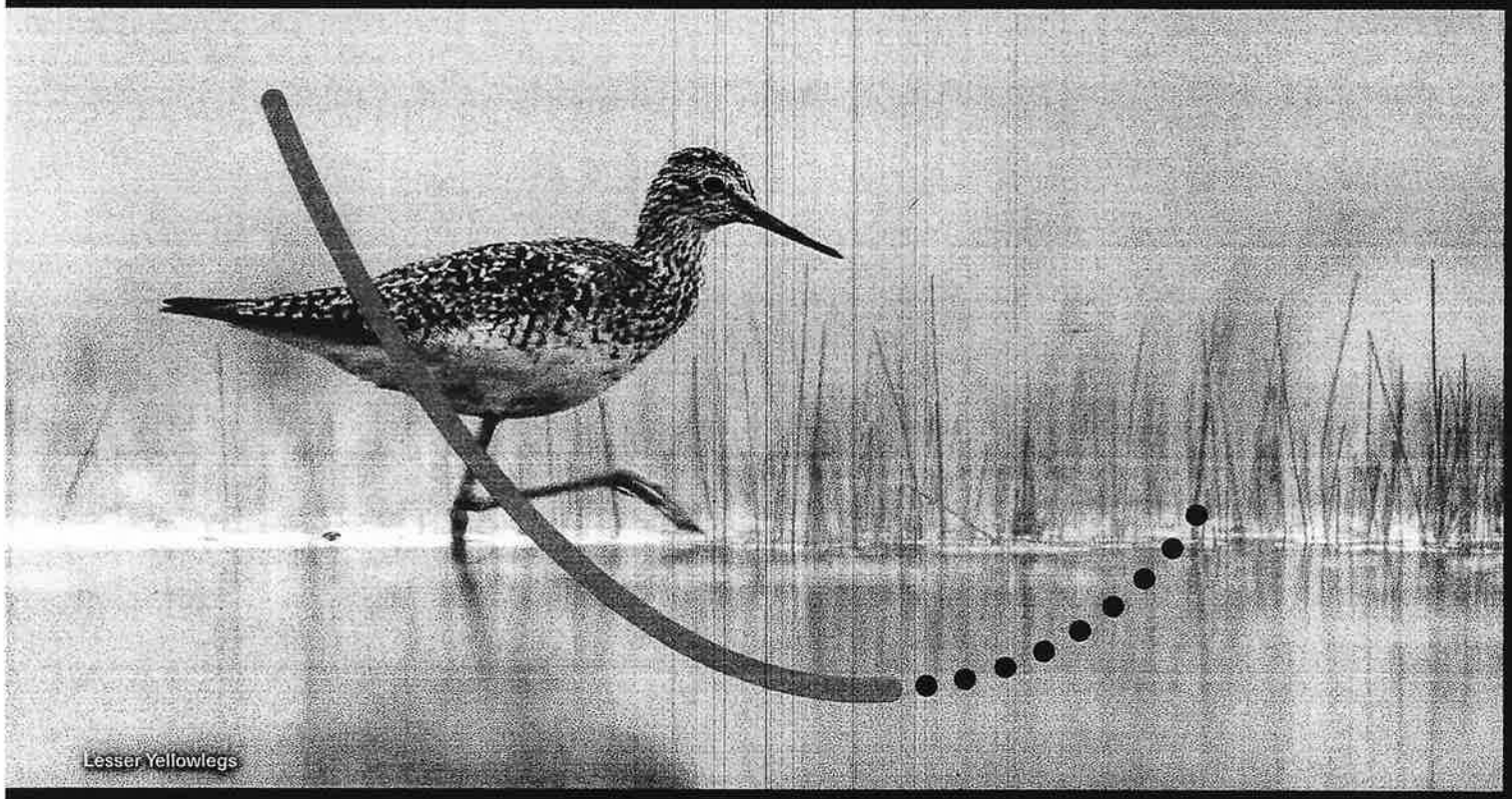
United States of America

2022



We Can Bend the Curve to Bring Birds Back

The United States and Canada have lost 3 billion breeding birds since 1970—a loss of 1 in 4 birds, according to research published in *Science* in 2019. This steep decline in abundance can be reversed with new scales of conservation actions that benefit not only birds but also wildlife and people.



When Birds Thrive. **We All Win**

State of the Birds at a Glance

The trends for our nation's birds reveal a vital message. Birds are declining overall in every habitat except in wetlands, where decades of investment have resulted in dramatic gains.

Conservation works when we give birds and nature a chance. Let's do more to save our nation's birds and benefit people in every state.

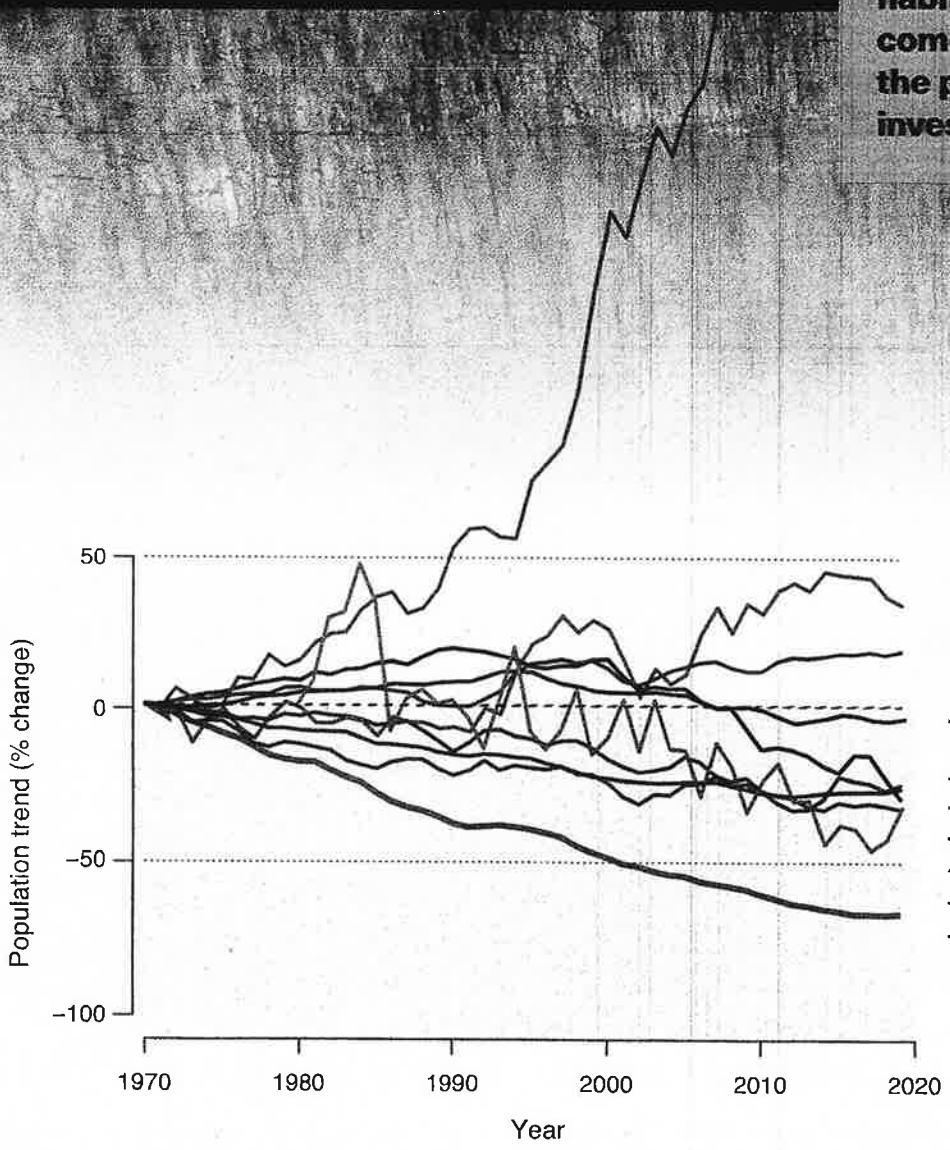
Three billion birds lost

1 in 4 breeding birds have been lost from the United States and Canada in the past 50 years.

70 Tipping Point bird species in the United States

These 70 species have lost two-thirds of their populations in the past 50 years, and are on track to lose another 50% in the next 50 years.

Birds across the U.S. show downward trends in every habitat except in wetlands, where comebacks of waterfowl show the power of funding and policy investments.



+1,076% Geese and Swans

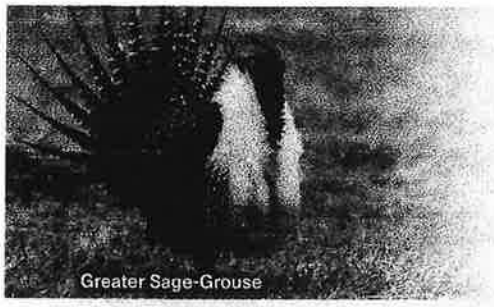
+34% Dabbling/Diving Ducks

+18% Waterbirds

−5% Western Forest Birds

−26% Aridland Birds
−27% Eastern Forest Birds
−30% Sea Ducks
−33% Shorebirds
−34% Grassland Birds
−67% Tipping Point Species

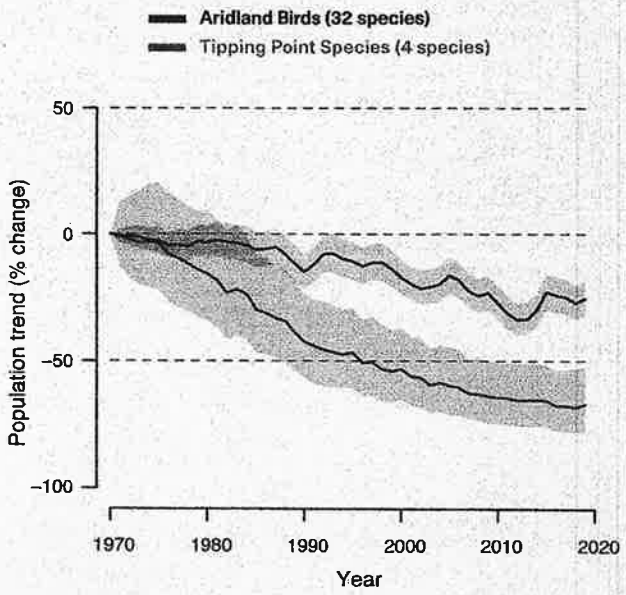
Trends for breeding bird species by group or by habitat during 1970–2019, except for the shorebirds trend, which begins in 1980. For details, see pages 6–13.


Greater Sage-Grouse

ARIDLAND BIRDS

A Key Role for Public Lands

Status: Long-term declines with unrelenting habitat threats

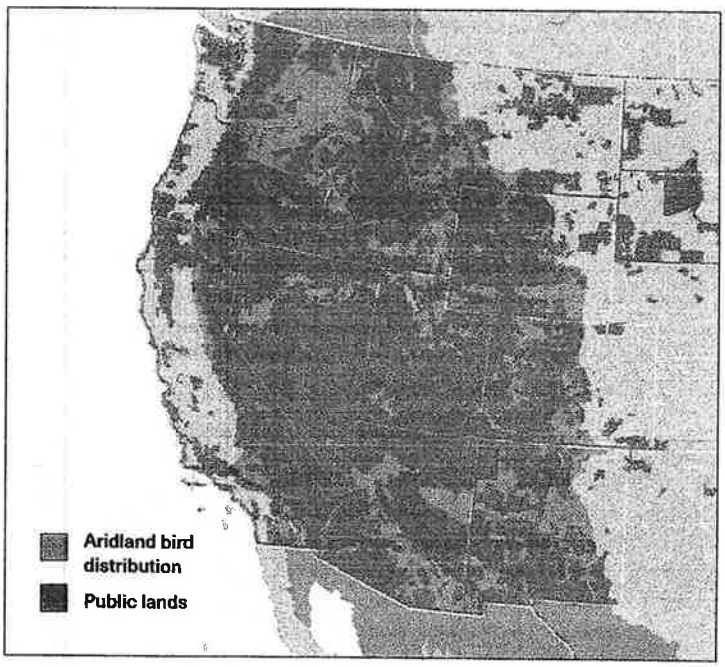


Aridland birds have been in a long-term decline, with a slight improvement since 2012. Fires, drought, invasive plants, development, unsustainable grazing, and energy extraction pressures on habitat are all driving aridland bird declines.

- Several aridland birds (such as Chihuahuan Raven, Sage Thrasher, and Pyrrhuloxia) exhibit accelerated rates of decline since 2010.
- Bendire's and LeConte's Thrasher have experienced long-term declines, but the Bendire's Thrasher population has stabilized in the past decade.
- Greater Sage-Grouse shows a continued steep decline that warrants increased voluntary habitat conservation incentives and renewed strong federal and state protections.

Public Lands Are Essential for Aridland Bird Conservation

The federal government and state agencies have a vital role to play in turning around bird declines in sagebrush and desert habitats. According to the 2011 State of the Birds report, public lands in the American West support more than half of the breeding distribution of aridland birds. Bureau of Land Management lands are particularly important, supporting almost a quarter of the distribution of all aridland birds and more than two-thirds of the U.S. distributions of Sage Thrasher and Sagebrush Sparrow, both species with declining populations. U.S. Forest Service lands in coastal chaparral habitats are important for the declining Wrentit. National Park Service lands are important for some desert bird species, such as the Bendire's Thrasher (a Tipping Point species). The 2011 State of the Birds Report found that about 80% of publicly owned aridlands were vulnerable to activities that could potentially degrade bird habitat—including energy development, off-road vehicle traffic, grazing, mining, and logging. Aridland bird habitat conservation can be compatible with multiple land uses, but management plans for these landscapes need to include measures to ensure long-term healthy populations of aridland birds.



WESTERN PUBLIC LANDS ARE HABITAT FOR ARIDLAND BIRDS

This map shows the cumulative range for 30 aridland bird species in North America, with the vast majority of that range falling within the boundaries of federal and state public lands. Source: Aridland bird data from Bird Conservation Regions, Bird Studies Canada and NABCI. Public lands map from GISGeography.com.


Bullock's Oriole

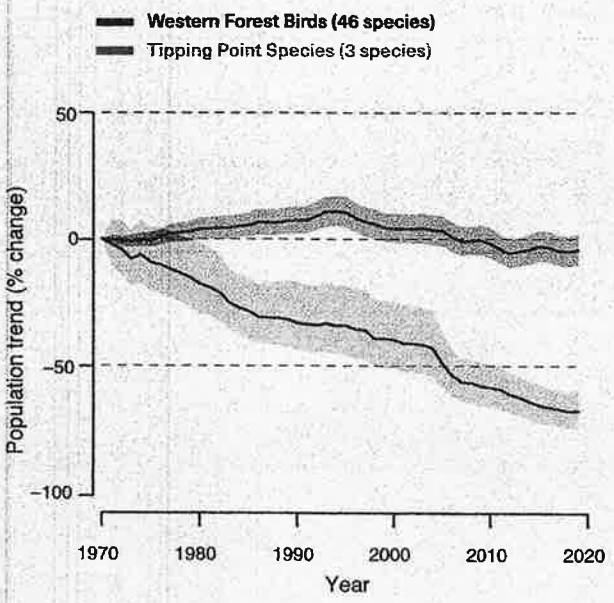
WESTERN FOREST BIRDS

Restoring Natural Cycles for Forest Health

STATUS: Stable overall, but with warning signs

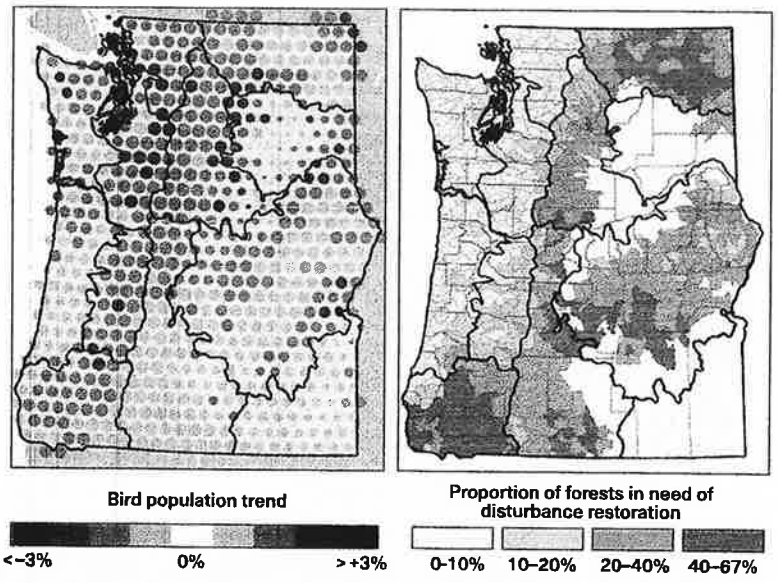
The overall population for the western forest birds group is much the same as it was 50 years ago, aided by protected habitats. But since reaching recent highs in the early 1990s, western forest birds have declined by nearly 20%.

- Almost half of this group (19 species) currently have declining population trends.
- Five species have lost more than half of their population since 1970, including Tipping Point species such as Pinyon Jay and Rufous Hummingbird with poorly understood life cycles. More science is needed to identify the drivers of their declines.
- Recent declining trends among Oak Titmouse, Williamson's Sapsucker, and other birds appear to be associated with the disruption of natural disturbance patterns such as fire cycles.



Birds Are Declining Where Western Forests Are Stressed

For most of the past 100 years, western forests have been managed to encourage conifer tree dominance and discourage fires. But for many centuries before the 1900s, fires were common on this landscape, both natural wildfires and intentional burns by Indigenous peoples. Today those historic disturbance patterns that created a mosaic of conifer and broadleaf forest cover and successional stages have been disrupted, and large swaths of western forest landscapes have departed from their natural range of tree species and structural diversity. These areas of forest departure from natural patterns are also hotspots for western forest bird declines. Furthermore, these compromised forests have very little resilience to the forces of wildfire and climate change, which puts greater forest landscape health and forest resources (such as water reservoirs) at risk of disaster. Investments in forest restoration can turn around this dim outlook for western forests and western forest birds.



BIRD DECLINES IN FORESTS THAT HAVE DEPARTED FROM HISTORIC CYCLES

According to population trends generated by eBird data, bird numbers tend to be declining in forests that have departed from historic conditions and are most in need of disturbance restoration. Sources: Cornell Lab | eBird data 2007–2019 (left map); DeMeo et al, "Expanding Our Understanding of Forest Structural Restoration Needs in the Pacific Northwest," *Northwest Science*, Winter 2018 (right map).

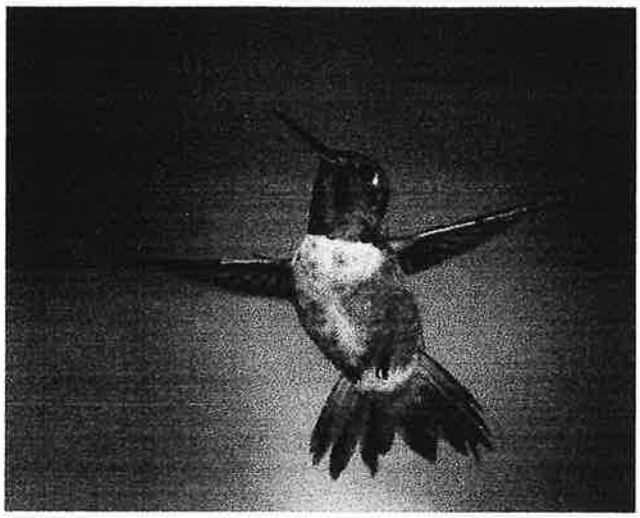
Bird Declines Are Reaching a Tipping Point

Sounding an Alarm About Steep Population Losses

In 2019, a study of 529 bird species with adequate long-term data for analysis (*Science*, Rosenberg et al.) found that 303 species in North America were declining—more than half of the bird species studied.

Now scientists with the Road to Recovery initiative have issued an alert for 90 declining bird species—birds that are not yet federally listed as threatened or endangered, but that have lost half or more of their breeding population since 1970. The scientists further identified a subset of 70 Tipping Point species that could lose another half or more of their populations in the next 50 years, based on recent trajectories and expert assessments.

These Tipping Point species are high priorities for science and conservation because of their high vulnerability to extinction, high urgency, and steep population declines where known. All are included on the Birds of Conservation Concern List of the U.S. Fish and Wildlife Service and/or state lists of Species of Greatest Conservation Need.



Two-thirds of Rufous Hummingbirds have been lost in the past 50 years.

On Alert: All of these bird species have lost half of their populations in the past 50 years

Baird's Sparrow
Black-billed Cuckoo
Black Skimmer
Black Swift
Canada Warbler
Cerulean Warbler
Clark's Grebe
Eastern Whip-poor-will
Grace's Warbler
Long-billed Dowitcher
Mourning Warbler
Olive-sided Flycatcher ✓
Red-headed Woodpecker ✓
Rock Sandpiper
Snowy Owl
Surfbird
Thick-billed Longspur
Western Grebe
Wilson's Plover
Wood Thrush

Allen's Hummingbird
American Golden-Plover
Ashy Storm-Petrel*
Audubon's Shearwater*
Bachman's Sparrow
Band-rumped Storm-Petrel*
Bendire's Thrasher
Bicknell's Thrush*
Black-capped Petrel*
Black-chinned Sparrow
Black-footed Albatross*
Black-vented Shearwater*
Black Rail*
Black Rosy-Finch*
Black Scoter
Bobolink
Bristle-thighed Curlew*
Brown-capped Rosy-Finch*

Buff-breasted Sandpiper
Cassia Crossbill*
Chestnut-collared Longspur
Chimney Swift
Craveri's Murrelet*
Elegant Tern*
Evening Grosbeak ✓
Fea's Petrel*
Golden-winged Warbler
Great Black-backed Gull
Greater Sage-Grouse ✓
Guadalupe Murrelet*
Harris's Sparrow
Heermann's Gull*
Henslow's Sparrow
Hudsonian Godwit
Ivory Gull*
King Eider

King Rail
Kittlitz's Murrelet*
Laysan Albatross*
Least Tern
LeConte's Sparrow
LeConte's Thrasher
Lesser Prairie-Chicken*
Lesser Yellowlegs
Mottled Duck
Mountain Plover
Murphy's Petrel*
Parkinson's Petrel*
Pectoral Sandpiper
Pinyon Jay ✓
Prairie Warbler
Red-faced Cormorant
Red-legged Kittiwake*
Ruddy Turnstone

Rufous Hummingbird ✓
Saltmarsh Sparrow*
Scripps's Murrelet*
Seaside Sparrow*
Semipalmated Sandpiper
Short-billed Dowitcher
Sprague's Pipit
Stilt Sandpiper
Townsend's Storm-Petrel*
Tricolored Blackbird*
Wandering Tattler
Whimbrel
Whiskered Auklet*
Yellow-billed Loon
Yellow-billed Magpie
Yellow Rail*

These Tipping Point species are on a trajectory to lose another 50% of their remnant populations in the next 50 years if nothing changes.

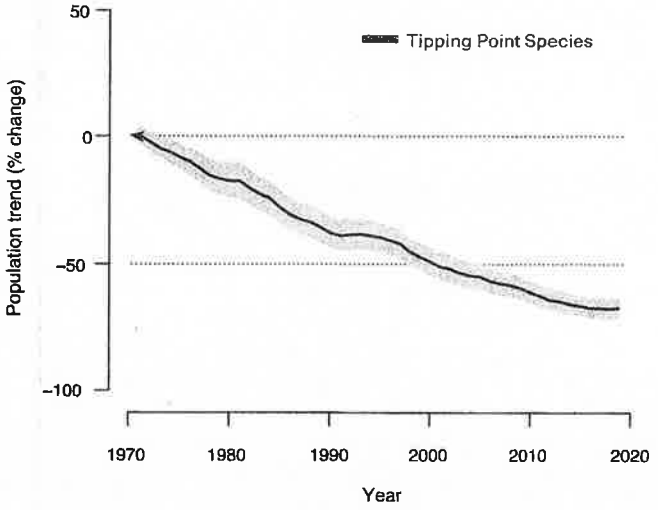
These 90 bird species lost 50% or more of their populations during 1970–2019. The Tipping Point species are on a trajectory to lose another 50% of their populations in the next 50 years (39 species), or already have perilously small populations and continue to face high threats, but lack sufficient monitoring data (31 species, indicated with an asterisk). For the USFWS Birds of Conservation Concern list, visit fws.gov/media/birds-conservation-concern-2021pdf.

The Next Set of Species Plummeting Toward Endangered Status

Of the 1,093 bird species protected under the Migratory Bird Treaty Act, 89 birds have received additional protections as either threatened or endangered under the U.S. Endangered Species Act to prevent their extinction.

The Tipping Point species represent another 70 birds that could be next to face threatened or endangered status. Cumulatively, the Tipping Point species that have sufficient data for monitoring have lost more than two-thirds of their populations in the past 50 years.

Tipping Point species come from varied habitats, but they all have the same urgency—immediate science and conservation actions are needed to turn around declines.



70 Tipping Point Species

Urgent action is needed to help these birds before they become endangered.

GRASSLAND BIRDS
Prairie specialists such as Mountain Plover, Sprague's Pipit, and Chestnut-collared Longspur have lost more than 75% of their populations since 1970.

FOREST BIRDS
The steepest declines among forest birds include species that specialize on tree seeds (e.g., Pinyon Jay), long-distance migrants (e.g., Bicknell's Thrush), and aerial insect-eating specialists (e.g., Chimney Swift).

ARCTIC & ALPINE TUNDRA
Shrinking habitats due to changing climate and resource extraction threaten Arctic-breeding shorebirds (e.g., Hudsonian Godwit and Whimbrel) and alpine birds (e.g., Black Rosy-Finch).

COASTAL & OCEANIC
Nearly a quarter of seabirds found in U.S. waters are at risk of an Endangered listing, including murrelets, albatrosses, petrels, and shearwaters.

ARIDLAND BIRDS
Aridland birds are experiencing long-term declines, including Allen's Hummingbird, Bendire's Thrasher, and Greater Sage-Grouse.

WETLAND BIRDS
Though many waterbirds benefited from decades of wetland conservation, steep bird declines are still occurring in coastal saltmarshes (e.g., Saltmarsh Sparrow), freshwater marshes (e.g., Yellow Rail), and beaches (e.g., Least Tern).

Science REPORTS

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Decline of the North American avifauna

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Species extinctions have defined the global biodiversity crisis, but extinction begins with loss in abundance of individuals that can result in compositional and functional changes of ecosystems. Using multiple and independent monitoring networks, we report population losses across much of the North American avifauna over 48 years, including once common species and from most biomes. Integration of range-wide population trajectories and size estimates indicates a net loss approaching 3 billion birds, or 29% of 1970 abundance. A continent-wide weather radar network also reveals a similarly steep decline in biomass passage of migrating birds over a recent 10-year period. This loss of bird abundance signals an urgent need to address threats to avert future avifaunal collapse and associated loss of ecosystem integrity, function and services.

Slowing the loss of biodiversity is one of the defining environmental challenges of the 21st century (*1–5*). Habitat loss, climate change, unregulated harvest, and other forms of human-caused mortality (*6, 7*) have contributed to a thousand-fold increase in global extinctions in the Anthropocene compared to the presumed prehuman background rate, with profound effects on ecosystem functioning and services (*8*). The overwhelming focus on species extinctions, however, has underestimated the extent and consequences of biotic change, by ignoring the loss of abundance within still-common species and in aggregate across large species assemblages (*2, 9*). Declines in abundance can degrade ecosystem integrity, reducing vital ecological, evolutionary, economic, and social services that organisms provide to their environment (*8, 10–15*). Given the current pace of global environmental change, quantifying change in species abundances is essential to assess ecosystem impacts. Evaluating the magnitude of declines requires effective long-term monitoring of population sizes and trends, data which are rarely available for most taxa.

Birds are excellent indicators of environmental health and ecosystem integrity (*16, 17*), and our ability to monitor many species over vast spatial scales far exceeds that of any other animal group. We evaluated population change for 529 species of birds in the continental United States and Canada (76% of breeding species), drawing from multiple standardized bird-monitoring datasets, some of which provide close to fifty years of population data. We integrated range-wide estimates of population size and 48-year population trajectories, along with their associated uncertainty, to quantify net change in numbers of birds across the avifauna over recent decades (*18*). We also used a network 143 weather radars (NEXRAD) across the contiguous U.S. to estimate long-term changes in nocturnal migratory passage of avian biomass through the airspace in spring from 2007 to 2017. The continuous operation and broad coverage of NEXRAD provide an automated and standardised monitoring tool with unrivaled temporal and spatial extent (*19*). Radar measures cumulative passage across all nocturnally migrating species, many of which breed in areas north of the contiguous U.S. that are poorly monitored by avian surveys. Radar thus expands the area and the proportion of the migratory avifauna that is sampled relative to ground surveys.

Results from long-term surveys, accounting for both increasing and declining species, reveal a net loss in total abundance of 2.9 billion (95% CI = 2.7-3.1 billion) birds across almost all biomes, a reduction of 29% (95% CI = 27-30%) since 1970 (Fig. 1 and Table 1). Analysis of NEXRAD data indicate a similarly steep decline in nocturnal passage of migratory biomass, a reduction of 13.6 ± 9.1% since 2007 (Fig. 2A). Reduction in biomass passage occurred across the eastern U.S. (Fig. 2, C and D), where migration is dominated by large numbers of temperate- and boreal-breeding songbirds; we observed no consistent trend in the Central or Pacific flyway regions (Fig. 2, B to D, and table S5). Two completely different and independent monitoring techniques thus signal major population loss across the continental avifauna.

Species exhibiting declines (57%, 303/529) based on long-

term survey data span diverse ecological and taxonomic groups. Across breeding biomes, grassland birds showed the largest magnitude of total population loss since 1970—more than 700 million breeding individuals across 31 species— and the largest proportional loss (53%); 74% of grassland species are declining. (Fig. 1 and Table 1). All forest biomes experienced large avian loss, with a cumulative reduction of more than 1 billion birds. Wetland birds represent the only biome to show an overall net gain in numbers (13%), led by a 56% increase in waterfowl populations (Fig. 3 and Table 1). Surprisingly, we also found a large net loss (63%) across 10 introduced species (Fig. 3, D and E, and Table 1).

A total of 419 native migratory species experienced a net loss of 2.5 billion individuals, whereas 100 native resident species showed a small net increase (26 million). Species overwintering in temperate regions experienced the largest net reduction in abundance (1.4 billion), but proportional loss was greatest among species overwintering in coastal regions (42%), southwestern aridlands (42%), and South America (40%) (Table 1 and fig. S1). Shorebirds, most of which migrate long distances to winter along coasts throughout the hemisphere, are experiencing consistent, steep population loss (37%).

More than 90% of the total cumulative loss can be attributed to 12 bird families (Fig. 3A), including sparrows, warblers, blackbirds, and finches. Of 67 bird families surveyed, 38 showed a net loss in total abundance, whereas 29 showed gains (Fig. 3B), indicating recent changes in avifaunal composition (table S2). While not optimized for species-level analysis, our model indicates 19 widespread and abundant landbirds (including 2 introduced species) each experienced population reductions of >50 million birds (data S1). Abundant species also contribute strongly to the migratory passage detected by radar (*19*), and radar-derived trends provide a fully independent estimate of widespread declines of migratory birds.

Our study documents a long-developing but overlooked biodiversity crisis in North America—the cumulative loss of nearly 3 billion birds across the avifauna. Population loss is not restricted to rare and threatened species, but includes many widespread and common species that may be disproportionately influential components of food webs and ecosystem function. Furthermore, losses among habitat generalists and even introduced species indicate that declining species are not replaced by species that fare well in human-altered landscapes. Increases among waterfowl and a few other groups (e.g., raptors recovering after the banning of DDT) are insufficient to offset large losses among abundant species (Fig. 3). Importantly, our population loss estimates are conservative since we estimated loss only in breeding populations. The total loss and impact on communities and ecosystems could be even higher outside the breeding season if we consider the amplifying effect of "missing" reproductive output from these lost breeders.

Extinction of the Passenger Pigeon (*Ectopistes migratorius*), once likely the most numerous bird on the planet, provides a poignant reminder that even abundant species can go extinct rapidly. Systematic monitoring and attention paid to population declines could have alerted society to its pending extinction (*20*). Today, monitoring data suggest that avian declines will likely continue without targeted conservation action, triggering additional endangered species listings at tremendous financial and social cost. Moreover, because birds provide numerous benefits to ecosystems (e.g., seed dispersal, pollination, pest control) and economies (47 million people spend 9.3 billion U.S. dollars per year through bird-related activities in the U.S. (*21*)), their population reductions and possible extinctions will have severe direct and indirect consequences (*10*, *22*). Population declines can be reversed, as evidenced by the remarkable recovery of waterfowl populations under adaptive harvest management (*23*) and the associated allocation of billions of dollars devoted to wetland protection and restoration, providing a model for proactive conservation in other widespread native habitats such as grasslands.

Steep declines in North American birds parallel patterns of avian declines emerging globally (*14*, *15*, *22*, *24*). In particular, depletion of native grassland bird populations in North America, driven by habitat loss and more toxic pesticide use in both breeding and wintering areas (*25*), mirrors loss of farmland birds throughout Europe and elsewhere (*15*). Even declines among introduced species match similar declines within these same species' native ranges (*26*). Agricultural intensification and urbanization have been similarly linked to declines in insect diversity and biomass (*27*), with cascading impacts on birds and other consumers (*24*, *28*, *29*). Given that birds are one of the best monitored animal groups, birds may also represent the tip of the iceberg, indicating similar or greater losses in other taxonomic groups (*28*, *30*).

Pervasiveness of avian loss across biomes and bird families suggests multiple and interacting threats. Isolating spatio-temporal limiting factors for individual species and populations will require additional study, however, since migratory species with complex life histories are in contact with many threats throughout their annual cycles. A focus on breeding season biology hampers our ability to understand how seasonal interactions drive population change (*31*), although recent continent-wide analyses affirm the importance of events during the non-breeding season (*19*, *32*). Targeted research to identify limiting factors must be coupled with effective policies and societal change that emphasize reducing threats to breeding and non-breeding habitats and minimizing avoidable anthropogenic mortality year-round. Endangered species legislation and international treaties, such as

the 1916 Migratory Bird Treaty between Canada and the United States, have prevented extinctions and promoted recovery of once-depleted bird species. History shows that conservation action and legislation works. Our results signal an urgent need to address the ongoing threats of habitat loss, agricultural intensification, coastal disturbance, and direct anthropogenic mortality, all exacerbated by climate change, to avert continued biodiversity loss and potential collapse of the continental avifauna.

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Table 1. Net change in abundance across the North American avifauna, 1970-2017. Species are grouped into native and introduced species, management groups (landbirds, shorebirds, waterbirds, waterfowl), major breeding biomes, and nonbreeding biomes (see data S1 in (*18*) for assignments and definitions of groups and biomes). Net change in abundance is expressed in millions of breeding individuals, with upper and lower 95% credible intervals (CI) shown. Percentage of species in each group with negative trend trajectories are also noted. Values in bold indicate declines and loss; those in italics indicate gains.

Species Group	Number of Species	Net Abundance Change (Millions) & 95% CI			Percent Change & 95% CIs			Proportion Species in Decline
		Change	LC95	UC95	Change	LC95	UC95	
Species Summary								
All N. Am. Species	529	**-2,911.9**	-3,097.5	-2,732.9	**-28.8%**	-30.2%	-27.3%	57.3%
All Native Species	519	**-2,521.0**	-2,698.5	-2,347.6	**-26.5%**	-28.0%	-24.9%	57.4%
Introduced Species	10	**-391.6**	-442.3	-336.6	**-62.9%**	-66.5%	-56.4%	50.0%
Native Migratory Species	419	**-2,547.7**	-2,723.7	-2,374.5	**-28.3%**	-29.8%	-26.7%	58.2%
Native Resident Species	100	*26.3*	7.3	46.9	*5.3%*	1.4%	9.6%	54.0%
Landbirds	357	**-2,516.5**	-2,692.2	-2,346.0	**-27.1%**	-28.6%	-25.5%	58.8%
Shorebirds	44	**-17.1**	-21.8	-12.6	**-37.4%**	-45.0%	-28.8%	68.2%
Waterbirds	77	**-22.5**	-37.8	-6.3	**-21.5%**	-33.1%	-6.2%	51.9%
Waterfowl	41	*34.8*	24.5	48.3	*56.0%*	37.9%	79.4%	43.9%
Aerial Insectivores	26	**-156.8**	-183.8	-127.0	**-31.8%**	-36.4%	-26.1%	73.1%
Breeding Biome								
Grassland	31	**-717.5**	-763.9	-673.3	**-53.3%**	-55.1%	-51.5%	74.2%
Boreal forest	34	**-500.7**	-627.1	-381.0	**-33.1%**	-38.9%	-26.9%	50.0%
Forest Generalist	40	**-482.2**	-552.5	-413.4	**-18.1%**	-20.4%	-15.8%	40.0%
Habitat Generalist	38	**-417.3**	-462.1	-371.3	**-23.1%**	-25.4%	-20.7%	60.5%
Eastern Forest	63	**-166.7**	-185.8	-147.7	**-17.4%**	-19.2%	-15.6%	63.5%
Western forest	67	**-139.7**	-163.8	-116.1	**-29.5%**	-32.8%	-26.0%	64.2%
Arctic Tundra	51	**-79.9**	-131.2	-0.7	**-23.4%**	-37.5%	-0.2%	56.5%
Aridlands	62	**-35.6**	-49.7	-17.0	**-17.0%**	-23.0%	-8.1%	56.5%
Coasts	38	-6.1	-18.9	8.5	-15.0%	-39.4%	21.9%	50.0%
Wetlands	95	*20.6*	8.3	35.3	*13.0%*	5.1%	23.0%	47.4%
Nonbreeding Biome								
Temperate North America	192	**-1,413.0**	-1,521.5	-1,292.3	**-27.4%**	-29.3%	-25.3%	55.2%
South America	41	**-537.4**	-651.1	-432.6	**-40.1%**	-45.2%	-34.6%	75.6%
Southwestern Aridlands	50	**-238.1**	-261.2	-215.6	**-41.9%**	-44.5%	-39.2%	74.0%
Mexico-Central America	76	**-155.3**	-187.8	-122.0	**-15.5%**	-18.3%	-12.6%	52.6%
Widespread Neotropical	22	**-126.0**	-171.2	-86.1	**-26.8%**	-33.4%	-19.3%	45.5%
Widespread	60	-31.6	-63.1	1.6	-3.7%	-7.4%	0.2%	43.3%
Marine	26	**-16.3**	-29.7	-1.2	**-30.8%**	-49.1%	-2.5%	61.5%
Coastal	44	**-11.0**	-14.9	-6.7	**-42.0%**	-51.8%	-26.7%	68.2%
Caribbean	8	-6.0	1.4	-15.7	12.1%	-2.8%	31.7%	25.0%

OLD-GROWTH HABITATS AND ASSOCIATED WILDLIFE SPECIES IN THE NORTHERN ROCKY MOUNTAINS

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Wildlife Habitat Relationships Program

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INVENTORY AND STAND SELECTION

INTRODUCTION

Old-growth forests are an important component of biological diversity. Old-growth stands are characterized by an increasing variety in sizes and species composition of trees, and more diversity of functions and interactions as compared with earlier successional stages. A complex, multi-storied structure and a mosaic of both early and late successional stages often are important attributes (Bormann and Likens 1979). Old-growth forests are not the same as successional climax (habitat type), often being dominated by seral tree species.

The greater vertical and horizontal diversity found within an old-growth stand allows for niche specialization by wildlife. Although the individual wildlife species occurring may not be unique to old-growth stands, the assemblage of wildlife species and the complexity of interactions between them are different than in earlier successional stages.

OLD-GROWTH FORESTS: CONDITIONS IN THE NORTHERN ROCKIES

The Northern Rocky Mountains exhibit very diverse vegetation patterns. In addition to wide gradients in climate and elevation, wildfire has played a major role in the evolution of forest ecosystems in the northern Rockies (Habeck 1987). At the time of European settlement, fire-generated or fire-perpetuated forest types dominated much of the region.

Northern Idaho and northwestern Montana, which experience an inland maritime climate, support near-climax old-growth forests dominated by western redcedar and western hemlock, as well as subclimax old-growth stands dominated by western larch and western white pine. These sites historically burned infrequently, at 100 to 200-year intervals, often by high-intensity stand replacing fires (Habeck 1985).

In west-central Montana, old-growth forests at lower elevations were typically maintained as an open-canopied savanna by frequent (5 to 20-year interval), low intensity ground fires (Arno 1980). These stands were dominated by western larch and ponderosa pine, or by Douglas-fir on moister sites. Recent fire suppression has favored shade-tolerant tree species such as Douglas-fir. At higher elevations, old-growth forests are dominated by true firs and burn less frequently.

In central and eastern Montana, lodgepole pine dominates large acreages. Lodgepole pine stands typically experience frequent, stand-replacing disturbances from fire or insect outbreaks. Along the eastern ecotone between forest and grassland, ponderosa pine and limber pine stands experienced frequent low-intensity fires (Habeck 1988).

DEFINITIONS OF OLD-GROWTH

Attributes of old-growth stands include large-diameter overstory trees, presence of large standing dead and defective trees, presence of down logs, development of a deep duff layer, and formation of canopy gaps and several canopy layers. Several of these attributes may be less apparent in types experiencing frequent fire.

Long periods of time are required to develop old-growth conditions within a stand. However, stand age may not accurately predict the onset of old-growth conditions, because tree species, site conditions, fire or other disturbance, variations in weather, and other factors interact to affect the rate of succession within a stand.

Structural attributes have generally been used as descriptors of old-growth stands. Pfister (1987) attempted to identify existing

old-growth stands on the Nez Perce and Kootenai National Forests, using overstory tree size, density of snags, density of down material, canopy closure, and canopy layering. Some of the attributes, particularly snags and down logs, were inadequately sampled. Using stand exam data, Pfister found that few stands met all of the pre-determined criteria for old-growth stands.

The national definition developed by the USDA Forest Service describes old growth conceptually, in terms of plant succession and general characteristics. Ecological classifications are to be developed to define the old-growth community type(s) for each major forest type (or forest type group). Definitions for old-growth communities will be based on vegetation structural characteristics which are easily measured.

OLD-GROWTH INVENTORY

Forest-Wide Inventory. Forest-wide estimates are needed of the relative abundance, patch sizes, and spatial distribution of old-growth habitats by forest type. As a first approximation, *candidate* old-growth habitats should be identified, by stand or groups of stands.

Timber stands are delineated on the basis of predominant overstory species, tree size, and tree density. Contiguous old-growth habitat may be composed of more than one stand.

Data sources for identification of candidate stands could include aerial photographs, satellite imagery, timber stand exam data, Ecodata plot data, and other inventories. Detailed information, particularly on dead trees and down logs, may not be available for each stand. For this reason, additional field analysis of candidate stands may be needed.

Candidate old-growth habitat maps should be updated periodically, to reflect actual old-growth habitat delineations as site-specific inventory information becomes available.

To develop an ecological classification for old-growth community types, data on dominant and indicator species must be collected. The Ocular Macroplot or the Cover Microplot sampling methods (FSH 2090.11) would be suitable for this purpose. The optional Density sampling method can be used to estimate the density of components such as snags and down woody material.

Site-specific Stand Analysis. Stand exam and Ecodata plot sampling methods are recommended to describe vegetation composition, tree characteristics, and structure within a stand. Additional sample plots are needed for components that occur in low densities, such as snags and down woody material.

A general rating of the ability of a given stand to provide old-growth habitat conditions can be made. If the old-growth criteria are used collectively as an "in/out" screen, some stands may be excluded which do in fact have value. Thus, a relative rating system should be used.

Old growth "Scorecards" have been used successfully in various areas. Points are scored for each parameter (such as overstory tree size, number of trees per acre, canopy cover, canopy structure, density of snags and down logs, and decadence) and summed for the stand.

Example scorecards, which are based on judgement rather than data, are shown in Exhibit 1. Scorecards should be refined to reflect local habitat types and conditions. To interpret the meaning of the scoring, comparisons could be made with reference stands (those sampled to develop old-growth community classification).

WILDLIFE SPECIES ASSOCIATED WITH OLD-GROWTH HABITATS

Meslow and Wight (1975) found that 69 percent of the birds occurring in Douglas-fir forest types of the Pacific Northwest used old-growth stands. Three species were listed as nesting primarily within old-growth forests: spotted owl, northern goshawk, and Vaux's swift. Bull (1978) identified six species which are primarily associated with old-growth forests in Oregon: great gray owl, barred owl, flammulated owl, white-headed woodpecker, northern three-toed woodpecker, and Townsend's warbler. The marten is associated with mature and old-growth spruce-fir forests in Idaho (Koehler and Hornocker 1977).

In northwestern Montana, McClelland (1977) described a general trend of increased species richness in cavity-nesting birds from young to old-growth stands of larch and Douglas-fir. Old growth was particularly important in providing an adequate number of suitable nesting trees for cavity-nesters. He also noted the association of open-nesters such as the pine grosbeak, Townsend's warbler, varied thrush, black-headed grosbeak, and goshawk with old-growth forests, as well as its value as big game thermal cover.

Based on a literature review, about 40 percent of the 373 wildlife species occuring in the Northern Region were thought to use old-growth forest for feeding and/or reproduction (Harger 1978). Of these, 33 species were thought to be closely associated with old-growth habitats (Table 1).

The following describes the importance to wildlife of various components of old-growth habitats.

Overstory Trees. Large trees are needed to provide suitable nesting sites for large birds. Bark crevices in older trees provide important foraging sites. Large-canopied trees can modify microclimate by providing shade, capturing moisture, and moderating winds.

Dead and Defective Trees. Dead trees (snags) and defective trees (partially dead, spike top, broken top) provide nesting and roosting sites for cavity-users. Snags host invertebrates which are an important food source for woodpeckers.

Down Woody Material. Downfall supports insects and other invertebrates, provides habitat for fungi and saprophytic plants, provides cover and den sites for wildlife, and creates debris dams in streams. Dead woody material holds moisture and contributes to nutrient cycling. In areas with high frequency of fire, this component will be less abundant.

Tree Canopy. A relatively closed canopy, often with two or more layers, creates a more moderate microclimate. Vertical diversity provides a variety of substrates for feeding or nesting, and supports development of forest components such as arboreal lichens.

Decadence. Presence of heart rot, mistletoe, dead or broken tree tops, diseased trees, and saprophytic plants create a variety of microsites and food sources for wildlife.

MANAGEMENT INDICATOR SPECIES

The National Forest Management Act and its implementing regulations require that fish and wildlife habitats be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. In order to estimate the effects of each Forest Plan alternative on fish and wildlife populations, Management Indicator Species (MIS) are to be selected.

Table 1. Species in the Northern Region (north Idaho, Montana, North Dakota, and South Dakota) thought to prefer old-growth components for breeding or feeding (from Harger 1978).

WILDLIFE SPECIES	STRUCTURAL STAGES Breed	Feed	OPTIMUM COVER TYPE
Great Blue Heron	5-6	1	ASP, COT
Northern Goshawk	5-6	3-6	ASP, DF, PP, LPP
Great Gray Owl	6	1	LPP, SAF, SP
Flammulated Owl	5-6	1-2	PP, DF, GF, LPP
Pygmy Owl	5-6	1-6	PP, DF, GF, WL
Saw-whet Owl	5-6	1-6	PP, DF, GF, LPP, SAF, SP
Boreal Owl	5-6	1-6	PP, ASP, SP, SAF, DF
Barred Owl	5-6	3-6	COT, DF, GF
Vaux's Swift	5-6	1-6	ASP, COT, DF, WRC
White-headed Woodpecker	4-6	4-6	PP, WWP
Pileated Woodpecker	4-6	3-6	COT, PP, WL, GF
Three-Toed Woodpecker	4-6	3-6	SAF, WBP
Black-backed Woodpecker	4-6	3-6	PP, DF, WWP
Red-naped Sapsucker	4-6	1-6	BGA, COT
Williamson's Sapsucker	4-6	2-6	PP, WL, GF, SAF, SP
White-breasted Nuthatch	4-6	3-6	PP, DF
Red-breasted Nuthatch	4-6	3-6	PP, ASP, LPP, SAF, SP
Pygmy Nuthatch	4-6	3-6	PP, DF
Brown Creeper	4-6	3-6	DF, LPP, SP, SAF
Great Crested Flycatcher	4-6	2-4	BGA, COT
Hermit Thrush	5-6	2-6	GF, WH, WRC, SAF, SP
Varied Thrush	5-6	2-6	WH, WRC, SP
Townsend's Warbler	4-6	2-6	ASP, COT, PP, DF
Silver-haired Bat	3-6	1-3	PP, DF, WRC, SP
Long-eared Bat	4-6	1-6	PP, DF, GF
Long-legged Myotis	4-6	1-6	LPP, SAF, SP
California Myotis	4-6	1-6	BGA, COT, PP, JPU
Fisher	5-6	3-6	ASP, COT, PP, DF, WWP
Marten	5-6	2-6	LPP, SAF, SP, WRC
Wolverine	3-6	1-6	SAF, WBP
Woodland Caribou	5-6	5-6	SAF, SP, WH, WBP
Boreal Red-back Vole	4-6	4-6	SAF
Northern Flying Squirrel	5-6	5-6	ASP, COT, DF, WWP, SAF

Structural Stages: 1=Grass/Forb, 2=Shrub/Seedling, 3=Pole Trees, 4=Young Trees, 5=Mature Trees, 6=Old-Growth

Cover Types: ASP=Aspen, BGA=Birch/Green Ash, COT=Cottonwood, DF=Douglas-fir, GF=Grand Fir, JPU=Juniper, LPP=Lodgepole Pine, LP=Limber Pine, PP=Ponderosa Pine, SAF=Subalpine Fir, SP=Spruce, WH=Western Hemlock, WL=Western Larch, WRC=Western Redcedar, WWP=Western White Pine, WBP=Whitebark Pine

Several categories of species are to be represented where appropriate: Endangered and threatened plant and animal species; species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished or trapped; non-game species of special interest; and plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities (36 CFR 219.19). The first four categories of MIS include "featured species", wherein management activities are directed to providing specific habitat components to meet management objectives for the individual species. The latter category is intended to include ecological indicators, which are selected to represent a larger community of species.

An ecological indicator will ensure the welfare of only those species whose niches are entirely included within its habitat niche and geographic range. To be effective, then, an ecological indicator should have a large home range and be closely associated with a specific habitat.

The goshawk, pileated woodpecker, and marten were identified as MIS by most Forests in the Northern Region to be used as ecological indicators for old-growth components or old-growth habitats. Each of these species have habitat requirements related to stand structure or components which are more likely to be found in old-growth habitats. Their population densities generally are higher in old-growth than in younger stands. In a California study, both marten and pileated woodpecker were found to be sensitive to habitat fragmentation (Rosenberg and Raphael 1986). Each of these species utilize a relatively large home range, which is thought to include the home ranges of other old-growth-associated species.

The habitat requirements of pileated woodpecker, goshawk, and marten, and models for assessing habitat suitability for each are detailed in subsequent sections. Although Schroeder (1987) identified several problems in HSI modeling, they are the most expedient method for evaluating impacts of habitat change.

The requirements of these species in terms of the size and spacing of habitat patches can be used to determine the distribution of old-growth habitats across the landscape.

OLD-GROWTH STAND SELECTION

Landscape Ecology Theory. Forman and Godron (1981) defined landscape patches as communities surrounded by a matrix with a dissimilar community structure or composition. They hypothesized that species diversity within a patch is a function of habitat diversity, disturbance, area, age, surrounding heterogeneity, isolation, and boundary discreteness.

Old-growth habitats offer comparatively high within-stand structural diversity. As forest management progresses through time, old-growth forests will be represented as remnant patches embedded in a younger-aged matrix.

Patch size correlates strongly with the numbers of species and individuals that can be supported and with rates of extinction and recolonization (May 1975, Simberloff and Aberle 1982). Patch size is particularly significant for large, wide-ranging species (Noss and Harris 1986). As acreage decreases, habitat patches become unsuitable for wildlife species with large home ranges. Of 48 old-growth-associated species occurring in the Northern Region, about 60 percent are thought to require stands larger than 80 acres (Harger 1978).

Patch size is modified by its shape due to edge effect. Changes in temperature, humidity, light, and wind, which influence plant species composition, can occur in a band along the ecotone (edge) (Greene 1988). In Douglas-fir old-growth forest, a circular-shaped stand smaller than 25 acres is effectively all "edge" (influenced by the ecotone); within a stand of 80 acres, half of

the patch provides "interior" conditions (Lemkuhl and Ruggerio in prep.). In northern California, Rosenberg and Raphael (1986) found that old-growth Douglas-fir stands of less than 50 acres tended to lack the full complement of vertebrate wildlife, and suggested that isolated stands should exceed 125 acres in size to be effective. Wilcove et al. (1986) estimated that habitat islands should exceed 250 acres to provide for birds inhabiting forest interior.

The abruptness of the edge, or edge contrast, affects stand insularity. Edges between similar cover types and successional stages cause less isolation than do edges between very dissimilar stands. A patch totally surrounded by dissimilar habitat becomes more similar to a true island, with less movement of species between patch and matrix (Forman and Godron 1981).

Selection of Stands to Manage for Old-Growth Conditions. The recommended scale for initial analysis of the quality and distribution of existing old-growth habitats is the watershed scale (typically about 10,000 acres in size). Individual stands or groups of contiguous stands can be evaluated using a scorecard method. The habitat requirements and dispersal capabilities of old-growth Management Indicator Species should be used to determine the size, shape and spacing of old-growth patches across the forest landscape.

If a particular analysis unit does not contain existing stands of high quality, large enough size, or sufficient overall acreage, the best available (nearest to old-growth condition) stands should be selected. Alternatively, old-growth stands in adjacent watersheds could be selected, provided the spacing of old-growth patches does not exceed the mobility of the MIS.

Roads are generally undesirable within an old-growth habitat patch. The road corridor fragments the habitat by creating edge, and access may result in loss of snags to woodcutting.

Landres et al. (1988) point out that selecting old-growth stands based on within-patch habitat conditions required by the MIS, and then predicting or monitoring habitat conditions for those MIS, is circular reasoning. Because old-growth-associated MIS are intended to represent a community of wildlife species, stand selection and management should not be directed only towards providing the minimum characteristics required by the individual species. Management objectives and actions in the selected old-growth patches should be directed towards protecting or enhancing the integrity and longevity of old-growth conditions.

In devising a conservation strategy, Forman and Godron (1981:738) emphasize the importance of recognizing that "no patch stands alone", but is influenced by surrounding patches. Harris (1984) recommended surrounding old-growth habitat islands with a long-rotation management area, and interconnecting these with riparian corridors and other linkages. Similarly, Noss and Harris (1986) suggest that a regional landscape level be used, wherein high-quality nodes, such as an old-growth patch, would be integrated within interconnected "multiple-use modules", where management activities are scheduled to maintain the integrity of the nodes.

Natural disturbance regimes such as fire often occur on a spatial scale larger than a landscape patch (Urban et al. 1987). Providing for well-distributed habitat patches with interconnections between patches thus are necessary to maintain species diversity over the long term.

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