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November 13, 2023

Mary Farnsworth, Regional Forester

USDA Forest Service

Intermountain Regional Office

324 25th Street

Ogden, UT 84401

**RE: OBJECTION AGAINST THE ASHLEY NATIONAL FOREST FOREST-WIDE
PRESCRIBED FIRE RESTORATION PROJECT**

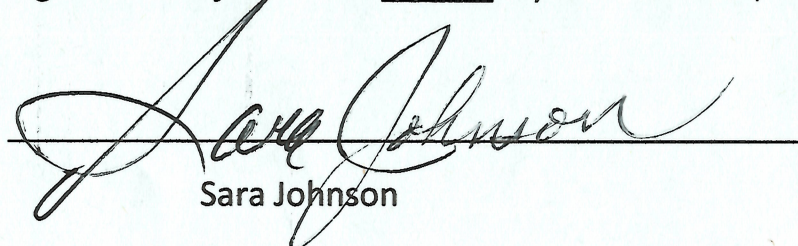
1. Name of Objectors

Sara Johnson, Lead Objector, Director of Native Ecosystems Council, PO Box 125,
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Mike Garrity, Director, Alliance for the Wild Rockies, PO Box 505, Helena, MT
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Signed for Objectors this 13th day of November, 2023


Sara Johnson

2. Description of the Project being Objected to

Ashley National Forest Forest-wide Prescribed Fire Restoration Project on the Ashley National Forest, signed by Responsible Official Susan Eickhoff, Forest Supervisor of the Ashley National Forest.

3. Attachments

This Objection includes 2 attachments, Appendix A with relevant portions of cited literature and/or reports, and Appendix B, which includes a variety of news clippings on the ongoing impacts of global warming.

4. Remedy

Due to the many planned violations of laws and administrative direction and executive orders, such as the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA), the Administrative Procedures Act (APA), the Roadless Area Conservation Rule, and executive order regarding the Migratory Bird Treaty Act (MBTA), we believe this massive slashing/burning proposal across almost 70% of the Ashley National Forest, including within most existing Inventories Roadless Lands, cannot be legally implemented and must be withdrawn. These many violations are summarized in the body of this Objection below.

5. Connection between the content of the Objection and prior written comments by Objectors

On November 17, 2022, Objectors submitted 30 day comments on the draft Environmental Assessment (EA) for the proposed Forest-wide Prescribed Fire

Restoration Project. The Forest Service responded to these comments at pages 152-194 in the draft Decision Notice/final EA section on Response to Public Comments. One of the major concerns that we repeatedly raised in these comments was the lack of adequate information as to how the project would be implemented, including design features and location of treatment units on the ground, but also, the essential complete lack of any valid analysis as to how this massive project would impact wildlife, including birds. Essentially none of the requested additional information and analysis was provided in response to these comments, with the exception of a brief discussion of the Pinyon Jay, a species of conservation concern. As a result, in order to avoid unnecessary duplication of the issues that we initially identified that are being carried forward into this Objection, we will include references to agency responses to these issues in the following Objection.

6. Violations of laws, administrative direction, and executive orders that will be triggered by implementation of the Ashley National Forest Forest-wide Prescribed Fire Restoration Project.

A. The Proposed Project will trigger violations of the NEPA, the NFMA, the APA, the Roadless Area Conservation Rule, and the MBTA.

1. Revised Forest Plan direction for BCC is being violated, triggering legal violations of the NFMA, the NEPA and the MBTA.

Wildlife guideline FW-GD-WILDL 14 in the Revised Forest Plan states: Prior to ground-disturbing or vegetation management activities, the Forest Service should evaluate the beneficial and adverse impacts of the action to bird of conservation concern identified by the U. S. Fish and Wildlife Service (FWS), and as practical, mitigate activities to lessen the impact to those species. The Birds of Conservation

Concern (BCC) identified by the FWS for the Southern Rockies/Colorado Plateau (Bioregion 16) include the following:

Broad-tailed Hummingbird	Flammulated Owl
Lewis's Woodpecker	Short-eared Owl
Lone-eared Owl	Olive-sided Flycatcher
Pinyon Jay	Clark's Nutcracker
Evening Grosbeak	Cassin's Finch
Virginia Warbler	Grace's Warbler

The NEPA analysis for the proposed burning program addressed only 2 of these BCC, the Flammulated Owl and Pinyon Jay. The Flammulated Owl is a sensitive species on the Ashley National Forest (Project EA 40-41). It was noted the project area contains 87,000 acres of potential Flammulated Owl habitat, and this species may occur in this landscape. No habitat objectives were identified, but no habitat loss or fragmentation is expected to occur from forest thinning, including understory removal (Project BE 17). Actual effects of this proposed project on the Flammulated Owl are not provided.

The agency did not identify the acres of Pinyon Jay habitat that occur in the project area and will have vegetation treatments to remove trees and shrubs. The Project BE in Table 1 shows there are 96,301 acres of pinyon-juniper habitat in the project area, and these are included as treatment acres. Thus all Pinyon Jay habitat in the project area is scheduled for vegetation treatments. The agency claimed that project impacts on this species are unknown, as are the causes for the rapid decline of this BCC. It was noted, however, that noted that Pinyon Jays forage on pinyon nuts, and that production of pinyon nuts is an important consideration in the management of this species. It was also noted that protection of nesting habitat is an important conservation measure for the Pinyon Jay. The importance of juniper trees for Pinyon Jays for forage, cover and nesting

habitat was not acknowledged. The project targets key habitats for this species, including pinyon pine and juniper trees, so that nesting and foraging habitat will be reduced. No conclusions about project impacts were provided, even though 100% of Pinyon Jay habitat could be treated with slashing/burning.

Project impacts to the Clark's Nutcracker will be partially similar to those triggered on the Pinyon Jay, because pinyon pine trees will be reduced. Pinyon seeds are an important forage resource for this species (Christensen et al. 1991).

In summary, the agency is violating the Revised Forest Plan due to a failure to evaluate projects impacts on the 12 BCCs that may occur on the Ashley National Forest. The agency is also violating the NEPA by claiming the project will have no significant impacts on wildlife, which includes these 12 BCC. The agency is also violating the MBTA by failing to evaluate project impacts on these 12 BCC.

2. The agency is violating the NEPA, the NFMA and the MBTA by failing to evaluate the impacts of the proposed project on Utah birds of conservation concern identified by various agencies/working groups, as well as adhering to the Revised Forest Plan.

Utah Partners in Flight Avian Conservation Strategy Version 2.0 (2002) identified the following 11 bird species as Priority Species in Utah:

Lewis's Woodpecker	Sage-grouse
Virginia's Warbler	Gray Vireo
Sharp-tailed Grouse	Brewer's Sparrow
Broad-tailed Hummingbird	Ferruginous Hawk
Black-throated Gray Warbler	Three-toed Woodpecker

Sage Sparrow

There were only 2 of these species that were evaluated for the proposed project, the Three-toed Woodpecker, a sensitive species for the Ashley National Forest, and the Greater Sage-grouse, also a forest sensitive species. There are an estimated 398,929 acres of forested habitat suitable for the Three-toed Woodpecker in the project area, all of which may have vegetation treatments. There are no habitat objectives identified for the Three-toed Woodpecker. However, the agency determined that the proposed slashing/burning program would benefit the Three-toed Woodpecker by killing trees to create foraging habitat. It was acknowledged that snags will be destroyed with burning, while also created with burning. However, snags created by burning are unlikely to provide suitable cavity trees (Hutto 1995), which means that burning will reduce nesting habitat. Burning will also reduce green trees of all sizes that provide hiding cover from predators as accipiters, and thermal cover for protection against severe weather events, including high winds and heavy precipitation. AS such forest thinning is unlikely to benefit this sensitive and Priority species, as is claimed by the agency.

The Greater Sage-grouse (hereafter "Sage Grouse") was the second Priority Species evaluated for the proposed project. It was noted that 90% of Sage Grouse habitat is included in the proposed slashing/burning program. Appendix C of the Revised Forest Plan notes that Sage Grouse are declining, and that numbers are low across the Ashley National Forest. Appendix C and Appendix D both emphasize that Sage Grouse habitat is threatened by invasions of cheatgrass, which not only destroys Sage Grouse habitat, but increase fire cycles. It was noted that deterring cheatgrass is a key to sustaining Sage Grouse on this forest. The NEPA analysis for project impacts on Sage Grouse did not estimate the expected increase of cheatgrass that will occur in sagebrush areas with this massive burning program, in violation of the NEPA. This identified risk factor to sagebrush clearly needs to be evaluated by expected acreage increases.

The analysis of project impacts on Sage Grouse also did not disclose the actual acreage of sagebrush habitats that will be burned. Table 1 in the project BE shows there are up to 174,462 acres of various types of sagebrush, in the project area that will potentially be burned. This would be all the sagebrush that occurs in this landscape. The actual acres of sagebrush that could be burned is limited by the Revised Forest Plan, a factor not identified in the agency's NEPA analysis. The agency's NEPA analysis repeatedly notes that this project is being implemented to achieve "Desired Conditions." A Desired Condition for sagebrush habitats (FW-DC-SAGE) is that 70% or more of sagebrush communities have 10-30 percent sagebrush canopy cover. In order to meet this Desired Condition, there can be no more than 30% of the sagebrush habitats that have less than 10-30 percent canopy cover. This Desired Condition will clearly limit the amount of sagebrush habitats that can be burned in this burning program. However, this Desired Condition is not mentioned in the agency's NEPA analysis, including how it will be implemented.

The agency also did not address how the Revised Forest Plan guideline (FW-GD-WILD 11) can be met with burning sagebrush. This guideline includes a requirement that management actions should not degrade occupied sage-grouse habitat. Although the Forest Plan amendment for management of Sage Grouse essentially allows any type of sagebrush treatments within occupied habitat, the current best science notes that the best measure of Sage Grouse habitat quality as measured by population persistence is the amount and patch-size of tall sagebrush (Johnson et al. 2011, Wisdom et al. 2011). Any burning programs will reduce both the amount and patch size of tall sagebrush, and thus degrade Sage Grouse habitat.

Due to the violations of the Revised Forest Plan and a lack of the estimated increase in cheatgrass across sagebrush landscapes that will occur in areas that are burned, the agency has failed to provide any meaningful assessment of how this program will impact Sage Grouse, a Utah Priority Species.

Two other Priority Species that will be severely impacted by burning of sagebrush include the Brewer's Sparrow and Sage Sparrow. Reduction and fragmentation of sagebrush patches across a landscape have been documented to reduce populations of both species (Knick and Rotenberry 1994).

There will also be 4 other Priority Species that will be adversely impacted by slashing and burning of pinyon-juniper habitats. The Ferruginous Hawk, Virginia's Warbler, Gray Vireo, and Black-throated Gray Warbler are Species of Conservation Concern identified by the Partners in Flight Western Working Group (Gillihan 2006). These 4 SCC are strongly associated with pinyon-juniper woodlands, including wooded-shrublands (*Id.*). This means that 8 of the 2002 Priority Species identified in Utah will be adversely impacted by massive disturbances/degradation of their habitats across the Ashley National Forest. It would be impossible for the proposed burning program to avoid significant population impacts on these 8 Priority Species.

Gillihan (2006) has also identified 8 other bird species associated with pinyon-juniper habitats that are considered birds on conservation concern. These include the Black-chinned Hummingbird, Ash-throated Flycatcher, Gray Flycatcher, Pinyon Jay, Juniper Titmouse, Townsend's Solitaire, Western Bluebird and Scott's Oriole. This brings the total of pinyon-juniper bird species that have been identified as a conservation concern to 16 species.

In 2021, Utah updated their species list of Species of Greatest Conservation Need (October 2021). These include the following bird species:

Boreal Owl	Burrowing Owl
Columbian Sharp-tailed Grouse	Ferruginous Hawk
Flammulated Owl	Lewis's Woodpecker
Golden Eagle	Greater Sage-grouse

Northern Pygmy Owl

Olive-sided Flycatcher

Pinyon Jay

Mexican Spotted Owl

These additional bird species will trigger yet more significant adverse impacts to the slashing/burning of both pinyon-juniper woodlands and wooded-shrublands, as well as sagebrush landscapes. The Golden Eagle, along with the Ferruginous Hawk, will have prey species reduced with burning of sagebrush (Kochert et al. 1999; Smith et al. 1981). And as previously discussed, the Pinyon Jay will have nesting, foraging, and caching habitat degraded with the slashing/burning of pinyon-juniper habitats (Somershoe et al. 2020). This species has recently been petitioned for listing under the Endangered Species Act (ESA) (Great Falls Tribune 2022).

Also, the Boreal Owl, Flammulated Owl, Northern Pygmy Owl, and Lewis's Woodpecker are known old growth-associated birds (USDA 2018) who will have their habitat degraded if old growth conifer stands are treated with understory slashing and burning and general stand thinning, which will reduce hiding and thermal cover, prey species associated with coarse woody debris and understory vegetation, as well as increase weather-related impacts, such as heat, cold, wind, and snow depths. As was noted in the project Forest-wide Prescribed Fire Restoration Project Effects Analysis by M. Littrell (2022), there is a design feature for this project (OG 1) where treatments in old growth stands will maintain the minimum old growth criteria as defined by Hamilton (1993), or other agreed upon criteria. There was no analysis provided as to why these minimum criteria, or other agreed upon criteria (unknown) will maintain the same habitat quality for old growth-associated wildlife as untreated stands. Without such an analysis, the agency cannot claim that treating old growth habitat will not have significant adverse impacts on associated wildlife.

There are also two other old growth-associated forest bird species that are identified as Sensitive Species on the Ashley National Forest (Project EA Table 10) that will be adversely affected by the proposed treatments of old growth forests. These include the Great Gray Owl and Northern Goshawk. The agency claims

there will be long-term benefits to these 2 forest raptors from the burning program. Id. There are an estimated 300,000 acres of Great Gray Owl habitat in the project area. No habitat objectives exist for this species on the Ashley National Forest, and the agency's basis for claiming project benefits for this species are not provided, including by treating old growth stands. Nor is there any information provided as to why treating old growth stands would not reduce habitat for this old growth-associated species. Actual impacts on this species are unknown due to a lack of analysis.

There are numerous Northern Goshawks on the Ashley National Forest, with over 70 viable goshawk nests in or adjacent to the project area. This forest raptor is also associated with old growth forests (USDA 2018), and 20% old growth levels are recommended within a goshawk territory to promote foraging and nesting habitat (Reynolds et al. 1992). Juveniles of this sensitive species are also known to rely heavily on lower elevation pinyon-juniper habitats during after leaving the parental territory (Wiens et al. 2006). The acres of old growth forests that will be treated with slashing/burning in the proposed project are not identified, so project impacts on goshawk foraging and nesting habitat are unknown. In addition, massive treatments in pinyon-juniper woodlands and wooded-shrublands will impact prey species for juvenile goshawks. Yet the agency claims that the project will not create losses or fragmentation of goshawk habitat, and long-term impacts will be beneficial. The basis for these claims was never provided.

In summary, there are 34 bird species that have been identified from some source as species of conservation concern in Utah. The Ashley National Forest does not have a habitat plan for any of these species, except Sage Grouse and the Northern Goshawk. Regardless, both of these species will be adversely affected by this project due to burning of old growth forests and sagebrush. Of the remaining 32 species of conservation concern, adverse impacts from the proposed burning program are known for at least 22 of these, which brings the total number of bird species of conservation concern that will be adversely impacted by the proposed burning program to 24 species, or 70% of all such species. The following is a

summary of birds of conservation concern and/or Forest Service sensitive species that are known to be adversely impacted by this project based on scientific publications and/or associations with pinyon-juniper habitat, sagebrush habitat, and/or old growth forests:

Lewis's Woodpecker	Pinyon Jay
Virginia Warbler	Flammulated Owl
Clark's Nutcracker	Black-throated Gray Warbler
Sage Sparrow	Sage Grouse
Gray Vireo	Brewer's Sparrow
Ferruginous Hawk	Three-toed Woodpecker
Boreal Owl	Golden Eagle
Northern Pygmy Owl	Northern Goshawk
Great Gray Owl	Gray Flycatcher
Black-chinned Hummingbird	Ash-throated Flycatcher
Juniper Titmouse	Townsend's Solitaire
Western Bluebird	Scott's Oriole

Currently, the Ashley National Forest lacks the basic information on all of these species, including (a) occupancy across the forest, (b) effects of past slashing/burning projects on any of these species, and (c) habitat objectives to guide management of vegetation, for 22 of these 24 SCC. This makes it impossible for the agency to predict how any of the proposed vegetation treatments for slashing/burning/masticating habitat for these 24 species. It also makes the repeated multiple claims that the agency will "restore" habitat for these species implausible. As such, the agency's repeated and multiple claims that this program will not only have no significant adverse impacts on these species, but in fact will improve their habitat long-term are violations of existing laws.

3. The agency will violate the Roadless Area Conservation Rule if the proposed slashing/burning project is implemented.

As noted above, there are 24 bird species of conservation concern that will be adversely impacted by the proposed slashing/burning of forests, woodlands, wooded-shrublands, and sagebrush ecosystems. Degradation of wildlife habitat within Inventoried Roadless Areas (IRAs) would not be consistent with the Roadless Area Rule. As such, the proposed treatments of thousands of habitat acres within IRAs of the Ashley National Forest violates management requirements for these protected areas. There are also many other bird species that will have habitat degraded by slashing/burning treatments, including within pinyon-juniper woodlands and wooded-shrublands. Balda and Masters (1980) reported that in the southwestern U.S., roughly 73 bird species use pinyon-juniper areas for nesting. These ecosystems not only provide high quality forage for birds, such as pinyon nuts, including for Pinyon Jays and Clark's Nutcrackers, but they also provide massive amounts of forage as per juniper berries, including for bird migrations and winter use. It was noted that a cubic meter of juniper foliage holds up to 20,000 berries, which are very high in calories. As such, reducing vegetation, including various sizes of pinyon pine and juniper trees to reduce fuels and vegetation density within IRAs will reduce forage for almost all birds that use these habitats. This is exactly the opposite effect as is repeatedly claimed by the Forest Service, that slashing/burning pinyon-juniper areas with "restore" wildlife habitat. Removing habitat can hardly be defined as restoring habitat. Notably, the agency never defines which missing habitat conditions for pinyon-juniper birds will be brought back with slashing and burning.

The agency also falsely claims that slashing/burning vegetation within IRAs is needed to reduce the risk of catastrophic and/or uncharacteristic wildfire. First, what constitutes catastrophic and/or uncharacteristic wildfire is never defined. There are some "inferences" in the agency's NEPA analysis for this project that too much severe fire areas (stand replacement fires) within a burned landscape constitutes catastrophic and/or uncharacteristic fire effects, but no actual definitions are provided. This definition could easily be developed given the many

thousands of acres of past fires on this forest. What is also never discussed as to why stand replacement fires are catastrophic for wildlife within IRAs. As was noted by Hutto (1995) stand-replacement are a key ecosystem for many bird species. Why the creation of these key ecosystems within IRAs should be prevented with fuels reduction programs is never addressed by the agency. However, this objective to reduce stand replacement fires within IRAs is highly detrimental to wildlife, and thus inconsistent with the purpose of IRAs to provide natural, undisturbed habitats for wildlife.

The agency did not ever evaluate how the proposed slashing/burning activities within IRAs will affect noxious weeds and cheatgrass. The implication is that these species are not expected to increase significantly within IRAs due to slashing/burning activities. However, this does not qualify as a valid assessment of burning impacts on cheatgrass within NEPA documents. No information is ever provided as to what is the expected percentage of increase of cheatgrass due to slashing/burning, based on past slashing/burning activities on the forest. If the agency has no actual monitoring data on the level of increase of cheatgrass that occurs following slashing/burning activities, then the agency has no valid basis for estimating that increases "will not be significant." What level of increase is "not significant?" Clearly, infestations of cheatgrass are an acknowledged problem on the Ashley National Forest, as is noted in the project NEPA documents. It seems likely that burning over 900,000 acres of forest will increase cheatgrass on a huge number of acres, even if increases within individual project areas are small. There are 2 factors that are particularly concerning about the agency's lack of concern about increasing cheatgrass. First, control of cheatgrass is very difficult, or otherwise, it would not currently be an acknowledged problem on this forest. Control of cheatgrass has clearly not been a priority for the agency, so why would this be different after implementing this project? It is highly likely that any new infestations/expansions created by the slashing/burning program will be permanent, not due to just difficulty to control, but due to the massive increase in the number of acres of cheatgrass that will require treatment. Current versus expected acreages of treatment with project implementation are not addressed, even though these will likely be thousands and thousands of additional acres.

In summary destruction of habitat for wildlife, including 24 bird species of conservation concern, is inconsistent with the functions of IRAs, to maintain natural ecosystem functions. Apparently, the Forest Service believes that wildlife are not part of any ecosystem. Second, deliberately increases invasive species within IRAs due to slashing/burning, including invasive species that are almost impossible to remove, also does not constitute restoring ecosystems. Noxious weeds do not need to be "restored." Finally, the agency's suggestion that stand replacement fires are catastrophic for wildlife within IRAs is never explained. Overall, it is clear the massive planned management interventions within IRAs is simply a fuels reduction program in violation of the Roadless Area Conservation Rule.

4. The agency is violating the NEPA by failing to include an action alternative that addressed public issues and concerns and demonstrated management issues on western public lands.

As per our 30-day scoping comments, we identified many concerns about the proposed slashing/burning program, including adherence to the Roadless Area Conservation Rule, and slashing/burning in pinyon-juniper woodlands and wooded-shrublands. However, there were no action alternatives developed that addressed these concerns. A major concern was also the adverse impacts that this massive program would have on birds, including species of conservation concern. Since the agency has no habitat objectives for almost all birds that occur in this project area, there is no basis for proposing habitat changes, and this action alternative is actually invalid; it's impacts on birds cannot be assessed due to a lack of habitat standards. One reasonable alternative that the agency could have included would be to initiate a priority program to control cheatgrass, instead of planning significant increases due to slashing/burning activities. This alternative would also address our concerns for viability of birds, as well as degrading/removing habitat for birds within IRAs. Another alternative would be to implement a monitoring program for birds on past fires and past slashing/burning projects, so that effects on birds can be identified and used for future planning. Another alternative would be to amend the Revised Forest Plan to include habitat

measures for species of conservation concern in various habitats, as is basically required by this Plan. Habitat objectives for species of conservation concern, however, should include the various lists of birds of conservation concern that are not included in the FWS BCC for Bioregion 16.

A range of action alternatives is also needed because the current action alternative does not address all of the current science. The agency claims that fuels reduction activities are needed as an emergency to prevent wildfires. However, this is a controversial claim, and we provide just one recent example, Forest News (2023) recently published an article on the unnecessary need for landscape fuels reductions projects in the western US; protection of homes requires a home protection zone of only 100 feet. This science regarding the need for fuels reduction projects across large landscapes has not been used in the agency's proposal for action, in violation of the NEPA. This is a significant NEPA failure, as failure to address this current science in the proposed need for action will trigger severe significant adverse impacts on most wildlife, with degradation of habitat on almost a million acres across the Ashley National Forest.

The agency's claim that fuels reduction activities are an emergency need on the Ashley National Forest, while never actually supported with any science, also is an arbitrary use of land management issues in the western U.S. because it ignores the recognized significant declines of western birds. Rosenberg et al. (2019) reported that 64% of 67 species of western forest birds are in decline, while 57% of 62 arid-land birds are in decline. Somehow, these severe declines, including a loss of over 3 billion North American landbirds since the mid-1970s, do not warrant considerations on Ashley National Forest lands, while invented emergencies of a need for landscape levels of fuels reduction activities to prevent catastrophic fire are used as the basis for management action. The agency's identification of the project's purpose and need do not reflect recognized land management issues, in violation of the APA, NEPA, NFMA and the MBTA.

The agency also did not address the effects of this program on climate change in identifying proposed land management activities of massive fuels reductions on almost a million acres of the Ashley National Forest. There was never any valid analysis as per the NEPA as to how the massive vegetation removal would affect carbon sequestration on this forest. This proposed huge reduction in the ability of the Ashley National Forest to sequester carbon, and thus help address climate change, was never addressed in the selection of action alternatives. The agency essentially is ignoring the reality of climate change, even though these impacts are readily evident. For an example of recognized impacts of climate change, we have included 4 pages of various reports in news magazines on the effects of climate change (Objection Appendix B). These impacts are clearly substantial and severe across the globe, so incremental reductions in carbon sequestration, including on the Ashley National Forest, cannot be considered as inconsequential. They will contribute to the effects of climate change globally.

One important factor regarding climate change that the Forest Service completely ignored was how the proposed slashing/burning program on almost one million acres of the Ashley National Forest will directly impact wildlife. Forest thinning will increase temperature extremes by reducing shade and increasing wind speeds, and thus increase the severity of extreme weather events. In addition to this effect, as we previously noted forest thinning and burning of woodlands and wooded-shrublands will also reduce forage resources for most wildlife. These combined effects likely contributed to the massive mortality (thousands to potentially millions of migratory birds) that occurred in New Mexico in 2020 (D'Amassa 2020) during the fall migration period. Causes of death were attributed to hypothermia and starvation.

Another factor related to climate change that was never considered by the Ashley National Forest for the proposed slashing/burning program on almost a million acres is the ongoing decline of juniper trees in parts of the western United States. Maffly (2020) reported that although juniper is considered the West's most drought-tolerant and resilient conifer, there has been widespread juniper mortality in southeast Utah, with juniper trees dying in droves after the driest and

warmest year on record. In spite of this problem, the Ashley National Forest is proposing to thin most of the pinyon-juniper woodlands on this forest.

In summary, the agency needs to adhere to the NEPA and develop action alternatives that (a) address public issues and concerns, including bird species of conservation concern, (b) address the current best science on fuels reduction activities, (c) address the crisis in North American landbird declines, (d) address the ongoing crisis of climate change, including how it is impacting wildlife on the Ashley National Forest, and (e) adhere to the Roadless Area Conservation Rule. Currently, there is no action alternative that meets these requirements.

5. The agency is violating the NEPA by providing inadequate information and analyses results to the public on the proposed slashing/burning program for almost a million acres of the Ashley National Forest.
 - a. The agency did not define the effectiveness of wildlife surveys for this project.

We raised a concern about the ability of the agency to do wildlife surveys on 24,000 acres per year. It is unclear how the agency will have the required personnel to complete valid surveys. The agency said this was beyond the scope of the project. However, the Revised Forest Plan, as well as the NEPA, requires the agency to clearly define the level and effectiveness of planned wildlife surveys. Revised Forest Plan FW-GD-WILDL 03 states that vegetation treatments should avoid removal of known raptor nests and should avoid, minimize or mitigate disturbance around known active nests, including raptor nests found through surveys. The agency did not define how this rather vague guideline will be implemented. For example, why wouldn't surveys be required for all treated acres? What criteria will be used to identify areas where wildlife surveys will be done? Will survey levels be based on funding? Specifically, the agency needs to provide to the public the percentage of treated acres that will have wildlife surveys, what is the expected level of detection for raptor surveys, and as such, what percentage of raptor nests in treated areas will not be protected and thus

have reproductive activity disturbed or nest sites removed. The level of effectiveness of surveys and mitigation is required as per analysis and public information, since this is used to estimate the level of impacts the project will have. Simply saying some surveys will be done is not an analysis of project impacts on forest raptors.

Also, the Design Features claim that migratory bird nests will be located prior to treatment activities. This would be a monumental effort, and it seems highly unlikely that this will actually occur. Is this false information being provided to the public? The agency needs to provide much more detailed information on what percentage of treatment areas will have migratory bird surveys, how these surveys will be done, and what protective buffers will be. If many nests occur within treatment units, 100-foot buffer areas may include most of the proposed treatment units, especially sagebrush treatments. Also, nesting sites could be burned outside of the breeding season. What is the expected loss of migratory bird nesting habitat within sagebrush and pinyon-juniper woodland and wooded-shrubland treatments? How will significant adverse impacts be avoided? How many nesting areas can be destroyed with fire before significant adverse impacts are expected?

- b. Monitoring results of past slashing/burning programs on the Forest were not provided, even though the agency claims extensive monitoring information exists.

We could not locate any actual monitoring information as to how previous slashing/burning projects on this forest have affected species of conservation concern or migratory birds in general. Since the agency is proposing to massively expand the burning/slashing program, it is not clear what the basis of this proposal is for wildlife effects. It seems no actual monitoring information exists for wildlife effects, which means expansion of this project is unwarranted.

- c. The agency did not identify the expected level of bird mortality that will result from vegetation treatments and burning on almost a million acres of this forest.

Slashing and burning of conifer forests, aspen stands, and woodlands and wooded-shrublands will occur year-round, so that bird nests will be destroyed if activities occur during the nesting season. However, there was no estimate provided as to the level of mortality that is expected for birds, including forest raptors, from these activities. In addition, it is known that birds are highly sensitive to smoke, which can kill birds directly and/or reduce their fitness due to smoke toxicity (Defiance Canyon Raptor Rescue 2022). This mortality is an adverse impact of this project, and estimates of effects on birds is required by the NEPA and the MBTA.

- d. The agency did not respond to our request that they estimate the loss of carrying capacity for birds based on the volume of vegetation to be removed from the 24 vegetation types planned for slashing/burning.

Table 1 in the Project Biological Evaluation (BE) identifies 27 vegetation classes in the proposed project area by available wildlife habitat. We requested that the agency provide a general estimate of the level of hiding cover, thermal cover, forage, as well as nesting sites, that will be reduced within each of these vegetation types, and on this basis, provide a general estimate of the reduction of carrying capacity for birds that will result from this habitat loss. This information would not be impossible to provide, as the agency has some idea of the amount of vegetation that will be slashed and burned per vegetation type. This information is essential for the agency to provide general information as to what the expected impact on birds will be, as is required by the NEPA. The agency said this type of analysis was not required as per the forest plan. However, it is required by the NEPA in order for the agency to estimate the level of project impacts on birds, as well as to provide “high quality” information to the public. The current analysis provided by the agency for birds is “some birds will benefit

and some birds will be harmed.” This hardly qualifies as an analysis as per the NEPA.

- e. The agency claims that the project is being driven by “Desired Conditions,” but there are no desired conditions ever identified for any wildlife species, in violation of the NFMA and MBTA.

It remains unclear what the desired conditions are for wildlife on the roughly million acres proposed for vegetation treatments. These are never identified by the agency. Since these desired conditions for various wildlife species are never defined, it is clear this project has nothing to do with wildlife, although it is called a restoration project. The implication to the public by the agency is clearly false, as wildlife restoration is not included, even though it is not clearly excluded as a project need. The agency needs to clearly define to the public that this project has nothing to do with wildlife management.

- f. The agency has not provided any connection between the Desired Conditions for vegetation in the Revised Forest Plan and the proposed fuel treatments.

The Revised Forest Plan (RFP) includes Desired Conditions for many of the vegetation types that are included in the proposed slashing/burning program. The desired condition for aspen do not identify structural stages. The RFP defines desired conditions for pinyon-juniper woodlands as 10, 10, 320, 40 and 20 percent for grass/forb, seedling/sapling, young woodland, mid-aged woodland, and old woodland, respectively. The RFP defines desired conditions for mixed conifer forests as 27, 13, 53, and 7 for grass/forb-seedling/sapling, young forests, mid-aged forest to mature forest, and old growth forests below 9,500 feet, respectively. The RFP defines the desired condition for other mixed conifer forests as 16, 12, 44, and 28 for grass/forb-seedling/sapling, young forest, mid-aged to mature forest, and old forest, respectively

The RFP defines the desired conditions for persistent lodgepole pine stands are 42, 17, 41, 0 and 0 for grass/forb, seeding/sapling, young forest, mid-aged to mature forest, and old forest, respectively. The RFP defines the desired condition for Douglas-fir forests as 20, 20, 40, and 20 for grass/forb-seedling/sapling, young forest, mid-aged to mature forest, and old forest, respectively. No desired conditions were defined for ponderosa pine forests. No desired conditions are provided for desert shrub vegetation types. A desired condition for sagebrush is to support habitat needs of known sagebrush-obligate species; the level of sagebrush patch sizes, and canopy cover were not identified. For sage grouse habitat, the desired condition is to have 70 percent or more of the sagebrush community with 10-30 percent sagebrush canopy cover and less than 10 percent conifer canopy cover.

The RFP then states that an objective for fire management is to move vegetation toward desired conditions on approximately 6,600 to 32,000 acres per year. The expected range of fuel treatments is provided in Table 9 for the above vegetation types, including ponderosa pine, lodgepole pine, Douglas-fir, mixed conifer, Engelmann spruce, seral and persistent aspen, sagebrush, pinyon pine and desert shrub. Planned treatment acres include many thousands of acres, and have considerable ranges of planned treatment acres per vegetation type. However, these treatment acres are based on the percent of fires in each severity class. These thus have no relationship to the desired conditions defined for these vegetation types in the RFP. This is also the case for the proposed forest-wide prescribed slashing/burning program, which would be implementation of the RFP. The estimated treatment acres are not based on desired conditions, as is repeatedly and falsely claimed in the project NEPA documents. The actual basis for the proposed treatment acres are unknown, but clearly is not based on RFP desired conditions.

- g. The proposed acres that could be treated in each vegetation class in the project area are not based on RFP vegetation desired conditions or any wildlife desired conditions; thus how this project will achieve a diversity of wildlife species and desired conditions for vegetation is unknown.

There is no analysis in the RFP Final Environmental Impact Statement (FEIS) as to how the proposed burning activity identified in Table 9 will affect either wildlife or achieve vegetation desired conditions. Without this analysis, implementing these fuels reduction activities across the Ashley National Forest are a violation of the NEPA, due to a lack of analysis of project impacts on wildlife at a programmatic level, which addresses cumulative impacts. These treatments are also a violation of the NFMA because it is never demonstrated how these fuels treatments will meet desired conditions for conifer forest, aspen, sagebrush, or juniper woodlands on this forest.

Appendix A for the Objection against the Forest-wide Prescribed Fire Restoration Project by NEC, AWR and Y2U on November 13, 2023.

Appendix A contains relevant portions of literature and/or reports cited in the Objection, except for references that are already cited in the agency NEPA documents for this project.

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Farmington Daily Times

NEWS

'Hundreds of thousands, if not millions': New Mexico sees massive migratory bird deaths

Algernon D'Ammassa Las Cruces Sun-News

Published 2:41 p.m. MT Sep. 12, 2020 | Updated 2:56 p.m. MT Sep. 12, 2020

LAS CRUCES - Biologists from New Mexico State University and White Sands Missile Range examined nearly 300 dead migratory birds Saturday at Knox Hall on the university's main campus.

Over the past few weeks, various species of migratory birds are dying in "unprecedented" numbers of unknown causes, reported Martha Desmond, a professor at NMSU's Department of Fish, Wildlife and Conservation Ecology.

"It is terribly frightening," Desmond said. "We've never seen anything like this. ... We're losing probably hundreds of thousands, if not millions, of migratory birds."

In August, large numbers of birds were found dead at White Sands Missile Range and at the White Sands National Monument in what was thought to be an isolated incident, Desmond said.

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After that, however, came reports of birds behaving strangely and dying in numerous locations in Doña Ana County, Jemez Pueblo, Roswell, Socorro and other locations statewide.

The affected birds have included warblers, sparrows, swallows, blackbirds, flycatchers, and the western wood pewee.

"A number of these species are already in trouble," Desmond said. "They are already experiencing huge population declines and then to have a traumatic event like this is – it's devastating."

On Saturday, Desmond was joined by Trish Cutler, a wildlife biologist at WSMR, and two NMSU students for an initial evaluation of the carcasses.

Desmond said her team also began catching and evaluating living specimens on Friday as residents find birds behaving strangely and gathering in large groups before dying.

"People have been reporting that the birds look sleepy ... they're just really lethargic," Cutler said. "One thing we're not seeing is our resident birds mixed in with these dead birds. We have resident birds that live here, some of them migrate and some of them don't, but we're not getting birds like roadrunners or quail or doves."

On the other hand, numerous migratory species are dying rapidly and it is not immediately clear why, although the cause appears to be recent. Desmond said the birds had moulted, replacing their feathers in preparation for their flight south, "and you have to be healthy to do that; but somewhere after that, as they initiated their migratory route, they got in trouble."

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The biologists guessed the cause might involve the wildfires ravaging the western U.S. and dry conditions in New Mexico.

"They may have been pushed out before they were ready to migrate," Desmond said. "They have to put on a certain amount of fat for them to be able to survive the migration. These birds migrate at night and they get up in the jet stream, and they might migrate for three nights in succession, they'll come down and they'll feed like crazy, put on more fat and go again."

The biologists noted that the majority of the dying birds are insectivores, but that seed eaters were sickening and dying as well.

The birds will be sent to the U.S. Fish and Wildlife Service Forensics Laboratory in Ashland, Ore. for further analysis. Desmond it could be weeks before results come back, and the findings could bear serious ecological implications.

"Over 3 billion birds have died since 1970. Insect populations are crashing, and this is just an unprecedented mortality," she said. "Climate change is affecting the abundance of insects, it's affecting the volatility of the fires, and the scary thing is this may be an indication of the future."

9/16/2020

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Algernon D'Amassa can be reached at 575-541-5451, adamassa@lcsun-news.com or @AlgernonWrites on Twitter.

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AVIAN COMMUNITIES IN THE PINYON-JUNIPER WOODLAND:

A DESCRIPTIVE ANALYSIS

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ABSTRACT

The expansive range and elevational distribution of the pinyon-juniper woodland in the western United States contributes to the wide variety of forms of this habitat type. Similarly, the breeding-bird community expresses this variety. A total of at least 73 different bird species are known to breed here. About 31 of these species breed with regularity in pinyon-juniper woodlands. Only about 5 of these species are restricted to this habitat type. Usually less than half of the breeders are permanent residents. A high proportion of the breeding birds forage for seeds or insects on the ground. The number of species that breed in cavities and/or forage on trunks and branches is positively correlated with pinyon pine density. Seasonal densities of breeding birds vary greatly depending on annual fluctuations in precipitation and seed and berry production. Winter diversity and density is strongly correlated with juniper berry production. Both junipers and pinyons show an adaptive suite of characters for dispersal by birds.

KEYWORDS: pinyon pine, juniper, avifauna, guilds, diversity, density, breeding-birds, winter birds.

The pinyon-juniper woodland could be labeled the characteristic habitat-type of the southwest because of its expansive range.

These fluctuations appear to be caused by a combination of physical and biotic factors. Open water appears to be critical to winter birds of this habitat-type. This may occur because most are feeding on tree, shrub, grass and forb seeds as water-bearing insects are rare. Large flocks of sparrows, jays, juncos, bluebirds and robins concentrate at different times of day at cattle watering tanks. In high density years flocks of robins have been seen by the authors flying kilometers to and from water holes. Heavy winter snows, however, cause a temporary movement to lower elevations (pers. obs.).

Heavy crops of juniper cones occur at irregular intervals but generally a heavy crop can be expected every two to five years (Tueller and Clark 1975). Shrout's (1977) data are for a year with a "bumper crop" of juniper cones and then for a year with no berry production. Large crops may be local or synchronized over relatively large areas. The "berry" crops ripen in the fall and attract large numbers of birds. Some birds such as the Cassin's finch and Evening Grosbeak consume the pulpy flesh and seed whereas others such as the bluebirds, robins, and solitaires digest only the fleshy pulp and defecate the seeds (Salomonson 1978). Johnsen (1962) and Salomonson (1978) found that fresh, ripe seeds passed through the digestive tract of birds germinate faster than other seeds. Due to bird dispersal Salomonson (1978) found that most seedlings germinate and grow away from the source trees but most berries were found below the trees. In early fall most juniper seed eaters are highly nomadic in their search for large crops. Defecation by these birds during nomadic flights over grassland and other rangelands may be one of the causes for the encroachment of junipers into other habitat types.] A

Other birds respond differently to large juniper berry crops. Some Townsend's Solitaires (Salomonson 1978) and possibly some American Robins (T. A. Vaughan pers. obs.) set-up permanent, exclusive, defended winter territories in these woodlands. All observations suggest that the birds defend (or attempting to defend) an adequate supply of juniper berries to survive the winter. Salomonson & Balda (1977) found that Townsend's Solitaires spent as much, if not more time wintering in pinyon-juniper woodland than on the breeding grounds. These birds should, thus, show adaptations that promote survival during the winter. Average territory size during a "bumper" berry crop averaged 0.70 ha and contained between 13 and 25 million juniper berries. Each territory contained more than a solitaire could possibly harvest. This may insure the solitaires an adequate berry supply against heavy snow, heavy consumption by flocking bluebirds and robins, and consumption by birds that sneak into their territories. At the same time the junipers make no attempt to conceal their seeds or make them difficult for animals (especially birds) to locate and consume. Thus, one must conclude that southwestern junipers rely on birds to disperse their seeds. *

The other dominant trees in this woodland show the same erratic production of propagules. Pinus edulis produces large synchronized crops of seeds every 6 or 7 years and intermediate crops every three to four years (Balda 1978). Pinus monophylla produces an abundant crop of cones every two to three years (Graves 1917). References too numerous to mention (in English, Navajo and Hopi) refer to the activities of birds in the consumption of pinyon pine seeds. It is generally concluded that dispersal of the large, wingless seeds occurs by the

actions of both mammals and birds.

Estimates of how many pinyon pine seeds are carried off during a good crop have been made and range from 18,000 to 33,000 seeds/autumn/bird (Table 12).

Table 12. Approximate number of pine seeds cached by a single bird when pinyon pine cone crop is high

Bird	Tree	Number of Seeds	Reference
Pinon Jay	<u>Pinus edulis</u>	21,500	Balda, 1978
Pinon Jay	<u>Pinus edulis</u>	18,000	Ligon, 1978
Clark's Nutcracker	<u>Pinus edulis</u>	22-33,000	Vander Wall and Balda, 1977

Subsidiary
Higher
Eleutheria
Fauna

Seeds harvested from cones by the permanent resident Pinon Jay and Scrub Jay are often stored in shallow subterranean caches from which they can be reclaimed at a later time (Balda and Bateman 1972, Ligon 1978). Two other corvids descend into the pinyon-juniper woodlands to harvest pinyon pine seeds. The Steller's Jay carries up to 15 seeds in its mouth and throat up into the ponderosa pine forest where they are cached. A single bird may make six or seven trips per day. If the woodlands are within 20 km of a mixed coniferous forest Clark's Nutcrackers, which often forage on and store seeds of limber pine and white-bark pine, will descend to harvest pine seeds for caching in the coniferous forest (Tomback 1977, Vander Wall and Balda 1977).

Caching sites are usually on relatively dry sites that are snow free or quick to melt. Seeds that are not found by the birds often germinate and grow. In this manner pinyon pine is planted in the woodland and in grasslands below (Ligon 1971) and in the coniferous forest above it (Vander Wall and Balda, unpubl. data). The Clark's Nutcracker, as it resembles its European congener has a remarkable memory for finding its hidden caches (Turcek and Kelso 1968, Balda in press, Tomback in press).

MANAGEMENT CONSIDERATIONS

Until quite recently the standard management procedure for pinyon-juniper woodlands was to get rid of it. This was done with little consideration for the nongame birds. Wise management guidelines of today require that we know what we are managing and the constraints imposed by each group of organisms that occur in the habitat type. Avian ecologists have long ignored this expansive plant community. The result is we do not have the data in hand to make concrete suggestions to the "What if we do..." questions so often asked by wildlife managers. We urge that a concerted, organized effort be made in the four-state region where this woodland is so abundant to find out what species are present, in what densities,

It is evident that this woodland as a whole is an extremely complex, variable community. As stated by West et al. (1975), "Early attempts to explain distribution, composition, successional changes, and management responses in terms of single factors were overly simplistic. These variations can be better explained in terms of a complex of environmental patterns, historical events, and successional mechanisms. The relative importance of each factor of the environmental complex varies with the synecological context."

A major characteristic of this woodland as far as birds are concerned is the periodic production of vast quantities of pinyon pine seeds and juniper berries. Large crops of pine seeds are produced once every five or six years whereas juniper berry production occurs every two to three years. In many years neither tree forms reproductive propagules. Both life-forms appear to have intra-specific synchrony. For example, in a year of a good berry crop, one hectare contains between 19 and 38 million berries. A cubic meter of foliage holds 20,000 berries. The number declines steadily through the late fall and winter as birds and mammals consume them. The flesh of a single berry has about 315 calories making it a desirable source of energy. The berries are a shiny blue in color making them conspicuous; they ripen in the fall when insects are sparse and bird densities are high due to migration (Salomonson 1978). Thus junipers have adaptations favoring zoochory (Morton 1973). The pinyon pine also has a constellation of adaptations that favor dispersal by animals, especially birds (Table 1) (Vander Wall and Balda 1977). This pine not only allows animals easy access to its seeds but may entice dispersal agents. This means the seeds are easily located, extracted from the cones and eaten or cached for future use (Vander Wall and Balda 1977, Ligon 1978). More Pinus edulis seeds are cached in dry, exposed soils than can be used by the birds in years of high cone crops. In some years, pinyon pines produce absolutely no cones per hectare (Balda, unpubl. data), whereas in other years they may produce as many as 1800 cones/tree (Ligon 1971). These seeds are extremely nutritious, containing about 7400 cal/g (Little 1938). A pinyon pine seed contains 14.5 percent protein, 60 percent fat, and 18.7 percent carbohydrate (Botkin and Shires 1948). The large size, high energy content, and high protein level makes this seed a highly desirable food stuff.

2-3 yrs
juniper

Management of pinyon-juniper woodlands since the mid-40's has largely consisted of control of the spread of junipers (and in some cases pinyon) into grasslands and type-conversion of pinyon-juniper woodlands into grazing lands. Both eradication of the type and control has been justified on public lands because the trees are generally considered as of low commercial value relative to other harvestable trees of the West. During the period 1950 to 1964 Box et al. (1966) estimate that approximately three million acres of pinyon-juniper woodland were converted to grazing lands. Between 1950 and 1961, more than one million acres were converted in Arizona alone (Arnold et al. 1964).

The major objective of most type-conversion projects, often referred to as "Range Improvement Projects" is to produce additional forage for livestock (Terrel and Spillett 1975). These conversions represent "a change from multiple use to one use, grazing" (Little 1977). Land managers today are going through a period of cautious

TABLE 2. Breeding birds of pinyon-juniper woodlands¹⁾

<u>Species</u>	<u>Status</u> ²⁾	<u>Distribution</u> ³⁾	<u>Niche Width</u> ⁴⁾
Turkey Vulture ✓	S	4	
Cooper's Hawk	P	2	
Red-tailed Hawk	P	4	
Swainson's Hawk	S	1	
Ferruginous Hawk	P	2	
Golden Eagle	P	3 (Sp.)	
Prairie Falcon	P	2 (Sp.)	
American Kestrel	P-S	4	
Gambel's Quail	P	2	
Mourning Dove	P-S	7	
Screech Owl	P	3	obligatory
Great Horned Owl	P	3	
Long-eared Owl	S	1	
Saw-whet Owl	P	1	
Poor-will	S	2	
Common Nighthawk	S	3	
Lesser Nighthawk	S	2	
White-throated Swift	S	2 (Sp.)	
Black-chinned Hummingbird	S	4	semi-obligatory
Costa's Hummingbird	S	1	
Broad-tailed Hummingbird	S	3	
Common (red-shafted) Flicker	P	6	
Hairy Woodpecker	P	4	
Ladder-backed Woodpecker	P	1	
Western Kingbird	S	1	
Cassin's Kingbird	S	2	
Ash-throated Flycatcher	S	7	semi-obligatory
Say's Phoebe	S	2	
Gray Flycatcher	S	2	obligatory
Western Wood Pewee	S	1	
Violet-green Swallow	S	2	
Cliff Swallow	S	1 (Sp.)	
Scrub Jay	P	6	obligatory
Black-billed Magpie	P	2	
Common Raven	P	6	
Piñon Jay	P	5	semi-obligatory
Mountain Chickadee	P	3	
Plain Titmouse	P	7	obligatory
Bushtit	P	6	semi-obligatory
White-breasted Nuthatch ✓	P	3	
House Wren	S	1	
Bewick's Wren	P-S	3	semi-obligatory
Cañon Wren	P-S	3 (Sp.)	
Rock Wren	P-S	4	
Mockingbird	S	4	semi-obligatory
American Robin	P-S	1	
Western Bluebird	P-S	1	
Mountain Bluebird	P-S	4	
Blue-gray Gnatcatcher	S	5	semi-obligatory
Loggerhead Shrike	S	2	

TABLE 2. (cont.)

Species	Status ²⁾	Distribution ³⁾	Niche Width ⁴⁾
Gray Vireo	S	3	obligatory
Solitary Vireo	S	2	
Black-throated Gray Warbler	S	5	semi-obligatory
Scott's Oriole	S	3	
Brown-headed Cowbird	S	4	
Hepatic Tanager	S	1	
Black-headed Grosbeak ✓	S	5	
Lazuli Bunting	S	2	
Cassin's Finch	S	1	
House Finch	P-S	5	semi-obligatory
Lesser Goldfinch	S	2	
Red Crossbill	S	1	
Green-tailed Towhee	S	2	
Rufous-sided Towhee	P	6	semi-obligatory
Brown Towhee	P	2	semi-obligatory
Vesper Sparrow	P-S	2	
Lark Sparrow	S	4	semi-obligatory
Black-throated Sparrow	P-S	3	
Sage Sparrow	S	1	
Dark-eyed Junco	S	1	
Gray-headed Junco	P-S	1	
Chipping Sparrow	P-S	6	
Brewer's Sparrow	S	1	
Black-chinned Sparrow	P	2	semi-obligatory
Total: n = 74	P = 23 (32%) S = 38 (51%) P-S = 13 (17%)	S-O = 13 O = 5	

- 1) Data from Rasmussen (1941), Hardy (1945), Miller (1946), Hering (1957), Grue (1977), Masters (1979)
- 2) P = permanent resident; S = summer resident
- 3) The number indicates the number of census plots or study areas used for breeding. The maximum is 7. Sp. = special landscape required.
- 4) Obligatory = in a given geographic area the species breeds only in the pinyon-juniper woodland; semi-obligatory = same as above but breeds in one additional plant community.

Few, if any other natural habitat-types in North America have so few truly obligatory species. The reason(s) such should be the case is not clear but may relate to the great physiognomic diversity found in the pinyon-juniper woodland. Just as there is no typical pinyon-juniper woodland there are few obligate pinyon-juniper birds.

Just as the number of breeding species varies between woodlands so does breeding bird density. In southwestern Arizona where many oaks are found in the woodlands breeding bird density may reach 250 pairs per 40 ha (Balda 1967). This density is seldom if ever reached in the pinyon-juniper woodland where densities vary between 30 and 190 pairs

Discrimination among pinyon pine trees by Clark's Nutcrackers: effects of cone crop size and cone characters

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Summary. The influences of Colorado pinyon pine (*Pinus edulis*) cone crop size, cone and seed weight, cone length, number of seeds per cone, number of viable seeds, and percent viable seeds on the foraging behavior of avian seed dispersal agents were examined in field and laboratory settings. In the field, there was a significant positive relationship between cone number per tree and both the absolute number of cones and the percentage of the cone crop from which seeds were harvested. Cone weight and the number of viable seeds were also significantly related to seed harvest intensity. Laboratory experiments examined the relationship between crop size and cone characters on seed harvest by 18 Clark's Nutcrackers (*Nucifraga columbiana*). Nutcrackers were offered a choice of two tree types: one with 20 cones attached, and another with 10 cones attached. Significantly more birds chose to remove seeds first from the tree with 20 cones than the tree with 10 cones. In timed trials, they also harvested seeds from significantly more cones on the tree with the higher cone density. In the laboratory, cones chosen for seed removal by the nutcrackers had significantly more viable seeds, more seeds, and were longer compared to cones that were not chosen. Such discriminatory foraging behavior may increase avian foraging efficiency and result in differential reproductive success of pinyon pines. This behavior may therefore influence the evolution of pinyon pine reproductive traits.

Key words: Pinyon pine reproduction – Discriminatory foraging behavior – Clark's Nutcracker – *Nucifraga columbiana* – *Pinus edulis*

The reproductive success of vertebrate-dispersed plants may depend not only on seed crop size (Herrera 1988) but also on the ability to attract seed dispersal agents (Howe and Primack 1975; Vander Wall and Balda 1977;

Ligon 1978; Lanner and Vander Wall 1980; Clark and Clark 1981; Hutchins and Lanner 1982; Tomback 1982; Murray 1987). Many plant species exhibit significant intraspecific variation in both crop size (Linhart and Mitton 1985; Herrera 1988) and fruit or cone traits that attract dispersers (Howe and Estabrook 1977; Howe and DeSteven 1979; Howe and Vande Kerckhove 1979; Courtney and Manzur 1985). Because crop size and fruit traits have some genetic basis (Atsatt 1970; Atsatt and Strong 1970; Schaal and Levin 1976; Atsatt and Guldberg 1978; Paul 1978; Herrera 1981; Linhart and Mitton 1985) seed dispersers that discriminate among individual plants based on these characters may affect the evolution of these traits.

Pinyon pines depend on several birds in the family Corvidae for dispersal of seeds away from the parent to microsites that enhance germination probabilities (Vander Wall and Balda 1977; Ligon 1978). It is thought that seeds not dispersed away from the parent are lost to insect and rodent seed predators in most plants (Janzen 1970, 1972; Vander Wall and Balda 1977; Ligon 1978; Tomback 1982).

Clark's Nutcracker is an important disperser (along with the Pinon Jay, *Gymnorhinus cyanocephalus*) of Colorado pinyon pine seeds (Vander Wall and Balda 1977). Although these birds are also seed predators when foraging early in the day and season, and when harvesting small crops (Vander Wall and Balda 1977; Vander Wall 1988), they disperse seeds up to 22 km when harvesting larger crops. These birds have been found to effect forest regeneration (Tomback 1978; Ligon 1978; Lanner and Vander Wall 1980; Lanner 1980; Hutchins and Lanner 1982; Tomback 1982) due to their caching behavior, and have possibly been important to the range expansion of pinyon pines (Vander Wall and Balda 1977).

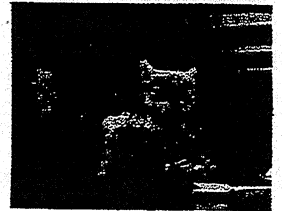
Previous studies have described apparent discrimination by nutcrackers among conifer stands (Tomback 1978), trees (Tomback and Kramer 1980; Benkman et al. 1984), and cones (Vander Wall and Balda 1977; Tomback and Kramer 1980), but have not examined in detail specific stand, tree, or cone characters influencing this

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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 Gary Naham
★ 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?

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(/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 management" 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 Arme Sundai — Nashunai Adopt A Sheitir Kiteh Munf

by FosterMornInCA

★ 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,

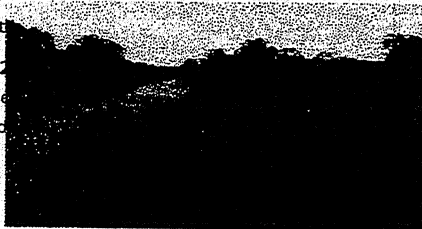
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/kos.com/%2Fstory%2F2022/Cal-Fire-burns-next-to-Bald-Eagle-nest-eaglets-die

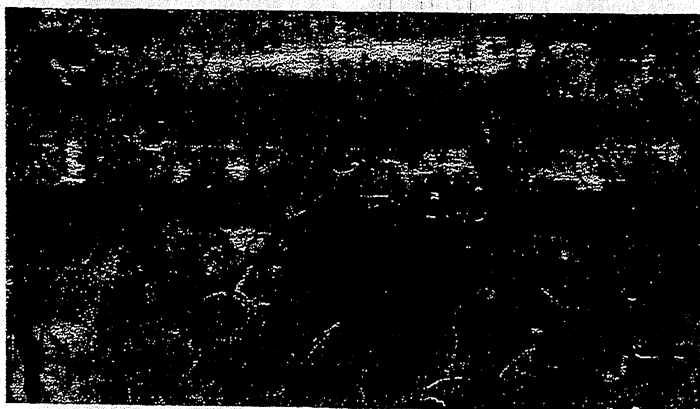
What has happened over the past several years to a bald eagle nest east of Red Bluff, California illustrates what is occurring because of these exemptions from any oversight. The fear of fire is being exploited to the detriment of the natural world, rather than substantive actions being implemented to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

"We are breaking them like nuts."

by annieli

★ 145 ● 59

A Ukrainian military expert confirms much of the analysis you've read here and looks to the future

by Charles Jay

★ 294 ● 188

Packard Museum: The 1920s (photo diary)

by Ojibwa

★ 37 ● 11



(https://www3.forbes.com/leadership/the-u-s-states-people-are-fleeing-and-the-ones-they-are-moving-to-version-5-ifs-vue-mn-wnb/?utm_campaign=The-US-States-People-Are-Fleeing-and-The&utm_source=Taboola&utm_medium=tb168760d0us3HfzydIXD-xXRU0dKoPgxdLW7JlFxsShf5nSD7_j0op8P9hb6qj_ZE)

The US States People Are...

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Funky-Looking Socks

Help Relieve Foot Pain ...

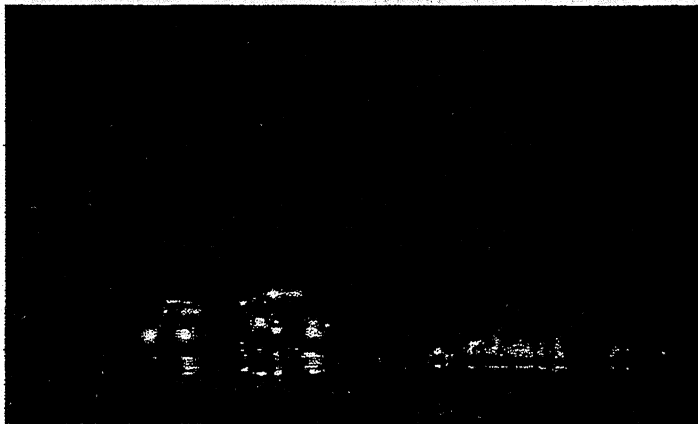
Happy Feet

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Kirstie Alley Is So Skin...

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

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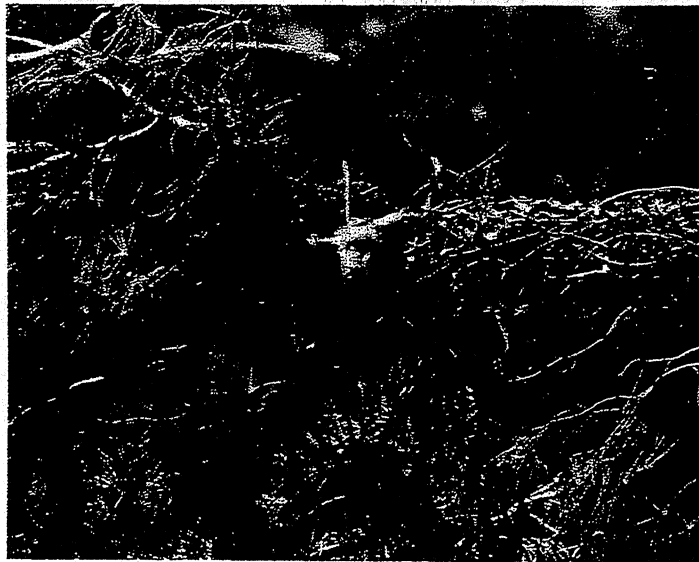
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Doctor Says Slimming Down After 60 Comes Down To This

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Dead eaglelet 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 eaglelet and the adults stayed in the tree top. I walked to the southeast side of the tree and looked up and saw the other eaglelet hanging dead in the tree, below the nest about 10'.



The second eaglelet, 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

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Putin's Greatest Victory Daily Kos

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Putin-s-Greatest-Victory)

Teach the Truth about the Supreme Court Daily Kos

(https://www.dailykos.com/story/2022/6/5/2102415/-
Teach-the-Truth-about-the-Supreme-Court)
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Teach-the-Truth-about-the-Supreme-Court)

Cut for the 'Not-So-Tall' Guy

Peter Manning NYC

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WFP Scaling Up To Reach 3.1 Million In Ukraine

UN World Food Program USA

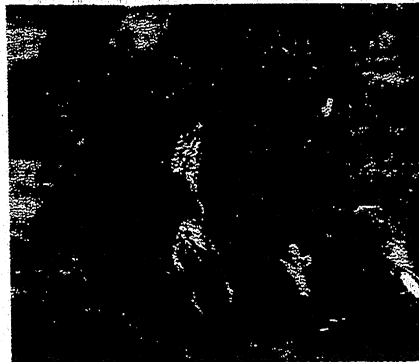
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compromise the immune system, making the bird more susceptible to infections. This is especially true in young birds in the nest that are unable to escape the smoke. Smoke inhalation toxicity in birds is caused by irritant gases (aldehydes, hydrogen 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.

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Do's And Don'ts For Pain-Free Knees

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Yes we can get gun control passed in the Senate

Daily Kos
(https://www.dailykos.com/story/2022/6/5/2102278/-Yes-we-can-get-gun-control-passed-in-the-Senate)
(https://www.dailykos.com/story/2022/6/5/2102278/-Yes-we-can-get-gun-control-passed-in-the-Senate)

Let's start assigning blame for mass shootings where it real...

Daily Kos
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The Ferrari of Kitchen Knives Now 50% Off

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Tweets of the Week May 29-Jun 4 2022

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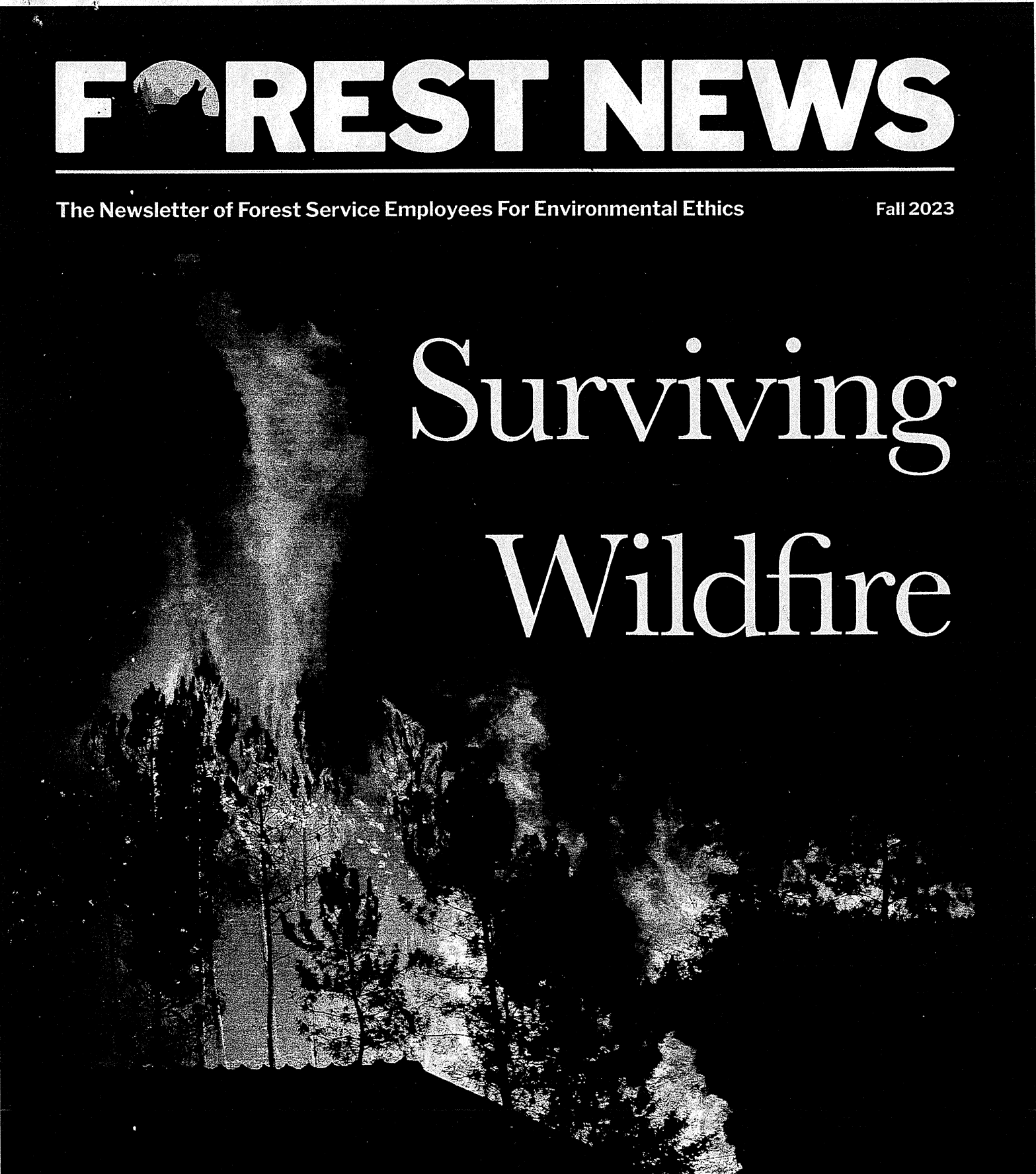
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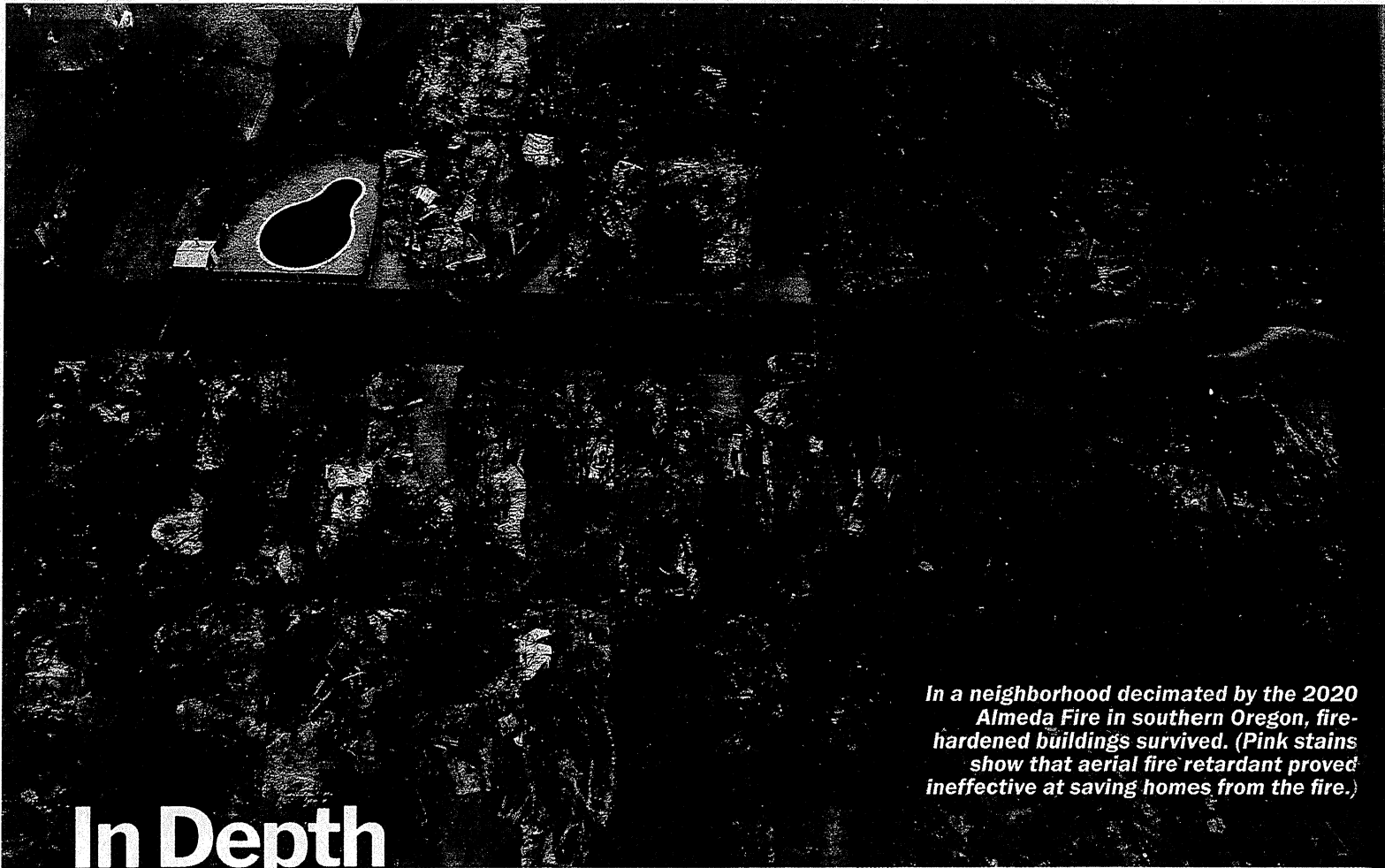
The Newsletter of Forest Service Employees For Environmental Ethics

Fall 2023

Surviving Wildfire

Inside

GUEST AUTHOR: RICK BASS / LOGGING NEAR YELLOWSTONE /
ELM RESTORATION / EASTERN FORESTS, PART 2



In a neighborhood decimated by the 2020 Almeda Fire in southern Oregon, fire-hardened buildings survived. (Pink stains show that aerial fire retardant proved ineffective at saving homes from the fire.)

In Depth

How Homes Can Survive Wildfire

While there's no historical evidence that Nero "fiddled while Rome burned," there's been plenty of fiddling in our forests while homes and communities burn in the American West. Jack Cohen has not been fiddling. His decades-long research at the Forest Service Missoula Fire Sciences Lab has dispelled commonly espoused wildfire myths and demonstrates that people who reside in wildland-urban (WU) areas do not have to live in fear of losing their homes to catastrophic wildfire.

As Cohen points out, Forest Service data show that 98% of wildfires are consistently controlled before they grow large enough to become destructive to communities. National Interagency Fire Center records show that the number of fires per year has remained fairly consistent, averaging around 70,000 since 1983 when the information was first tracked. While the number of fires per year remain reasonably consistent and the percentage of uncontrolled fires holds steady at 2%, a study led by Philip Higuera shows that the destructiveness of uncontrolled fires increased by 246% over the past decade.

Examples of this increased destructiveness include

the 2018 Camp Fire, which claimed 85 lives. The fire burned through thinned and clear-cut forest to incinerate over 18,000 homes and destroy the town of Paradise. In 2021, the Dixie fire burned through forests treated for fire mitigation and leveled the town of Greenville, California. In December 2021, the Marshall Fire near Boulder, Colorado, burned through grasslands to destroy more than 1,000 homes in less than 8 hours.

The numbers reveal, as Cohen states in the film *Elemental: Reimagine Wildfire*, "There is no management trend that indicates that we're going to be able to control all wildfire." Cohen concludes, "While extreme wildfires will evade control and inevitably spread to communities, WU fire disasters are not inevitable. We can effectively prevent WU fire disasters by reducing home ignitability ... without necessarily controlling wildfires or altering vegetation."

Much of the rationale for cutting trees in the forest is based on the idea of preventing crown fires, which spread from treetop to treetop. But as Cohen's research revealed, "More than half the time, the big crown fires aren't igniting these structures. It's something else. ... As

it turns out we're talking about a burning ember landing on the structure and the debris that maybe is in the rain gutters and igniting that debris that then puts flame on the eaves that then spreads into the attic of the house and totally consumes the house." And wind-driven wildfires are essentially impossible to control no matter how much fuel (i.e., trees) is removed from forests. That's because wind can carry embers more than a mile, bypassing fuel breaks and thinned forest to start spot fires that create more embers to be spread by the wind.

Cohen's passion for science readily translates to film as he describes the implications of his work in *Elemental*: "What this all means is that we have huge opportunities to change the requirements of combustion such that it doesn't happen. We don't have to control the extreme wildfire in order to keep the house from igniting and burning. And we don't have to live in a concrete ammo bunker to prevent the next Paradise."

As Cohen's research demonstrates — along with the Camp, Dixie, and Marshall fires — forest treatments for wildfire mitigation have not been shown to save lives, homes, or communities, yet the Infrastructure Investment and Jobs Act gave the Forest Service \$3 billion to accelerate forest treatments — i.e., tree cutting. "For the sake of fiscal responsibility, scientific integrity, and effective outcomes," Cohen told Bill Gabbert of *Wildfire Today*, "it's high time we abandon the tired and disingenuous policies of our century-old all-out war on wildfire and fuel treatments conducted under the guise of protecting communities."

Cohen's work informs the National Fire Protection Association's (NFPA's) Firewise USA program, which provides practical, effective recommendations for protecting homes and communities from wildfire. The NFPA website acknowledges that "embers and small flames" are "the main way that the majority of homes ignite in wildfires," and its Wildfire USA program stresses the importance of the Home Ignition Zone, a concept developed by Cohen.

The Home Ignition Zone is actually three zones, each of which carries different recommendations for protecting homes and communities against wildfire. The home and everything within 5 feet of any part of the structure are the Immediate Zone and the most critical for home survival. Firewise USA guidelines are explicit:

"START WITH THE HOUSE ITSELF then move into the landscaping section of the Immediate Zone."

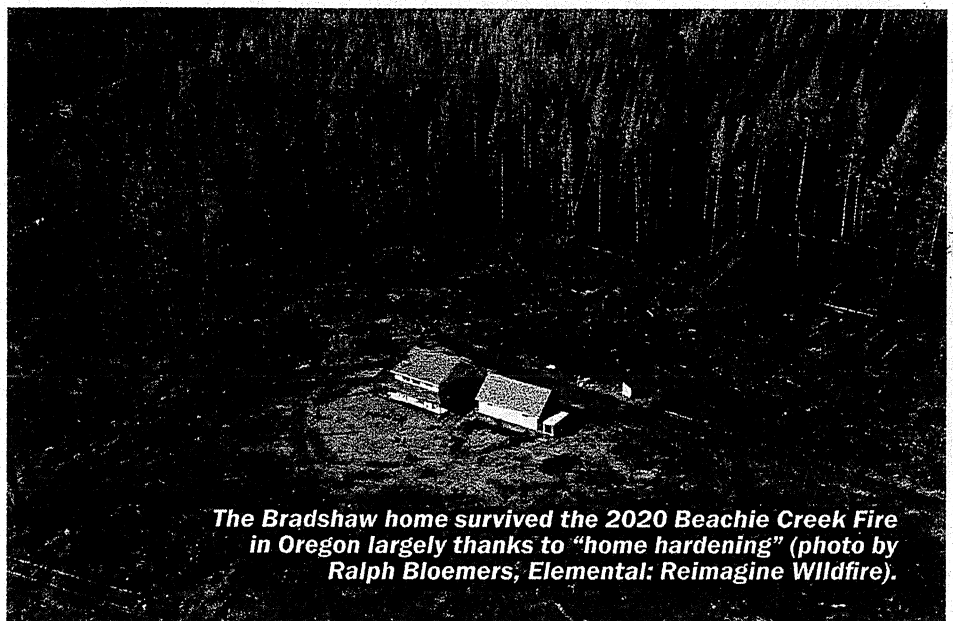
Recommendations for this zone include:

- Clean roofs and gutters of dead leaves, debris and pine needles that could be ignited by embers.
- Replace or repair any loose or missing shingles or roof tiles.
- Reduce the risk of embers passing through eave vents by installing 1/8-inch metal screening.
- Clean debris from exterior attic vents and install 1/8 inch metal screening to prevent embers blowing into attics.
- Repair or replace damaged or loose window screens and any broken windows.
- Screen or box-in areas below patios and decks with wire mesh to prevent combustible materials like leaves from accumulating.
- Move anything that can burn away from wall exteriors — mulch, plants, leaves, needles, firewood, etc.
- Remove anything stored underneath decks or porches.

From 5 to 30 feet from the home is the Intermediate Zone. Within this zone, Firewise USA calls for "careful landscaping" that can help "decrease fire behavior."

Intermediate Zone recommendations include:

- Clear vegetation from under stationary propane tanks.
- Create fuel breaks with driveways, walkways, patios, and decks.
- Keep lawns and native grasses mowed to a height of four inches.
- Remove ladder fuels (vegetation under trees) so a



The Bradshaw home survived the 2020 Beachie Creek Fire in Oregon largely thanks to "home hardening" (photo by Ralph Bloemers, *Elemental: Reimagine Wildfire*).

surface fire cannot reach the crowns. Prune trees up to 6-10 feet from the ground (not more than a third of the overall tree height for smaller trees).

- Space trees to have a minimum of 18 feet between crowns with the distance increasing as the slope increases.
- Tree placement should be planned to ensure the mature canopy is no closer than 10 feet to the edge of the home.
- Trees and shrubs in this zone should be limited to small clusters of a few each to break up the continuity of the vegetation across the landscape.

The Extended Zone is the area 30-100 feet from the home. For this zone, Firewise USA guidelines include:

- Dispose of heavy accumulations of ground litter and debris.
- Remove dead plant material.
- Remove small conifers between mature trees.
- Remove vegetation adjacent to storage sheds or other outbuildings.
- Trees 30-60 feet from the home should have at least 12 feet between canopy tops (more if the trees are on a slope).
- Trees 60-100 feet from the home should have at least 6 feet between the canopy tops (again, more spacing for steeper slopes).

Firewise guidelines can be implemented for a single home or for an entire community, and communities of between eight and 2,500 homes can become certified as Firewise USA sites, a process that engages the entire community in a multi-year planning and implementation process. Firewise guidelines are also shaping new construction, sometimes through building code requirements, and evidence from the Aug. 9 Lahaina Fire in Maui shows that the guidelines work.

The Insurance Institute for Business and Home Safety recently published a report showing that these building codes and construction techniques were effective in saving homes from the Lahaina Fire. The report highlights a residential development of single-family homes and multifamily units that escaped destruction at least partly due

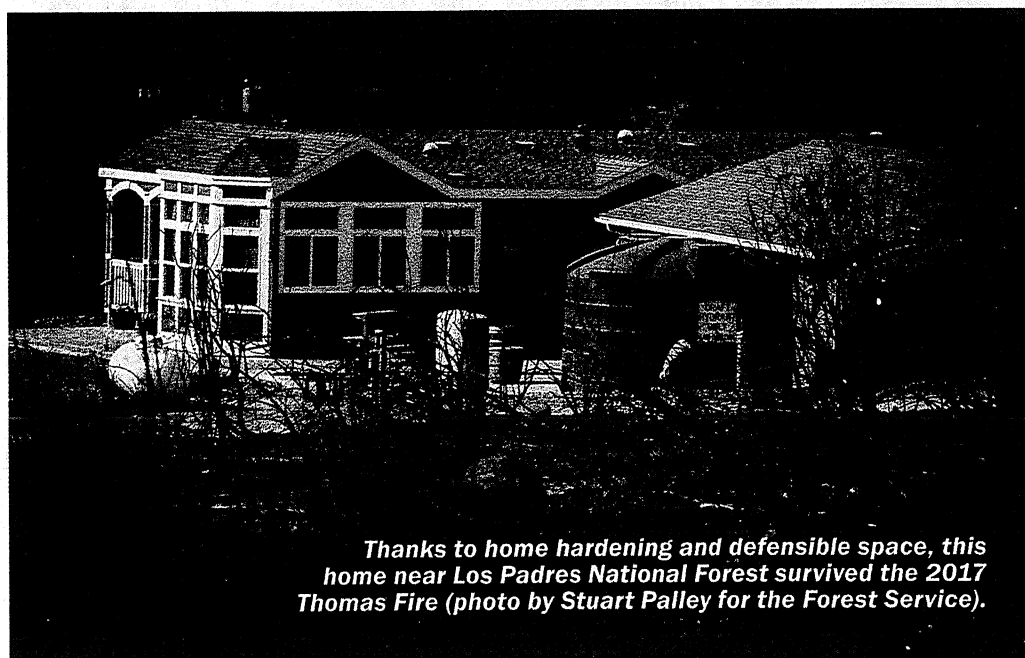
to fire-resistant construction and modern building codes. While the exteriors of some buildings ignited, they were not consumed by flames. The report notes, "Hawaii's modern building code has high-wind requirements that introduced elements that helped newer construction resist wildfire conditions."

Even though the homes in this development were located close together, the homes did not burn. The report lists three construction traits that contributed to home survival:

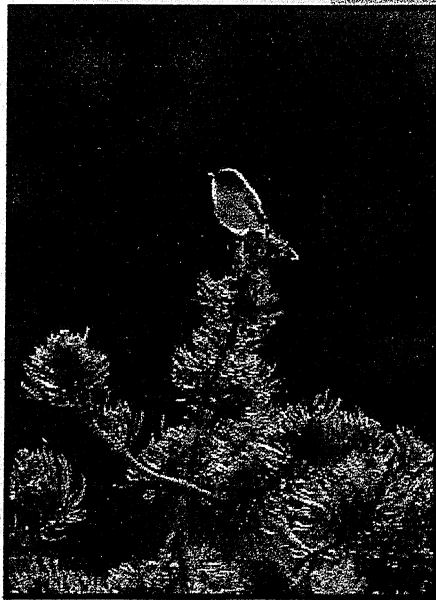
- Class A roof covers (asphalt shingles and metal).
- Non-combustible exterior wall materials.
- Screened vents that prevented embers from entering the attic space.

The report also notes that the surviving neighborhood had less landscape vegetation than subdivisions that were destroyed by the fire. Less vegetation near structures meant less fuel for the flames to spread from one structure to the next.

Real-world evidence from Colorado to Hawai'i refutes the current federal funding paradigm and supports Cohen's findings. "I have a high level of confidence," Cohen says, "that we can prevent community fire destruction during extreme wildfires because the research that has gone on for the last 30-plus years shows us that we have opportunities to prevent the big community fire disasters. But if we continue our current emergency response approach, wildland-urban fire disasters will be inevitable. ... It's very frustrating to me to realize that Paradise didn't have to happen and then listen to an interview of a fire professional saying there is nothing that we could have done — because there is."



Thanks to home hardening and defensible space, this home near Los Padres National Forest survived the 2017 Thomas Fire (photo by Stuart Palley for the Forest Service).



Sharing the Land with Pinyon-Juniper Birds

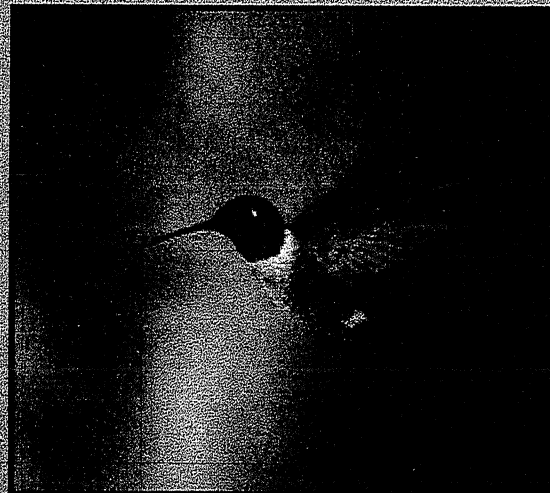


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Sharing the Land with Pinyon-Juniper Birds

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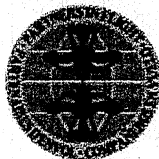
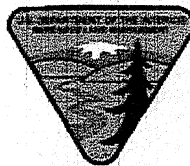
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Cover photos

Blue-gray Gnatcatcher (top)—Tony Leukering, RMBO

Landscape—Glenn Giroir, RMBO

Black-chinned Hummingbird (bottom)—© Brian Small / www.briansmallphoto.com

The mission of Rocky Mountain Bird Observatory is to conserve Rocky Mountain and Great Plains birds and their habitats through research, monitoring, education, and outreach.

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Composition of Bird Communities Following Stand-Replacement Fires in Northern Rocky Mountain (U.S.A.) Conifer Forests

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Abstract: During the two breeding seasons immediately following the numerous and widespread fires of 1988, I estimated bird community composition in each of 34 burned-forest sites in western Montana and northern Wyoming. I detected an average of 45 species per site and a total of 87 species in the sites combined. A compilation of these data with bird-count data from more than 200 additional studies conducted across 15 major vegetation cover types in the northern Rocky Mountain region showed that 15 bird species are generally more abundant in early post-fire communities than in any other major cover type occurring in the northern Rockies. One bird species (Black-backed Woodpecker, *Picoides arcticus*) seems to be nearly restricted in its habitat distribution to standing dead forests created by stand-replacement fires. Bird communities in recently burned forests are different in composition from those that characterize other Rocky Mountain cover types (including early-successional clearcuts) primarily because members of three feeding guilds are especially abundant therein: woodpeckers, flycatchers, and seedeaters. Standing, fire-killed trees provided nest sites for nearly two-thirds of 31 species that were found nesting in the burned sites. Broken-top snags and standing dead aspens were used as nest sites for cavity-nesting species significantly more often than expected on the basis of their relative abundance. Moreover, because nearly all of the broken-top snags that were used were present before the fire, forest conditions prior to a fire (especially the presence of snags) may be important in determining the suitability of a site to cavity-nesting birds after a fire. For bird species that were relatively abundant in or relatively restricted to burned forests, stand-replacement fires may be necessary for long-term maintenance of their populations. Unfortunately, the current fire policy of public land-management agencies does not encourage maintenance of stand-replacement fire regimes, which may be necessary for the creation of conditions needed by the most fire-dependent bird species. In addition, salvage cutting may reduce the suitability of burned-forest habitat for birds by removing the most important element—standing, fire-killed trees—needed for feeding, nesting, or both by the majority of bird species that used burned forests.

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Composición de las comunidades de aves luego del reemplazo de rodales a causa de incendios forestales en bosques de coníferas de las montañas Rocosas del norte

Resumen: Durante las dos últimas temporadas de cría inmediatamente después de los numerosos y extensos incendios de 1988, estimé la composición de la comunidad de aves en cada uno de los sitios de bosques incendiados, en el oeste de Montana y el norte de Wyoming. Detecté un promedio de 45 especies por sitio y un total de 87 especies en todos los sitios combinados. Una recopilación de estos datos con otros de conteo de aves a partir de más de 200 sitios adicionales, conducido a lo largo de 15 tipos principales de cobertura de vegetación en las montañas Rocosas del norte mostró que 15 especies de aves eran en general más abundantes en las comunidades tempranas posteriores al incendio, que en cualquier otro tipo principal de cobertura presente en las Rocosas del norte. Una especie de ave (el pájaro carpintero de espalda negra, *Picoides arcticus*) parece estar restringida en su distribución a los árboles muertos en pie, que quedan a causa del reemplazo de rodales a partir de los incendios. Las comunidades de aves en los bosques recientemente incendiados, son diferentes en composición de aquellos que caracterizan otros tipos de cobertura de las montañas Rocosas (in-

cluyendo la tala durante la sucesión temprana) principalmente porque los miembros de tres gremios alimenticios son especialmente abundantes en ellos: los pájaros carpinteros que se alimentan de las abundantes larvas de los escarabajos, los insectívoros y los comedores de semillas. Los árboles muertos en pie que quedaron después de los incendios proveen de sitios para el anidamiento de casi dos tercios de las 31 especies que se encontraron anidando en sitios incendiados. Las cavidades abiertas en los troncos a causa de la rotura de ramas y los álamos muertos que quedaron en pie, fueron usados como sitios para anidamiento por especies que anidan en cavidades más frecuentemente que lo esperado en función de su frecuencia relativa. Más aún, dado que la casi totalidad de las cavidades de los troncos que fueron utilizadas estaban presentes antes del incendio, las condiciones anteriores al incendio (especialmente la presencia de tocones) podrían ser importantes en la determinación de la adaptabilidad de un sitio después de un incendio para las aves que anidan en cavidades. Para las especies que fueron relativamente abundantes o estuvieron relativamente restringidas a los bosques incendiados, el reemplazo de rodales a partir de incendios podría ser necesario para el mantenimiento a largo plazo de sus poblaciones. Desafortunadamente, la presente estrategia sobre incendios a cargo de las agencias de manejo de las tierras públicas no promueve el mantenimiento de los regímenes de incendios para el reemplazo de rodales, los que serían necesarios para la creación de las condiciones requeridas por la mayoría de las especies que dependen de los incendios. En forma adicional, una tala de recuperación podría reducir la adaptabilidad de los hábitats de bosques incendiados para las aves al remover los elementos más importantes, árboles muertos en pie a causa de los incendios, necesarios para la alimentación y/o el anidamiento de la mayoría de las especies de aves que hacen uso de los bosques incendiados.

Introduction

"Of all biotic and abiotic influences on vegetation, fires were the most prevalent major disturbances on the [Rocky Mountain] landscape prior to European settlement" (Gruell 1983). Within all forest zones, climax forests that have escaped fire are rare in the Northern Rockies (Habeck & Mutch 1973). For mid- to high-elevation forest types within the Northern Rockies, the predominant fire regime is one of infrequent, intense, stand-replacement fires, not one of frequent, low-intensity, understory burns (Fischer & Bradley 1987). The origin of most Rocky Mountain forest stands can be traced to stand-replacement, as opposed to mild, understory fires (Arno 1980; Heinzelman 1981; DeByle et al. 1987). This implies that much of the variety in forest cover types across the northern Rocky Mountains is more a product of the presence of a variety of successional stages following stand-replacement fires than the presence of a multitude of climax community types. The importance of stand-replacement fires in this forest system should give the maintenance of such fires a high priority in land-management goals but, instead, the historical effort has been to eradicate such fires from these systems. In so doing, we have created a landscape with much less early successional post-fire habitat than existed prior to the era of fire suppression, when half the forest area burned every 100 years and roughly 35% of the forested land was less than 40 years of age at any one point in time (Barrows 1951; Gruell 1980). Even in wilderness areas, where fire control has been minimal, the annual area burned by stand-replacement fires during presettlement times was 1.5 times what it is today (Brown et al. 1994). The biological consequences of allowing a re-

duced amount of land to burn are unclear, but there is a distinct possibility that those plant and animal species that have evolved to depend on early post-fire communities may have been negatively affected by fire-control policies over the last 50 years.

Given the unique vegetative physiognomy following a stand-replacement fire, we might expect the bird communities associated with early post-fire forests to be unique as well. A review of the literature dealing with early post-fire bird communities in the northern Rocky Mountains (Blackford 1955; Koplin 1969; Davis 1976; Taylor & Barmore 1980; Harris 1982) suggests that some bird species are relatively abundant in recently burned forests (such as Black-backed Woodpecker [*Picoides arcticus*], Hairy Woodpecker [*Picoides villosus*], American Robin [*Turdus migratorius*], Dark-eyed Junco [*Junco hyemalis*]). Most of these species occur in other cover types as well, however, so the loss of fire would not necessarily threaten the maintenance of their populations. Unfortunately, existing descriptions of post-fire bird communities are largely anecdotal (without replication across a number of burns of the same age), of variable time periods after a burn (rarely soon afterward), and not designed to evaluate (through a comparison with other vegetation types) whether there exists a unique combination or association of bird species that occupy recently burned areas.

The purpose of this study, therefore, was to conduct bird counts in a number of different northern Rocky Mountain conifer forests that burned in 1988 to determine (1) which bird species are relatively abundant in early post-fire forests; (2) whether any of those bird species are relatively restricted to such conditions; and (3) whether different bird species vary significantly and similarly in abundance among burns.

an unburned forest edge was nearby, beyond 100 m but within 150 m.

Habitat Distribution of Birds

To determine the broader habitat distribution of the bird species that I detected in burned forests, I used published and unpublished census data from all the independent studies I could find for each of 15 broadly defined Rocky Mountain cover types: riparian bottomland, riparian streamside, aspen, grassland, sagebrush, pinyon-juniper, ponderosa pine, mixed conifer, lodgepole pine, spruce-fir, cedar-hemlock, post-fire forests in early succession (<10 years old), post-fire forests in mid-succession (10–40 years old), clearcut forests in early succession (<10 years old), and clearcut forests in mid-succession (10–40 years old). Because of the limited number of studies in any of the latter four categories, each included data from a variety of conifer forest types. To keep the information as relevant as possible to the northern Rocky Mountains while still achieving decent sample sizes for the various cover types, I included data from studies conducted in Alberta, eastern British Columbia, Colorado, Idaho, Montana, North Dakota, eastern Oregon, Utah, eastern Washington, and Wyoming. I recorded, for each cover type, the proportion of studies in which a given species was detected. Bird species that were present but too rare for density or abundance estimates (often noted with a "+" in the literature) were counted as present, but those recorded as "incidental" or "accidental" were not. An acceptable "study" was one that involved at least two days of census work (or 18 point counts) during a single season. Several studies included data from more than one site but, except for my own work in burned forests, I treated those data as a single sample unit. When an author provided data from more than one season, I used data from the most recent year available (see Table 3 for references). Similar methods have been used by Wiens (1975) and Raphael (1987a) to estimate probabilities of occurrence for bird species of mixed-conifer and spruce-fir forests, respectively.

Records of Trees and Nests Used by Woodpeckers

I examined patterns of tree species use in three sites (Grant Village, North Fork, and Canyon Creek) by walking haphazardly oriented, straight-line transects and, for each tree more than 10 cm dbh within 5 m of the transect, recording the tree species and presence of woodpecker feeding activity (small holes and/or bark flaking). I continued along a transect until I either counted 200 trees or came to the edge of the burn; I conducted two transects in each site. Using the same methodology, I collected data in the summer of 1993 on both the species and sizes (in 10-cm-dbh increments) of trees used

by woodpeckers from a site burned in 1991 (Blackfoot-Clearwater Game Range; 47°02'N, 113°20'W).

All instances of nesting were obtained incidentally to the bird census work. Upon discovering a nest, I recorded the following: bird species, date, site, nest location, plant species, height of plant, height of nest, and, when possible, number of eggs or young present. In the case of snag-nesting species, I also recorded the dbh, snag condition (broken or intact top), and whether the broken-top condition was present before the fire (as evidenced by burned rather than unburned heartwood at the break point).

Bird Nomenclature and Analysis

The taxonomic arrangement and English names for all species mentioned in the text are based on the A.O.U. Checklist (American Ornithologists' Union 1983, and supplements). Both Latin and English names are given in Table 2.

Statistical analyses were conducted with SPSS/PC+ software. To investigate the relative similarity among bird communities characteristic of each of 15 Rocky Mountain cover types, I generated an average-linkage within-groups dendrogram based on the squared Euclidean distance between bird-occurrence probabilities. For a given bird species, I tested whether the proportion of points occupied and mean number of birds per point differed significantly among sites with chi-square and Kruskal-Wallis ANOVA tests, respectively. To investigate whether the pattern of relative abundance across sites varied among bird species, I used a subset of the 20 most common bird species and the 10 most heavily sampled sites and tested the significance of the species by site interaction through a two-way ANOVA. The relative importance of each local-scale vegetation characteristic in predicting the mean number of birds per point at a site was established through partial correlation analyses. I restricted these analyses to species that were detected in at least five sites and to a subset of 13 continuous independent variables (the first 13 listed above), which were not significantly intercorrelated ($p < 0.05$). I also combined the single point obtained from the Totem Peak site with points from the nearby Glen Lake site.

Results

I detected a total of 87 species in one- to two-year-old burns (mean = 45 species per site), of which 77% were migrants that winter to the south (Table 2). Bird-community composition in recently burned forests is relatively distinct from that in other Rocky Mountain habitat types, but it clusters most closely with the two clearcut forests and mid-successional, post-fire forests (Fig. 1). A number of species seem to be relatively abundant in early

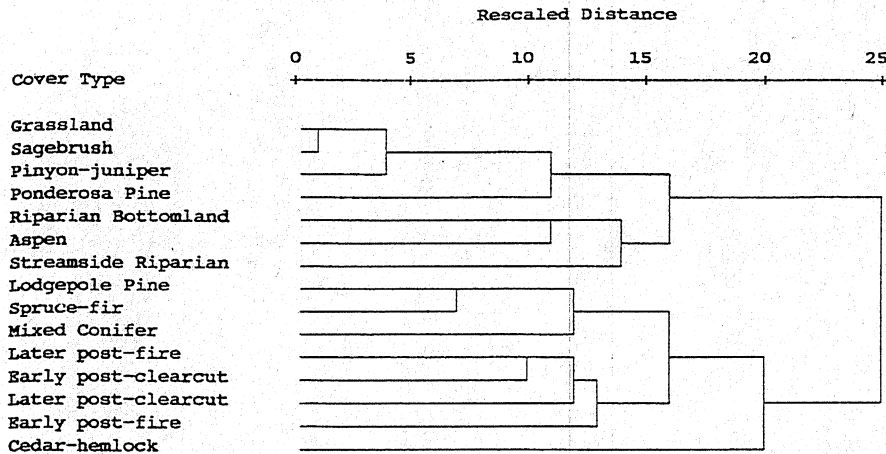


Figure 1. The pattern of similarity of bird communities among 15 major Rocky Mountain cover types. Dendrogram based on the average-linkage within-groups clustering method using squared Euclidean distances between bird occurrence probabilities given in Table 3.

post-fire forests and contribute to the distinctiveness of bird communities therein. In particular, 15 species were more frequently detected in early post-fire forests than they were in any other major cover type that occurs in the northern Rockies (Table 3). Other authors (Blackford 1955; West & Speirs 1959; Koplin 1969; Bock & Lynch 1970; Heinselman 1973; Niemi 1978; Pfister 1980; Taylor & Barmore 1980; Apfelbaum & Haney 1981, 1985; Harris 1982) have noted that many of the same species (such as Black-backed Woodpecker, Three-toed Woodpecker [*Picoides tridactylus*], Olive-sided Flycatcher [*Contopus borealis*], American Robin, Dark-eyed Junco) either appeared only after fire or dominated early post-fire bird communities. Bent (1939) also wrote about the abundance of Black-backed Woodpeckers in fire-killed forests, quoting Manly Hardy, who said he shot the heads off six within a few minutes when he was short of material for a stew!

Some species are not only more abundant in burned forests, but they are relatively restricted in their habitat distribution to early post-fire forests (Table 3). Of the 77 species for which I obtained an estimate of the breadth of habitats occupied, only two were more specialized than the Black-backed Woodpecker (Table 3). Even though Black-backed Woodpeckers were recorded on rare occasions ($\leq 12\%$ of the studies) in each of three other cover types (Table 3), the authors of several studies (Davis 1976; Taylor & Barmore 1980; Medin 1985; Skinner 1989) noted the presence of either a burned forest nearby or a prior burning treatment on their plot. Thus, my measure of habitat specialization for Black-backed Woodpeckers is probably conservative and is consistent with the suggestion that this species evolved in close association with burned forests (Bock & Bock 1974; Short 1982). I am aware of unpublished records of Black-backed Woodpeckers in unburned forests associated with severe budworm outbreaks in northern Idaho, and of unpublished nesting records in unburned and selectively harvested forests in western Montana, but

based on the comprehensive literature review herein and on my own field experience, these appear to be the exception more than the rule.

Insectivorous diets characterize most (78%) species that comprise early post-fire bird communities (Table 2). The number of bark-probing insectivore species that occur on the majority of studies in recently burned forest is unmatched by that in any other vegetative type in the northern Rockies (see Table 3).

Not all tree species and sizes were equally used by woodpeckers. At least half of the ponderosa pine, Douglas-fir, and western larch that I sampled showed signs of woodpecker feeding, but significantly smaller proportions (less than 3%) of Engelmann spruce, lodgepole pine, and subalpine fir showed signs of feeding activity (Table 4). In addition, larger trees (> 10 cm dbh) of each species were significantly more likely to show evidence of feeding use than were smaller trees (Table 5), which corresponds well with the pattern of use by beetle larvae (Amman & Ryan 1991).

I found active nests for 31 (36%) of the 87 species that I detected on point counts (Table 2). Standing dead trees provided nest sites for the majority (61%) of species, including open-nesting species (Table 6). Eleven (52%) of the 21 open-cup nests that I found were positioned in burned snags, as were five of the 12 open-cup nests that were placed above ground. Broken-top snags were especially important as nest sites. Of the 48 cavity nests that I found, 35% were located in broken-top conifer or broken-top aspen snags, even though such snags comprised only 6% of the trees available (Table 6). Nearly all of these trees had their tops broken before the fire occurred, as evidenced by blackened wood across the broken top. An additional 38% of the nests were in intact-top aspen snags (Table 6). While most of the intact-top aspen were probably not dead before the fire event, most did have already-existing cavities, as evidenced by the blackened entrances of numerous nest holes. Thus, 73% of the nests were located in already ex-

Table 4. The numbers of seven species of conifers (>10 cm diameter at breast height) encountered along a series of transects in the Grant Village, North Fork, Canyon Creek, and Blackfoot-Clearwater sites, and the percentages of those used by woodpeckers for feeding purposes.

Tree Species	(n)	Woodpecker use (%)*
Ponderosa pine, <i>Pinus ponderosa</i>	297	80.5
Western larch, <i>Larix occidentalis</i>	100	64.0
Douglas-fir, <i>Pseudotsuga menziesii</i>	593	47.9
Engelmann spruce, <i>Picea engelmanni</i>	109	2.3
Lodgepole pine, <i>Pinus contorta</i>	647	0.2
Subalpine fir, <i>Abies lasiocarpa</i>	172	0.0

*Percentages differ significantly among tree species ($G = 1081$, $p = 0.000$).

species are not the same as those that best predict the presence of another. Accordingly, the single variable that shows the best partial correlation with bird abundance varies widely among species (Table 7).

Discussion

Contrary to what one might expect to find immediately after a major disturbance event, I detected a large number of species in forests that had undergone stand-replacement fires. Huff et al. (1985) also noted that the density and diversity of bird species in one- to two-year-old burned forests in the Olympic Mountains, Washington, were as great as in adjacent old-growth forests. These numbers are not an artifact of birds simply passing through on their way from one adjacent unburned area to another. Most species we detected were feeding in the burned forests, and at least a third (36%) of those detected were nesting therein as well. If the birds were merely feeding while passing through, I should have detected more species and individuals in small burns and fewer in large burns because the probability of passage should decrease with increased isolation from unburned source areas. In fact, the presence of a species was

Table 6. Number (%) of cavity and open-cup nests in each of six classes of potential nest sites.

Nest Site	Cavity Nests	Open-Cup Nests	Available (%)*
Broken-Top Conifer	15 (31)	3 (14)	6
Intact-Top Conifer	12 (25)	9 (44)	92
Broken-Top Aspen	2 (4)	0 (0)	0
Intact-Top Aspen	18 (38)	0 (0)	2
In Bank, On Ground	1 (2)	8 (38)	n/a
In Shrub	0 (0)	1 (5)	n/a

*Based on a sample of 200 trees along a single, 10-m-wide transect in the Canyon Creek site.

largely independent of burn size; in only two cases (Townsend's Solitaire [*Myadestes townsendi*] and Solitary Vireo [*Vireo solitarius*]) was bird abundance significantly negatively correlated with burn size, and those species may indeed have been present in the smaller burns because of the proximity of unburned forest to some of the census points.

Several bird species seem to be relatively restricted in distribution to early post-fire conditions. These include Olive-sided Flycatcher, Three-toed Woodpecker, Black-backed Woodpecker, Clark's Nutcracker [*Nucifraga columbiana*], and Mountain Bluebird [*Sialia currucoides*]. Although none of these species may be considered an early post-fire obligate in the strictest sense, few strict obligates are associated with any habitat (Niemi & Probst 1990). I believe it would be difficult to find a forest-bird species more restricted to a single vegetation cover type in the northern Rockies than the Black-backed Woodpecker is to early post-fire conditions. Although it is possible that Black-backed Woodpecker populations are maintained by source refuges of low numbers in unburned forests, it is equally likely that their populations are maintained by a patchwork of recently burned forests. The relatively low numbers in unburned forests may be sink populations that are maintained by birds that emigrate from burns when conditions become less suitable 5-6 years after a fire.

5-6

Table 5. The sizes of each of three species of trees used by woodpeckers for feeding purposes in the Blackfoot-Clearwater site.

Tree Status	Tree Diameter at Breast Height (cm)					Significance*
	0-10	10-20	20-30	30-40	>40	
Douglas-fir, <i>Pseudotsuga menziesii</i>						
not fed upon	269	180	77	9	0	
fed upon	10	70	123	24	10	0.0000
Ponderosa pine, <i>Pinus ponderosa</i>						
not fed upon	261	39	17	1	1	
fed upon	72	175	48	7	9	0.0000
Western Larch, <i>Larix occidentalis</i>						
not fed upon	16	4	0	0	0	
fed upon	11	30	3	0	0	0.0001

*Based on G-test of independence between tree size and signs of feeding activity.

ern Flicker [*Colaptes auratus*], Steller's Jay [*Cyanocitta stelleri*], Orange-crowned Warbler [*Vermivora celata*], and Chipping Sparrow [*Spizella passerina*] were most abundant in the slightly older burned forests (10–40 years after fire) (Table 3). Three species (American Robin, Yellow-rumped Warbler [*Dendroica coronata*], and Dark-eyed Junco) were detected in both early- and mid-successional burned forest studies 100% of the time.

Thus, burned forests may be of critical importance to a large number of Rocky Mountain bird species that are either relatively restricted to or relatively abundant in such forests.

The picture I paint of bird communities in burned forests contrasts sharply with that painted by other authors (Emlen 1970; Bendell 1974; Lyon et al. 1978; Niemi 1978; Lyon & Marzluff 1985), who have stated that bird communities change little after fire. After a careful review of those papers and the papers that those authors summarized, however, it is clear that the no-effect conclusions have emerged, in part, from studies of low-intensity fires or nonforested habitats and almost always from comparisons of one or two study sites and one or two controls—far too little replication to draw general conclusions about fire effects. Most important, however, the no-effect conclusions are based on composite statistics such as total bird density, species richness, and within-guild abundances, which hide more than they reveal in terms of biological effects of fire on specific species.

Bird species that use burned forests occupy a variety of feeding guilds and most rely heavily on the standing dead trees for food acquisition. For example, several bird species detected in recently burned forests may be taking advantage of the increased availability of conifer seeds after cones open in response to fire. Seed eaters that feed on conifer seeds (especially Clark's Nutcracker, Cassin's Finch [*Carpodacus cassinii*], Red Crossbill [*Loxia curvirostra*], and Pine Siskin [*Carduelis pinus*]) were more abundant in early post-fire habitat than in any other cover type, and they were significantly more abundant (Mann-Whitney $U = 29,568, p < 0.001$) in the first year than in the second year following a fire, when conifer-seed resources would have been more depleted. Another feeding group that seems to depend on food provided by the burned trees includes the bark-probing woodpeckers, which eat primarily wood-boring beetles (Beal 1911). Woodpeckers are clearly responding to the increase in availability of cerambycid and buprestid beetle larvae (Evans 1964; Komarek 1969; Bock & Bock 1974; Fellin 1980; Harris 1982; Amman & Ryan 1991), which in some cases are themselves responding to the increase in availability of unburned wood that lies beneath the bark of fire-killed trees (Amman & Ryan 1991). Adult beetles in the genus *Melanophila* are, in fact, specialized to feed on fire-killed trees and are capable of using infrared sensors to detect and colonize

burned forests more than 161 km distant (Evans 1964, 1966). Finally, aerial insectivores (flycatchers, swallows) relied on standing dead trees as perch sites from which they sallied into the open air space for their prey.

Because the pattern of relative bird abundances differed among sites, the relative suitabilities of sites probably also differed among bird species. The same conclusion is suggested by results of the partial correlation analysis, in which the specific elements associated with bird abundance differ among species.

Most (77%) of the bird species I detected in burned forests were migrants. With concern about declining populations of migrants (Askins et al. 1990), perhaps conservation biologists should be devoting more attention to the loss of early successional habitats born of "natural" disturbance by investigating the extent to which such habitats are necessary for the maintenance of viable populations.

Conservation and Management Implications

The Importance of Stand-Replacement Fires

Fires are clearly beneficial to numerous bird species and are apparently necessary for some. The same case has been made for plants, in which some species germinate and flower only within 1–3 years after a fire and then bank their seeds for storage until the next fire (Heinselman 1981). Fire is such an important creator of the ecological variety in Rocky Mountain landscapes (Arno 1980; Gruell 1983) that the conservation of biological diversity is likely to be accomplished only through the conservation of fire as a process. Fire is in fact "... the only natural agent that is sufficiently widespread, abundant, fast, and regular to hold plant successions in seral stages on a vast scale and, therefore, to maintain the diversity of animal life that is so dependent upon such successional vegetation" (Komarek 1966). Efforts to meet legal mandates to maintain biodiversity should, therefore, be directed toward maintaining processes like fire, which create the variety of vegetative cover types upon which the great variety of wildlife species depend (Hansen et al. 1991).

Unfortunately, we are not currently managing the land to maintain the kind of early successional seral stages that follow stand-replacement fires and, hence, many fire-dependent plant and animal species. Why not? First, prescribed fires in conifer forests are most often low-intensity, understory burns that are justified by the argument that, with past fire prevention, forest composition is now "unnatural" and that we need to reintroduce a native fire regime of frequent, mild, understory burns to restore forests and to prevent catastrophic crown fires, which are "destructive" and "unnatural" (Biswell 1968; Alexander & Dube 1982). This justification holds only

for a very limited number of habitat types, however (for example, low-elevation ponderosa pine forests). Most of the forested landscape in the northern Rockies evolved under a regime of high-intensity, large fires every 50–100 years (Fischer & Bradley 1987), not under a regime of low-intensity, frequent understory burns. A study of fire history in the Selway-Bitterroot Wilderness showed that less than 10% of the forested land experienced non-lethal fire; most of the forest types experienced partly to completely lethal fires every 100–200 years (Brown et al. 1994). Although some might argue that all forest types have been subjected to fire suppression for too long and that unnaturally dense understory buildups are leading to unnaturally severe fires, the stand-replacement fires that currently consume forests that evolved under that regime (for example, the 1988 Yellowstone fires) are not at all unusual in intensity or extent (Romme & DeSpain 1989).

Second, current human population and human settlement trends allow for the retention of very few areas large enough to allow free-ranging fire, and almost none of those areas have prescriptions allowing stand-replacement fires to occur (Agee 1991). Even when there is plenty of space to let fires burn, the general response is to expend enormous resources to eradicate fire because of the damage it does to timber resources, the danger it poses to humans and their buildings, and—despite ample evidence to the contrary—the damage it may do to tourism because of the visual impact. Brown and Arno (1991) have addressed this growing predicament of putting fire back into the landscape while still operating within the economic, social, and political constraints that society continues to impose: It will not be easy.

Third, there is a lack of public education about the benefits of stand-replacement fires. The biological naivete surrounding the 1988 fires was astounding and did more to muster opposition than support for “let it burn” wilderness policies. The lack of understanding demonstrated by the public, especially prominent politicians, generated a good bit of the conflict over policy (Cutler 1988). Simple facts—for example, there exists a strong distributional association between some bird species and burned forests—should be used to garner support from the public for liberal prescribed-fire policies.

Fourth, forests are not being managed in ways that mimic natural processes. One could argue that the loss of burned forest acreage due to fire control has been compensated for, at least in part, by timber harvesting. Many people believe that the conditions present after a clearcut are basically the same as those present after a severe fire (Kohrt 1988; Maschera 1988; Eggleston 1989; Swift 1993). But conditions created by a stand-replacement fire are biologically unique, at least in terms of the biomass of standing, dead trees that remain and, to a much greater extent, in terms of ecosystem structure and function. Clearcutting is, in general, a poor substi-

tute for fire because such timber harvesting does not retain some of the most important elements, such as standing, dead trees, that are integral components of the post-fire ecosystem and that probably contribute to unique successional pathways (Agee 1991; Hansen et al. 1991) and wildlife communities.

Stand-replacement fires should not be viewed as unnatural disasters that can (and should) be prevented (Kipp 1931). As Heinzelman (1985) has argued, plans to maintain stand-replacement fire regimes are justified in at least the more remote of our public lands, and prescribed-fire regimes should not be limited to periodic, mild, understory burning in lower-elevation ponderosa pine forests. Managers must also be careful to mimic all aspects of natural disturbance (such as timing, frequency, and intensity) and not just introduce disturbance as such (Hobbs & Huenneke 1992). Finally, because the pattern of relative bird abundances differs among burns, managers probably need to provide a diversity of burned cover types, intensities, and maybe even a variety in landscape contexts of burns to provide for the variety of species that may depend on fire.

Post-fire Timber Harvesting

On public lands, managers should leave an adequate amount of standing, dead trees after a fire because of the species that depend on that forest element. The current tendency to expedite timber “salvage” sales on burned forest lands needs to be re-examined. Already, as much as 60% of all timber sales on some forests in the Northern Region of the U.S. Forest Service come from salvaged timber (Schwennesen 1992). These sales, which are often exempt from public notice or comment, are generally supported by a well-meaning but misguided public that believes “dead and dying timber ought to be harvested and put to use” (Schwennesen 1992).

If some bird species require burned forests for the maintenance of viable populations (which is strongly suggested by this study), then post-fire salvage cutting may be conducted too frequently to be justified on the basis of sound ecosystem management. In instances where a salvage cut is deemed necessary, managers who wish to mitigate such effects by leaving some of the standing dead trees should be aware that bird species differ in the microhabitats they occupy within a burn. Therefore, methods that tend to “homogenize” the stand structure (such as selective removal of all trees of a certain size and/or species) will probably not maintain the variety of microhabitats and, therefore, bird species that would otherwise use the site. Selective tree removal also generally results in removal of the very tree species (Table 4) and sizes (Table 5) preferred by the more fire-dependent birds. It may be best, instead, to take trees from one part of the burn and leave another part of the burned area untouched. That way, some of the guess-

work associated with choosing what to leave is avoided. This is clearly an area that deserves additional research attention.

Implications for Live-Tree Harvesting Methods

It is unfortunate that the effect of a timber harvesting method on birds (and other vertebrates) is nearly always evaluated in terms of how much the bird community composition changes from before to immediately after harvest (Hutto et al. 1993; Hejl et al. 1995). The method that best mitigates immediate harvest effects (that produces the least change) is generally viewed as the best alternative. Instead, maybe managers should favor methods that minimize deviation not from the bird communities typically associated with the pre-cut forest, but from those associated with the series of post-fire successional communities anticipated to have eventually occurred on that particular plot of land. In this light, many of the "new forestry" thinning practices, which appear favorable in terms of mitigating the immediate effects of cutting, may not represent the best strategy in terms of minimizing the impact of timber harvesting on natural patterns and processes. This is because many of the newer harvesting practices in mid- to high-elevation conifer forests create structurally artificial stands of thinned trees, which may bring "unnatural" combinations of bird species together, eliminate the full range of seral stages, and, perhaps worst of all, reduce the prospect of fire in the future (Gruell 1980). Recent full-page ads by the timber industry in the northern Rocky Mountains (for example, Missoulain, 24 August 1994, p. A-10), have, in fact, emphasized the fire-prevention "benefit" of forest thinning. Such a consequence may be fine at the urban-forest interface. It may be a well-intentioned but misplaced goal, however, for forested wildlands.

Most selective harvesting and thinning methods also result in the loss of large trees, many of which are otherwise destined to become the kind of snags that many primary and secondary cavity nesters depend on for nesting purposes should a stand-replacement fire occur. The predominant use of already existing snags by cavity nesters in burned forests (Table 6) implies that excavation is much easier in those than in the plentiful but otherwise less suitable (sometimes case-hardened) standing, dead trees. Because the most suitable nest trees for cavity excavation are snags that are themselves old-growth elements, one might even suggest that many of the fire-dependent, cavity-nesting birds depend not only on forests that burn, but on older forests that burn. Clearly, the relationship between pre-fire forest structure and post-fire bird communities deserves more attention.

A comparison of the bird communities in recent clearcuts and recent burns (Fig. 1) reveals a fair amount of similarity in the face of some important differences between the two cover types (Table 3), due primarily to

the presence of standing dead trees in the burned sites, which are used for feeding and/or nesting purposes by a large number of bird species (see also Davis 1976). I found an even greater overall similarity between clearcuts and burns that are in mid-successional stages, suggesting that, when considered over all post-harvest successional stages, clearcutting may come closer to matching the natural patterns of bird occupancy on a patch of land than do many (or most) other cutting practices. I must reiterate, however, that the relative abundances of many species differ quite markedly between recently burned and recently cut forests. Even in mid-successional burns and clearcuts, which showed a greater relative similarity in bird-community composition than the earlier stages did, there were still significant differences in the absolute abundances of a large number of individual species (for example, compare the two abundance estimates for Calliope Hummingbird, Red-naped Sapsucker [*Sphyrapicus nuchalis*], Clark's Nutcracker, and Cedar Waxwing [*Bombycilla cedrorum*]). Therefore, even though the bird communities in clearcuts begin to look similar to those in fire-disturbed forests after a decade or two (Fig. 1), the bird communities are still quite different (in an absolute sense) from those that occur after a natural fire. Perhaps the best alternative to traditional harvesting methods in forests that evolved under standard-replacement fire regime may be to conduct some sort of partial harvest, after which the remaining forest would be burned lethally.

Fire (and its aftermath) should be seen for what it is: a natural process that creates and maintains much of the variety and biological diversity of the Northern Rockies. Most current cutting practices neither create large amounts of standing dead timber nor allow forests to cycle through stages of early succession that are physiologically similar to those that follow stand-replacement fires. Unless managers begin to couple lethal burning with their cutting practices in those forests that evolved under stand-replacement fire regimes, traditional land-management practices will not achieve the goals of ecosystem management.

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GREATER SAGE-GROUSE

*Ecology and Conservation
of a Landscape Species and Its Habitats*

Steven T. Knick and John W. Connelly, *Editors*

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CHAPTER SEVENTEEN

Influences of Environmental and Anthropogenic Features on Greater Sage-Grouse Populations, 1997–2007

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Steven E. Hanser, Courtney L. Amundson, and Steven T. Knick

Abstract. The Greater Sage-Grouse (*Centrocercus urophasianus*), endemic to western North America, is of great conservation interest. Its populations are tracked by spring counts of males at lek sites. We explored the relations between trends of Greater Sage-Grouse lek counts from 1997 to 2007 and a variety of natural and anthropogenic features. We found that trends were correlated with several habitat features, but not always similarly throughout the range. Lek trends were positively associated with proportion of sagebrush (*Artemisia* spp.) cover, within 5 km and 18 km. Lek trends had negative associations with the coverage of agriculture and exotic plant species. Trends also tended to be lower for leks where a greater proportion of their surrounding landscape had been burned. Few leks were located within 5 km of developed land and trends were lower for those leks with more developed land within 5 km or 18 km. Lek trends were reduced where communication towers were nearby, whereas no effect of power lines was detected. Active oil or natural gas wells and highways, but not secondary roads, were associated with lower trends. Effects of some anthropogenic features may have already been manifested before our study period and thus not have been detected in this analysis. Results of this

range-wide analysis complement those from more intensive studies on smaller areas. Our findings are important for identifying features that could threaten Greater Sage-Grouse populations.

Key Words: *Centrocercus urophasianus*, communication towers, Greater Sage-Grouse, lek, oil and gas wells, population, roads, sagebrush.

Influencias de Características Ambientales y Antropogénicas en Poblaciones de *Centrocercus urophasianus*, 1997–2007

Resumen. El Greater Sage-Grouse (*Centrocercus urophasianus*) es endémico a Norteamérica occidental y de gran interés para la conservación. Sus poblaciones son monitoreadas mediante conteos de los machos en los sitios donde se encuentran los leks (asambleas de cortejo) en la primavera. Exploramos las relaciones entre las tendencias de conteos de leks de Greater Sage-Grouse durante 1997–2007 y una variedad de características naturales y antropogénicas. Encontramos que las tendencias estaban correlacionadas con varias características del hábitat, pero no siempre de forma similar en todo el territorio. Las tendencias de los leks estuvieron positivamente asociadas a la

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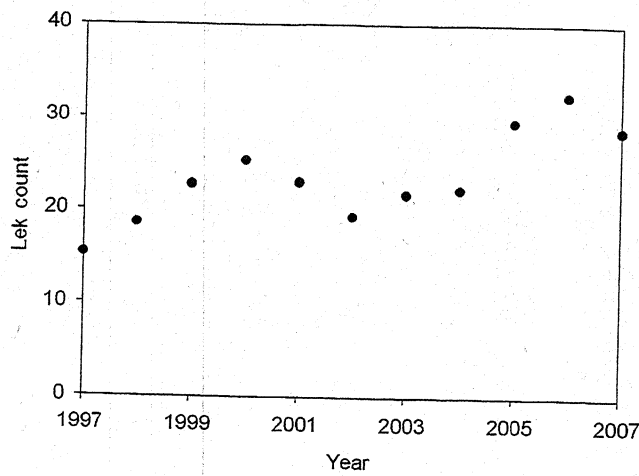
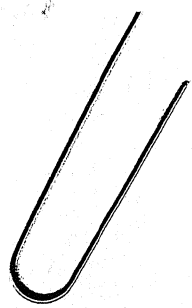


Figure 17.2. Average counts during 1997–2007 for 854 leks that had complete records for that period, across all management zones.

(Table 17.2). Relations in all SMZs but the Great Plains were positive. The Wyoming Basin appeared to have a peak near 2,100 m (Fig. 17.3), but in the other SMZs patterns continued upward (e.g., Northern Great Basin; Fig. 17.4).

We found no relation between lek trends and average annual precipitation (Table 17.2). Our metric was too general to capture any short-term effects due to either drought or deluge. Extremes of drought and deluge, especially on a more local scale, likely have more important consequences to sage-grouse reproduction and survival than does a simple long-term average.

Land Cover

Sagebrush

Sagebrush was common in all SMZs, of course, but least common in the Colorado Plateau, Great Plains, and Columbia Basin and most common in the Northern Great Basin (Table 17.1). The type of sagebrush cover also varied by SMZ. Of note is that the average percentage cover of sagebrush within 5 km exceeded the average within 18 km (Table 17.1), suggesting that sage-grouse leks are preferentially located within sagebrush. Lek trends across all SMZs increased modestly but steadily with the cover of tall sagebrush (combined categories for big sagebrush shrubland, big sagebrush steppe, mountain big sagebrush) at both 5-km (Fig. 17.5) and 18-km (Fig. 17.6) radii (Table 17.2). Patterns within individual SMZs generally were similar, except in

the Columbia Basin and the Colorado Plateau, where data were minimal. Similarly, lek trends across all SMZs increased modestly but steadily with the cover of all sagebrush (combined categories for tall sage and low sagebrush) at both 5-km (Fig. 17.7) and 18-km (Fig. 17.8) radii (Table 17.2).

Low sagebrush was present in all SMZs but the Great Plains. There was no consistent pattern for all SMZs combined (Fig. 17.9), and results for 5- and 18-km radii were similar. Low sagebrush was fairly common in the Northern Great Basin, where trends in lek counts generally increased until the cover of low sagebrush was about 40% of the landscape, after which trends were roughly steady (Fig. 17.10).

Grassland

Grassland was common only in the Great Plains, where a slight positive relation could be seen (Fig. 17.11). The Columbia Basin also contained large areas of grassland but had too few leks to draw any conclusions.

Exotic Vegetation

Average cover of exotic vegetation was about 2–3% for all SMZs except the Great Plains and Colorado Plateau, where it was lower (Table 17.1). Lek trends tended to be lower as the cover of exotic species increased at both 5-km (Fig. 17.12) and 18-km scales, although few leks had >8% coverage within either 5 km or 18 km.

TABLE 17.1
Average values of lek count trend, environmental features, and anthropogenic variables, by Sage-Grouse Management Zone (SMZ).

	Great Plains	Wyoming Basin	Southern Great Basin	Snake River Plain	Northern Great Basin	Columbia Basin	Colorado Plateau
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Regardless of whether sage-grouse populations increased or decreased during our study period, the analytical techniques we used compared relative patterns, for example, how numbers at leks with towers nearby changed in comparison to leks without nearby towers. Given the consistent effects of prevailing conditions, the relative patterns established across the large number of and broad spatial distribution of leks investigated suggest relationships that were essentially standardized for these prevailing conditions.

Physical Attributes, Land Cover, and Fire History

The distribution of sage-grouse is closely aligned with the distribution of sagebrush-dominated landscapes (Schroeder et al. 2004). The well-documented dependence of the species on sagebrush cannot be overemphasized (Patterson 1952, Connelly et al. 2000c, Hagen et al. 2007). Lek trends across the range of the species were positively associated with the proportions of tall-stature sagebrush and all sagebrush land covers within 5- and 18-km radii of the lek location. Also, the coverage of sagebrush was greater within 5 km than within 18 km. Low sagebrush was common in only the Northern Great Basin SMZ, where it was positively associated with sage-grouse. Walker et al. (2007a) found strong support for models relating lek persistence in southern portions of the Great Plains SMZ with the proportion of sagebrush habitat within 6.4 km. Aldridge et al. (2008) predicted that across the range of the species areas where sage-grouse persisted, compared with areas where populations were extirpated, were those containing at least 25% sagebrush cover within 30 km. Clearly, sagebrush at both local and landscape scales is a necessary, if not sufficient, requirement for viable sage-grouse populations.

Sage-grouse depend on sagebrush through all seasonal periods. Females consistently select areas with more sagebrush canopy cover than other available locations during nesting (Sveum et al. 1998b, Holloran et al. 2005, Hagen et al. 2007), and increased shrub cover at nests has been linked to increased probability of a successful hatch (Wallestad and Pyrah 1974, Gregg et al. 1994). Sage-grouse broods throughout Wyoming selected relatively dense sagebrush stands between hatching and 2 weeks post-hatching, presumably for thermal and predator protection of young chicks (Thompson et al. 2006). During

summer, sage-grouse select mesic areas closely associated with sagebrush that are used for loafing and security cover (Klebenow 1982). And the primary requirement of wintering sage-grouse is sagebrush exposure above the snow (Patterson 1952, Hupp and Braun 1989, Crawford et al. 2004); winter ranges in general are characterized by large expanses of dense sagebrush (Eng and Schladweiler 1972, Beck 1977).

Lek trends were positively related to elevation in the northwestern portion of sage-grouse range. The positive relation was consistent over all elevations in the Northern Great Basin and at elevations greater than average in the Snake River Plain and Columbia Basin SMZs. These SMZs have lower mean lek elevations (Table 17.1). The risk of invasion by exotic annual grasses such as cheatgrass in big sagebrush communities is greatest at lower-elevation (<1,500 m), drier sites (Hemstrom et al. 2002, Crawford et al. 2004). Because of shortened fire-return intervals and the inability of sagebrush-steppe plant communities to recover from fire quickly, invasion of a sagebrush-dominated site by annual grasses may result in the permanent conversion of that site into one that is unsuitable for sage-grouse (d'Antonio and Vitousek 1992, Brooks et al. 2004a, Baker 2006a). Although SMZs differed little in the average proportional area dominated by exotic vegetation (Table 17.1), few leks across the range of the species had >8% cover within 5 km or 18 km, suggesting that when the extent of the landscape dominated by exotic vegetation becomes relatively high, leks become inactive (Enyeart 1956; Connelly et al. 2000c; Miller et al., this volume, chapter 10).

The functional conversion of relatively small amounts of landscape either through exotic species invasion or agricultural conversion had pronounced negative effects on sage-grouse populations. Lek count trends tended to be more negative for leks with greater proportions of either exotic species or agricultural land cover, even at low proportions. Extirpation of sage-grouse throughout the species' range was found to be most likely in areas that had >25% cultivated cropland within 30 km (Aldridge et al. 2008). Inactive sage-grouse leks were noted to have a higher percentage of tillage agriculture within 4 km and within 6.4 km compared with active leks in eastern (Smith 2003) and southern portions of the Great Plains (Walker et al. 2007a). Additionally, replacement of native understory vegetation by exotic annual grasses such as cheatgrass has altered fire regimes, resulting in

losses of sagebrush over large expanses of the Southern Great Basin, Snake River Plain, Northern Great Basin, and the Columbia Basin SMZs (Mack 1981, Knick and Rotenberry 1997, Wambolt et al. 2002, Crawford et al. 2004, Beck et al. 2009).

Greater Sage-Grouse populations have consistently responded negatively to habitat management practices that manipulated large proportions of sagebrush on a landscape (Connelly et al. 2000c). We found that lek count trends across the range of the species generally were lower the greater the area burned within 5 km and 18 km. No relationship was evident between number of post-fire years and lek count trends, however. Baker (2006a) reports that the time required to burn once through an area in big sagebrush-dominated habitats is >70 years, indicating that the 11 years of our analysis was inadequate to determine long-term effects of fire on sage-grouse populations.

In most SMZs, sage-grouse lek trends tended to be higher at higher elevations. Exceptions were the Great Plains, with no consistent trend, and the Wyoming Basin, where a peak at about 2,000 m was evident. This association may reflect the greater human development and disturbances associated with valleys in mountainous areas.

We found no consistent relationship between lek count trends and mean precipitation across SMZs. However, our study period may be too short to identify potential long-term effects of precipitation on populations. Severe, persistent drought conditions have coincided with declining sage-grouse populations throughout the range of the species both historically (1930s) and recently (mid-1980s to early 1990s) (Patterson 1952, Connelly and Braun 1997, Aldridge et al. 2008), and researchers have surmised that grouse numbers were reduced during periods of below-average precipitation (Slater 2003, Holloran et al. 2005, Moynahan et al. 2007). Mean annual precipitation by states throughout the species' range suggests that below-average conditions have persisted for one to four ($\bar{x} = 1.7$) consecutive years since 1960. Our use of mean precipitation during the 11-year period did not allow us to explore any short-term effects of annual precipitation on sage-grouse populations.

Anthropogenic Features

Sage-grouse populations and distributions in many areas have diminished as a result of modifications to sagebrush-dominated landscapes from anthro-

pogenic activities (Connelly et al. 2000c, Knick et al. 2003). Few sage-grouse leks were located within 5 km of developed land, and a strong negative relationship was found between lek count trends and the proportion of the landscape developed within 5 km or 18 km. Many of the anthropogenic stressors associated with urban and suburban areas may act synergistically to cause sagebrush habitat fragmentation (Knick et al. 2003, Leu et al. 2008). As a landscape becomes bisected into smaller patches of habitat, functional connectivity among patches may be lost (With and Crist 1995). A patch of habitat that by itself is too small to support sage-grouse may nonetheless be valuable to the species if it is connected to other patches of suitable habitat. If that connection is lost, the patch may no longer have value (Fahrig 2003). Viable sage-grouse populations require large landscapes (Patterson 1952, Connelly et al. 2000c), so fragmentation resulting even from scattered disturbances may lead to disproportionate population declines or regional extinctions.

Lek count trends tended to be lower on leks that had >20 km of interstate, federal, or state highway within 18 km and on leks nearer such highways, but no apparent relationship occurred between lek count trends and the presence of secondary roads. Avoidance of roads by Greater Sage-Grouse (Lyon and Anderson 2003), Gunnison Sage-Grouse (Oyler-McCance 1999), and Lesser Prairie-Chickens (*Tympanuchus pallidicinctus*; Crawford and Bolen 1976, Hagen 2003) has been documented. Given that most major highways were constructed before 1997, their major effects likely occurred before our study period, and leks near highways that have persisted may be situated where topography has isolated them from these sources of disturbance (Braun et al. 2002). However, declines in count trends during the study period suggest a continuing disturbance associated with highways, possibly due to increased traffic levels, which have been identified as reducing numbers of sage-grouse occupying leks (Remington and Braun 1991, Holloran 2005).

The apparent reaction of sage-grouse to vertical structures at leks varied by the type of structure. Lek count trends were negatively related to proximity to the closest communication tower and to the number of towers within 18 km. However, trends were not consistently related to the distance to nearest power line or to the length of power line within 5 km or 18 km. Towers typically indicate

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Landscape Characteristics of Fragmented Shrubsteppe Habitats and Breeding Passerine Birds

1994

STEVEN T. KNICK* AND JOHN T. ROTENBERRY†

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Abstract: We examined the influence of local and landscape-level attributes of fragmented habitats in shrubsteppe habitats on the breeding distributions of Sage (*Amphispiza belli*) and Brewer's (*Spizella breweri*) Sparrows, Sage Thrashers (*Oreoscoptes montanus*), Horned Larks (*Eremophila alpestris*), and Western Meadowlarks (*Sturnella neglecta*) in the Snake River Plains of southwestern Idaho. We developed habitat (resource) selection models for each species by combining bird counts conducted from 1991 through 1993 with local vegetation characteristics and landscape attributes derived from satellite imagery. Site selection by shrubsteppe species (Sage and Brewer's Sparrows, and Sage Thrashers) depended on local vegetation cover and landscape features, such as the patch size of shrub habitats or the spatial similarity of sites. Marginal sites for these species (with species present in one of three years) were intermediate between unoccupied (never present) and occupied sites along environmental gradients characterized by increasing size of shrub habitat patches and total shrub cover and by decreasing disturbance. Horned Larks and Western Meadowlarks, typical grassland species, were not sensitive to landscape features, and their occupancy depended on the amount of grassland or shrub cover. In contrast to shrubsteppe species, sites that varied by occupancy rates of Western Meadowlarks did not significantly differ in vegetation or landscape components. Our results demonstrate that fragmentation of shrubsteppe significantly influenced the presence of shrub-obligate species. Because of restoration difficulties, the disturbance of semiarid shrubsteppe may cause irreversible loss of habitat and significant long-term consequences for the conservation of shrub-obligate birds.

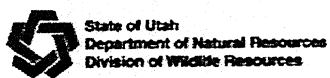
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Características del paisaje en ambientes fragmentados de estepas arbustivas y pájaros paserínidos en estado reproductivo

Resumen: Examinamos la influencia de los atributos a nivel local y del paisaje de los hábitats fragmentados dentro de ambientes de estepas arbustivas, sobre las distribuciones reproductivas de los paserínidos *Amphispiza belli* y *Spizella breweri*, *Oreoscoptes montanus*, *Eremophila alpestris* y *Sturnella neglecta* en las planicies del Río Snake del Sudoeste de Idaho. Desarrollamos modelos de selección de hábitats (recursos) para cada especie, combinando conteos de pájaros llevados a cabo entre 1991 y 1993 con características de la vegetación local y los atributos del hábitat derivados de imágenes de satélite. La selección de los sitios por parte de las especies de arbustos de las escarpas o pendientes (*Amphispiza belli* y *Spizella breweri*) dependió de la cobertura de la vegetación local y las características del paisaje, tales como el tamaño de los parches de los ambientes arbustivos o similitud espacial de los sitios. Los sitios marginales para esas especies (aquellos con las especies presentes en solo 1 de los 3 años) fueron intermedios entre los desocupados (nunca presentes) y los sitios ocupados, a lo largo de gradientes ambientales caracterizados por un incremento en el tamaño de los parches del ambiente arbustivo y la cobertura total de arbustos y un decrecimiento en la perturbación. *Eremophila alpestris* y *Sturnella neglecta*, especies típicas de pastizales, no fueron sensibles a las características del paisaje y dependieron de la cantidad de cobertura de pastizal o de arbustos. En forma opuesta a las especies de las estepas arbustivas, los sitios que variaron en cuanto al grado de ocupación de *Sturnella neglecta*, no presentaron

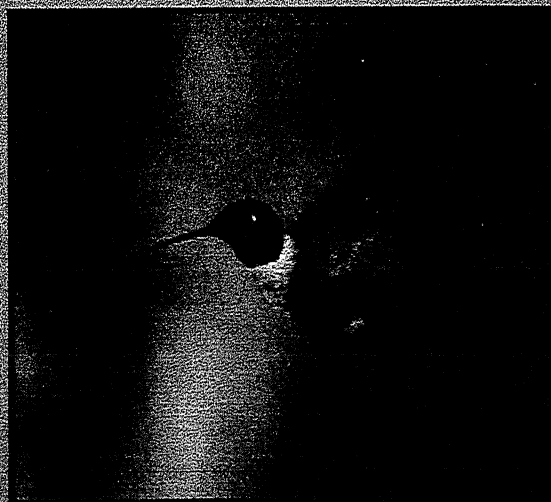


Sharing the Land with Pinyon-Juniper Birds



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Scott W. Gillihan
Rocky Mountain
Bird Observatory



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Sharing the Land with Pinyon-Juniper Birds

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EFFECTS OF FIRE ON GOLDEN EAGLE TERRITORY OCCUPANCY AND REPRODUCTIVE SUCCESS

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Abstract: We examined effects of fire on golden eagle (*Aquila chrysaetos*) territory occupancy and reproductive success in southwestern Idaho because wildfires since 1980 have resulted in large-scale losses of shrub habitat in the Snake River Plain. Success (percentage of pairs that raised young) at burned territories declined after major fires ($P = 0.004$). Pairs in burned areas that could expand into adjacent vacant territories were as successful as pairs in unburned territories and more successful than pairs in burned territories that could not expand. Success at extensively burned territories was lowest 4–6 years after burning but increased 4–5 years later. The incidence and extent of fires did not help predict territories that would have low occupancy and success rates in postburn years. The presence of a vacant neighboring territory and the amount of agriculture and proportion of shrubs within 3 km of the nesting centroid best predicted probability of territory occupancy. Nesting success during preburn years best predicted the probability of a territory being successful in postburn years. Burned territories with high success rates during preburn years continued to have high success rates during postburn years, and those with low success in preburn years continued to be less successful after burning. In areas where much shrub habitat has been lost to fire, management for golden eagles should include active fire suppression and rehabilitation of burned areas.

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Key words: *Aquila chrysaetos*, fire, golden eagle, habitat selection, home range, Idaho, reproductive success, shrub-steppe, territory occupancy.

Most raptor studies have focused on immediate or short-term responses of wintering or foraging raptors to fire (Komarek 1969, Smallwood et al. 1982, Tewes 1984, Chavez-Ramirez and Prieto 1994); long-term effects of fire on nesting raptors are poorly understood. Watson et al. (1987) predicted that burning may reduce golden eagle prey by eliminating shrub habitat. Predictions about the effects of fire or other habitat alteration on breeding raptor populations are complicated by the interaction between habitat quality and attributes of the pair (Newton 1991, 1992). Nesting success depends not only on habitat but also on the individuals that live there.

Golden eagles typically use and defend a group of 1–13 nests and a surrounding hunting range collectively known as a "territory" (Watson 1997). Golden eagles occupy territories year-round in southwestern Idaho, and the same individuals tend to occupy the same ter-

ritory year after year (Marzluff et al. 1997, Watson 1997). Golden eagles nesting in southwestern Idaho prey primarily on black-tailed jackrabbits (*Lepus californicus*; Steenhof and Kochert 1988), and golden eagle reproduction is closely tied to jackrabbit abundance (Steenhof et al. 1997). Black-tailed jackrabbits in southwestern Idaho are associated with shrub habitats, and jackrabbit densities are low in disturbed grassland habitats (Smith and Nydegger 1985, Knick and Dyer 1997). In the early 1980s, wildfires in southwestern Idaho burned vast areas of shrubs, resulting in large stands of exotic annual grasses (primarily cheatgrass [*Bromus tectorum*]) and forbs. The reduction in black-tailed jackrabbit habitat within the foraging areas of nesting golden eagles provided a unique opportunity to study long-term effects of fire on occupancy and nesting success of golden eagles.

In this paper, we examine 24 years of data on golden eagle territory occupancy and reproductive success in relation to the occurrence of wildfires. Because of the relation between black-tailed jackrabbits and shrub habitats, and the dependence of golden eagles on jackrabbits,

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The Salt Lake Tribune

The juniper mystery: Why is a tree that's supposed to withstand drought suddenly dying in southern Utah?



(Courtesy photo | Kate Magargal, University of Utah) Scientists and federal land managers are scrambling to investigate widespread juniper mortality in southeast Utah. Researchers shot this photo last month on Cedar Mesa, where junipers started dying in droves in September after the driest and warmest year on record. Foresters are stumped because juniper is seen as a drought-tolerant species.



By Brian Maffly • Published: November 18
Updated: November 20, 2018

The Utah juniper is considered the West's most drought-tolerant and resilient conifer, withstanding even the worst dry spells while nearby pinyon and ponderosa drop their needles and die.

So it was with some alarm for Kay Shumway, a retired science educator from Blanding, when he noticed yellowing among the juniper on southeastern Utah's Moki Dugway last spring, a time of year when these trees' needles should carry a vivid shade of green as they ramp up their photosynthetic capacity.

"During summer, the dying junipers were such a bright yellow color. It was easy to see. You could look out over the landscape and see thousands of those dying trees. Now a lot have dropped their needles and are becoming a skeleton," said Shumway, a former botanist who has kept himself busy as a nature photographer since retiring from the College of Eastern Utah 20 years ago. "They are dying. They are not going to come back [even if they get] some moisture."

He frequents the Moki Dugway on the southern tip of Cedar Mesa, which provides photogenic views of the buttes and canyons falling toward the San Juan River in what was initially part of Bears Ears National Monument. Shumway has since documented dying juniper in other parts of San Juan County, which is in the midst of a severe drought.

"My first reaction was the drought was causing it. The interesting thing is the pine trees, which are the most susceptible to drought, aren't affected. They are still green and healthy," Shumway said. "There were more and more of [the juniper] turning yellow. By July, I went all over the county, like Mustang Mesa and Alkali Ridge [east of Blanding]. Lo and behold, it was happening there, too."

Shumway has shared his photos and drone footage with academic scientists and forestry officials, who are now scrambling to determine the extent and causes of Utah's latest round of tree mortality.

The Colorado Plateau just experienced its driest year on record. Bluff saw barely 2 inches of precipitation in the water year that ended Sept. 30, about a fourth of normal, according to a National Weather Service database.

But juniper should be able handle a dry year.

"You can't look at the weather data for one year. Often the stress from drought is lagged," said entomologist Liz Hebertson. "We would have to look at conditions back three years, six years, 10 years. When a tipping point occurs might be different between species and even individual trees."

Other factors, working in combination with climate change, are probably at play, according to Hebertson, who works with the U.S. Forest Service's Forest Health Protection program in Ogden.

"It could be the perfect storm of other factors," Hebertson said. "Right now, we have a lot of questions." Like what is the extent of the mortality? What are the elevation profiles, soil conditions and other environmental characteristics of the affected areas? Are there signs of beetle infestation? Is the wood discolored? Are other tree species showing signs of distress?

Utah is no stranger to conifer die-offs. Dixie National Forest outside Cedar City is ground zero in a beetle epidemic that wiped out spruce, while lodgepole pines are falling victim to beetles in the Uinta Mountains. Ghost forests stretch across basins and plateaus for miles around the West.

Hebertson and her colleagues have been preoccupied this year with a new infestation afflicting forests in northern Utah, where a nonnative beetle, the balsam woolly adelgid, is decimating subalpine fir. This tree mortality is just as troubling as the one unfolding in San Juan County.

In search of clues in the juniper deaths, Hebertson is leading numerous scientists on a tour near Blanding later this month, along with Shumway, who wishes the group came earlier while the yellowed foliage was still hanging from the juniper branches.

"I'm thrilled to know there is some work being done on it," Shumway said. "I'm going to have this group get up close and personal with these trees, though it won't be as easy to see. You can still see there are dying trees all over the place."

Since retiring from CEU (now part of Utah State University), where he served as dean of instruction after helping to establish the Blanding campus in 1977, Shumway has explored Bears Ears country with cameras in tow. While stressed junipers have been documented across the state line in Colorado since last year, Shumway was the first to systematically record the phenomenon in Utah.

Almost more a shrub than a tree, Utah junipers crowd valley bottoms and mesa tops all over the Beehive State. They often mistakenly were called cedars in pioneer times; hence the appearance of the word "cedar" in so many Utah place names.

Junipers, along with the pinyons they usually grow with, are the subject of vegetation-removal operations in the name of habitat improvement. But these trees play a vital ecological role, stitching landscapes together and providing habitat for countless animals.

Widespread loss of junipers would have far-reaching consequences for southern Utah's fragile desert environments.

Among those taking a keen interest is University of Utah biology professor Bill Anderegg, who studies the impact of climate change on forest ecosystems.

"What we see is worrying and it's mind-boggling because juniper has weathered drought. In the drought of 2002, they were not affected," Anderegg said. "To see juniper die on a landscape scale is pretty disturbing. The pinyon don't seem to be dying at the same rate."

A possible factor is the Western cedar borer or cedar bark beetle, insects known to attack juniper. Shumway has pulled bark off dead trees to find larvae munching on the phloem, the critical tree tissues that conduct the fruits of photosynthesis to the root system.

But the presence of beetle larvae is just a clue, not a complete causal picture.

Last year was not only the driest on record for Utah, but it also was the second warmest. Could warm weather be compromising the trees' health, undermining their ability to repel beetle attacks? Or could it be enabling populations of hungry beetles to explode?

"We want to know how bad is the mortality event, how prevalent it is across the Four Corners, pin down the drivers," Anderegg said. "What are the thresholds that push junipers over the edge, and why are those thresholds being crossed now?"

Anderegg has applied for a Forest Service grant to explore such questions. At this stage, however, the extent of juniper mortality has yet to be established, much less why it might be happening, although few doubt climate change is playing some role.



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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

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%

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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.

RELATIONSHIPS BETWEEN JACKRABBIT ABUNDANCE AND FERRUGINOUS HAWK REPRODUCTION

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JOSEPH R. MURPHY
AND
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ABSTRACT.—From 1966–70 and 1972–74, we studied relationships between Ferruginous Hawk (*Buteo regalis*) reproduction and abundance of their main prey, the black-tailed jackrabbit (*Lepus californicus*) in the eastern Great Basin Desert of central Utah. Correlation tests showed significant relationships between jackrabbit abundance and hawk reproduction: the population of nesting hawks, number of nesting pairs, total eggs laid and total young fledged varied in synchrony with jackrabbit abundance. Key Factor Analysis and stepwise removal procedures indicated that jackrabbit abundance influenced hawk reproduction in the following order of decreasing importance: number of nesting pairs; failure of nesting pairs to achieve maximum clutch size; total number of young fledged and total number of young hatched. Regression tests revealed that two of these, the failure to nest and achieve maximum clutch size, are important limiting factors on reproduction and at least partially act to regulate the size of this Ferruginous Hawk population.

Solomon (1949) proposed that predators respond to changing prey densities in two basic ways, functionally and numerically. In the functional response, a predator consumes prey of a given species at a rate according to the density of prey. In the numerical response, predator population density changes with changing prey density, usually through migration and/or corresponding adjustments in reproduction rate.

Studies of raptor responses to density changes of their main prey have been reviewed by Newton (1979). Important European investigations include those of Tawny Owls (*Strix aluco*) and their prey in England (Southern 1970), Goshawk (*Accipiter gentilis*) clutch sizes and game bird abundance in Finland (Sulkava 1964), and Common Buzzard (*Buteo buteo*) breeding sequences relative to vole densities in Norway (Hagan 1969). In North America, Rusch et al. (1972) examined Great Horned Owl (*Bubo virginianus*) reproduction responses to snowshoe hares (*Lepus americanus*) near Alberta, while Hamerstrom (1979) reported Marsh Hawk (*Circus cyaneus*) breeding responses to vole (*Microtus pennsylvanicus*) abundance in Wisconsin. In this study, we analyze the numerical response of Ferruginous Hawk (*Buteo regalis*) reproduction to changes in its main prey, the black-tailed jackrabbit (*Lepus californicus*).

The Ferruginous Hawk is the largest and

most powerful of North American buteos and is the most common nesting raptor in the eastern Great Basin Desert of Utah. The black-tailed jackrabbit is a characteristic and frequently abundant mammal in the same area. It fluctuates in abundance, possibly cyclically, over a period of several years (Gross et al. 1974). The jackrabbit is an important prey species in the diet of the Ferruginous Hawk, comprising in some years more than 85–90% of the total food biomass (Smith and Murphy 1973, 1978, 1979; Howard and Wolfe 1976; Woffinden and Murphy 1977).

STUDY AREA

D.G.S. studied relationships between Ferruginous Hawks and jackrabbits on an 1,170 km² portion of the eastern Great Basin Desert in central Utah. The area includes Rush and Cedar valleys in Utah and Tooele counties. Woffinden and Murphy (1977) selected a 932 km² section of the original study area for their investigation. Topographically, the area is characterized by broad, flat, alkaline valleys separated by high, north-south oriented hills and ranges. Valley elevations range from 1,460 to 1,620 m and maximum elevations range from 1,830 m to 2,440 m.

Climatically, the area is a northern cold desert. Annual precipitation averages 38 cm and monthly temperatures average from –5°C in January to 24°C in July, with wide daily and seasonal variations.

Two distinct vegetative associations are present. The desert shrub community occurs over the lower elevations and covers the valley floors. It consists of shrubs, herbs, and grasses, several of which form large, homogeneous stands under certain edaphic soil conditions. Predominant desert shrub species include big sagebrush (*Artemisia tridentata*) on the better-drained



United States
Department of
Agriculture

Forest Service

April 2018



Glacier Loon Fuels Reduction and Forest Health Project

Draft Decision Notice

Swan Lake Ranger District, Flathead National Forest
Missoula County, Montana



PA 37,320 - 2
WMA = 12,000 - 28
25,320 = PA parcel
39.6 sq mi.

Timeline
- 5 yr after log - 30

Timeline 8 yr
5-18

Monitor
0-29

April 2018

OLD GROWTH ASSOCIATED WILDLIFE

INTRODUCTION

Old growth is defined in Amendment 21 of the Forest Plan as "a community of forest vegetation that has reached a late stage of plant succession." The generic description is as follows:

- The age of the dominant cohort of trees is significantly older than the average time interval between natural disturbances (interval will vary depending upon forest cover type and habitat type);
- Forest composition and structure are different from younger stands;
- Rates of change in composition and structure of the stand are slow relative to younger forests;
- There is a significant showing of decadence (wide range of defect and breakage in both live and dead trees).

In The Dictionary of Forestry (Helms 1998), old growth forests are described as having:

- Large trees for the species and site;
- Accumulations of large dead standing and fallen trees;
- Decay or breakage of tree tops, boles, or roots;
- Multiple canopy layers;
- A wide variation in tree size and spacing; and
- Canopy gaps and understory patchiness.

The characteristics of old growth forest described above provide habitat for many plant and animal species. Old growth forests are an important component of biological diversity. For the purpose of this discussion, old growth associated species includes any wildlife species that use the various attributes of old growth forests for some or all of their ecological needs. These needs could include nesting, denning, security, or foraging habitat. For some species, closed canopy old growth provides snow capture and reduces snow depths, insulates the animals from cold winds, and provides protection from predators. Some species, such as the fisher, are strongly tied to canopy cover and mature forest structure for the majority of their habitat needs. More open canopies, or open understories, provide foraging opportunities for prey and predator species alike. Wildlife may use interior old growth habitat as shelter from sun, heat, dryness, or wind and old growth cover may provide protection from predators. Some old growth associated wildlife species need only a portion of their home range to be in old growth; examples include the Canada lynx, northern goshawk, and American marten. Other species such as southern red-backed voles, chestnut-backed chickadee, Swainson's thrush, and northern flying squirrels, have relatively small home range sizes (less than 400 acres), with the necessary proportion of this home range being in old growth unknown.

The following table displays 31 old growth associated species that may be found in the Swan Valley, along with their associations with various old growth habitat characteristics (USDA 1999b).

TABLE 3- 87 HABITAT REQUIREMENTS OF OLD GROWTH ASSOCIATED WILDLIFE SPECIES. (BASED ON WARREN 1998 AND LRMP AMENDMENT 21 FEIS).

SPECIES	COVER TYPE IN AFFECTED AREA	CANOPY	EDGE	LARGER PATCHES	SNAG	DOWN LOG	OCCURRENCE
American Marten	Mixed mesic, lodgepole, spruce/fir forests	Closed	-	+	X	X	Known current
Bald Eagle (S)	Mixed mesic forests, near large lake or river	Open		+	X		Known current
Black-backed Woodpecker (S)	Lower Montane & Montane; post-fire or insect-epidemic forests	Open			X		Known current
Boreal Owl	Mixed mesic and spruce/fir forest mosaic	Closed			X	X	Known current
Brown Creeper	Mixed mesic, lodgepole, and spruce/fir forests	Closed	-		X		Known current
Canada Lynx (T1)	Mixed mesic, lodgepole, and spruce/fir forests; gentle terrain		+2	+	X3	X	Known current
Chestnut-Backed Chickadee	Mixed mesic and spruce/fir forests, especially cedar-hemlock	Closed	-4		X		Known current
Fisher (S5)	Mixed mesic and lodgepole forests	Closed				X	Known current
Flammulated Owl (S, F)	Lower Montane and Montane, single-story.	Open			X		Known current
Golden-crowned Kinglet	Mixed mesic, lodgepole, and spruce/fir forests	Closed		+	X		Known current
Hairy Woodpecker	Mixed mesic, lodgepole, and spruce/fir forests	Open			X	X	Known current
Hammond's Flycatcher (F)	Mixed mesic and spruce/fir forests	Closed					Known current
Harlequin Duck (S)	Swift mountain streams, riparian old growth (weak association)	Open				X	Known current
Hermit Thrush	Dry mixed mesic and spruce/fir forests	Open		+			Known current
Lewis' Woodpecker	Lower Montane ponderosa pine and old burns	Open			X		Known current
Northern Flying Squirrel	Mixed mesic and lodgepole forests			+	X	X	Known current
Northern Goshawk	Single or multistory old growth; clear forest floor	Closed		+	X		Known current
Pileated Woodpecker	Mixed mesic forests	Closed		+	X	X	Known current
Pine Grosbeak	Mixed mesic, lodgepole, and spruce/fir forests						Known current
Pygmy Nuthatch	Large single-story ponderosa pine and mixed mesic forests	Open			X		Known current
Red-Breasted Nuthatch	Mixed mesic, lodgepole, and spruce/fir, relatively dry	Open		+	X		Known current
Silver-haired Bat	Mixed mesic and lodgepole forests; caves and snags				X		Suspected
Southern Red-backed Vole	Mixed mesic, lodgepole, and spruce-fir forest				X	X	Known current
Swainson's Thrush (F)	Mixed mesic and lodgepole forest with shrub understory			+			Known current
Tailed Frog	Cold, high gradient headwater streams					X	Known current

TABLE 3- 87 HABITAT REQUIREMENTS OF OLD GROWTH ASSOCIATED WILDLIFE SPECIES. (BASED ON WARREN 1998 AND LRMP AMENDMENT 21 FEIS).

SPECIES	COVER TYPE IN AFFECTED AREA	CANOPY	EDGE	LARGER PATCHES	SNAG	DOWN LOG	OCCURRENCE
Three-toed Woodpecker	Mixed mesic, lodgepole, and spruce/fir forests; post-fire				X		Known current
Townsend's Warbler	Mixed mesic and lodgepole forest; dense understory	Closed	-	+			Known current
Varied Thrush	Mixed mesic and spruce/fir forests, especially cedar-hemlock	Closed		+			Known current
Vaux's Swift (F)	Mixed mesic and spruce/fir forests; large hollow snags				X		Known current
White-breasted Nuthatch	Large single-story ponderosa pine	Open			X		Known current
Winter Wren	Mixed mesic and spruce/fir forests, especially cedar-hemlock	-	-	+	X		Known current
¹ T = Threatened ² + = Positive correlation (where known) ³ X = Important Habitat Component ⁴ - = Negative correlation (where known) ⁵ S = Sensitive ⁶ F = Forest-dwelling Neotropical migrant with apparently declining populations							

ANALYSIS AREA

SPATIAL BOUNDS

The effects analysis area for direct, indirect, and cumulative effects to old growth associated wildlife species is the Glacier Loon Project Area (37,320 acres). This area is large enough to include the home ranges of old growth associated species, and is representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. At the same time, this analysis area is small enough to not obscure the effects of the alternatives. A multi-scale assessment has also been conducted to address habitat diversity concerns.

TEMPORAL BOUNDS

The length of time for effects from the proposed fuels reduction and forest health treatments is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, and the timeframes for related activities.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included stand exams, field surveys of snags and down woody logs, old growth surveys, project area field visits, research literature, and GIS and dataset information for features, such as general forest attributes, habitat type, and forest type.

MEASUREMENT INDICATORS

The effects analysis will focus on:

1. Effects to old growth habitat, and
2. Potential effects to old growth associated wildlife species.

April 2018

SNAG AND DOWN WOODY ASSOCIATED SPECIES

INTRODUCTION

Snags, broken-topped live trees, down logs, and other woody material are required by a wide variety of species for nesting, denning, roosting, perching, feeding, and cover (Bull et al. 1997). Snags and down, dead, material are also used for communication purposes:

- Singing, (songbirds),
- Drumming (grouse and woodpeckers),
- Calling (squirrels, jays, birds of prey), and
- Sight recognition posts.

Small mammals and birds use standing and down dead material for food storage and for hunting. Down logs and stumps are important for travel, both below the snow in the winter, and as travel cover throughout the year. It is estimated that about one third of the bird and one third of the mammal species that live in the forests of the Rocky Mountains use snags for nesting or denning, foraging, roosting, cover, communication, or perching. On the Flathead National Forest, at least 42 species of birds and 10 species of mammals are dependent on dead wood habitat for nesting, feeding, or shelter (USDA 1999b). The more mobile species that depend on dead wood habitat include black bears, Canada lynx, wolverines, marten, fisher, bats, woodpeckers, and small owls. Less mobile species that depend on dead wood include snowshoe hares (the primary prey of Canada lynx), red-backed voles (the primary prey of marten, fisher, boreal owl, and several other species), shrews, bryophytes, lichen, fungi, and protozoa. As down woody material further decays, it plays an important role in nutrient cycling, soil fertility, and erosion control.

Snags and their management have become a major conservation issue in managed forests across the western United States. Biologists have recognized for a long time that snags and down woody material provide important wildlife habitat, but only in the last decade or so have managers begun to understand that not only is tree decay an important ecological process that affects wildlife habitat (Bull et al. 1997), but snags and dead wood are an essential, important part of the larger ecosystem. The number, species, size, and distribution of available snags strongly affect snag-dependent wildlife. An insufficient number of suitable snags may limit or eliminate populations of cavity-using species (Saab et al. 1998; Thomas et al. 1979).

Although various sizes of snags and down woody are used, larger birds and mammals require larger dead trees. The larger-diameter down trees provide stable and lasting structure and offer better protection from weather extremes (Bull 2002). Longer down woody pieces provide better runways, shelter, and under-snow access.

Several wildlife species that use snag and down woody habitats on the Flathead National Forest are USFS Region One Sensitive Species, including the bald eagle, black-backed woodpecker, fisher, flammulated owl, Townsend's big-eared bat, and wolverine. One of the TES Species on the Flathead National Forest, the Canada lynx, has a strong habitat association with down woody material (denning).

Snags are essential habitat for at least 42 species of birds and 10 species of mammals in Montana. Table 3- 88 displays specific habitat relationships and Montana NHP rankings for wildlife species in Montana associated with snag, "defective" live tree, or down woody habitat.

GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT

CHAPTER 3

WILDLIFE - SNAG AND DOWN WOODY ASSOCIATED SPECIES

TABLE 3- 89 SPECIES THAT USE SNAGS, "DEFECTIVE" LIVE TREES, AND/OR DOWNED LOGS.

SPECIES	GLOBAL & STATE RANKS (MTNHP 2009) *	SNAG DBH (INCHES)	SNAG HEIGHT (FEET)	DOWNEED LOGS?	OCCURRENCE
American Kestrel (N)	G5, S5B	17	20		Known current
Bald Eagle (S)	G5, S3, SOC	25	40		Known current
Barred Owl (former MIS)	G5, S4	25	30		Known current
Barrow's Goldeneye	G5, S4, potential SOC	25	10		Known current
Big Brown Bat	G5, S4	17	20		Known current
Black-backed Woodpecker (S)	G5,S3 (SOC)	17	10		Known current
Black-capped Chickadee	G5, S5	9	10		Known current
Bobcat	G5, S5	-	-	yes	Known current
Boreal Chickadee	G5,S3 (SOC)	9	10		Known current
Boreal Owl (former S)	G5, S4	17	10		Known current
Brown Creeper	G5, S3, SOC	15	20		Known current
Bufflehead	G5, S5B	17	10		Known current
Canada lynx (T)	G5, S3, SOC	-	-	yes	Known current
Chestnut-backed Chickadee	G5, S4	9	10		Known current
Common Goldeneye	G5, S5	25	10		Known current
Common Merganser	G5, S5B	17	10		Known current
Dark-eyed junco	G5, S5B	-	-	yes	Known current
Downy Woodpecker	G5, S5	11	10		Known current
Fisher (S)	G5, S3, SOC	25	30	yes	Known current
Flammulated Owl (S, N)	G4, S3B, SOC	17	10		Known current
Great Horned Owl	G5, S5	25	30		Known current
Hairy Woodpecker	G5, S5	17	20		Known current
Harlequin Duck (S)	G4, S2B, SOC	-	-	yes	Known current
Hooded Merganser	G5, S4, potential SOC	17	10		Known current
House Finch	G5, S5	15	10		Known current
House Sparrow	G5, undesired species	15	20		Known current
House Wren (N)	G5, S5B	15	10		Known current
Lewis' Woodpecker	G4, S2B (SOC)	17	30		Known current
Little Brown Myotis	G5, S4	17	10		Known current
Long-eared Myotis	G5, S4	17	10		Known current
Long-legged Myotis	G5, S4	17	10		Known current
Long-tailed Weasel	G5, S5	-	-	yes	Known current
Marten (former MIS)	G5, S4	17	20	yes	Known current
Mountain Bluebird	G5, S5B	15	10		Known current
Mountain Chickadee	G5, S5	9	10	yes	Known current
Northern Alligator Lizard	G5,S3 (SOC)	-	-	yes	Known current
Northern Flicker	G5, S5	17	10		Known current
Northern Flying Squirrel	G5, S4	17	20		Known current
Northern Goshawk (former S)	G5,S3 (SOC)	-	-	yes	Known current
Northern Hawk Owl	G5, S4, potential SOC	25	10		Known current
Northern River Otter	G5, S4	-	-	yes	Known current
Northern Waterthrush (N)	G5, S5B	-	-	yes	Known current
Osprey	G5, S5B	17	40		Known current

GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT
WILDLIFE - SNAG AND DOWN WOODY ASSOCIATED SPECIES

CHAPTER 3

TABLE 3- 89 SPECIES THAT USE SNAGS, "DEFECTIVE" LIVE TREES, AND/OR DOWNED LOGS.

SPECIES	GLOBAL & STATE RANKS (MTNHP 2009) "	SNAG DBH (INCHES)	SNAG HEIGHT (FEET)	DOWNED LOGS?	OCCURRENCE
Painted Turtle	G5, S4	-	-	yes	Known current
Pileated Woodpecker (former MIS)	G5, S3 (SOC)	25	60		Known current
Pygmy Nuthatch	G5, S4	17	30		Known current
Pygmy Owl	G5, S4	17	30		Known current
Raccoon	G5, S5	25	10		Known current
Red-breasted Nuthatch	G5, S5	17	20		Known current
Red-naped Sapsucker (N)	G5, S4B	17	20		Known current
Rubber Boa	G5, S4	-	-	yes	Known current
Ruffed Grouse	G5, S4	-	-	yes	Known current
Saw-whet Owl	G5, S4	17	20		Known current
Silver-haired Bat	G5, S4, potential SOC	17	20		Known current
Southern Red-backed Vole	G5, S4	-	-	yes	Known current
Spruce Grouse	G5, S4	-	-	yes	Known current
Striped Skunk	G5, S5	-	-	yes	Known current
Swainson's Thrush (N)	G5, S5B	-	-	yes	Known current
Tailed Frog	G5, S4	-	-	yes	Known current
Three-toed Woodpecker	G5, S4	17	20		Known current
Tree Swallow (N)	G5, S5B	15	20		Known current
Vaux's Swift (N)	G5, S4B	25	40		Known current
Violet-Green Swallow	G5, S5B	15	20		Known current
Western Bluebird	G5, S4B	15	10		Known current
Western Jumping Mouse	G5, S4	-	-	yes	Known current
Western Screech Owl	G5, S3, potential SOC	17	20		Known current
Western (Townsend's) Big-eared Bat (S)	G4, S2 (SOC)	?	?		Known current
White-breasted Nuthatch	G5, S4	17	20		Known current
Williamson's Sapsucker (N)	G5, S4B	17	20		Known current
Wilson's Warbler (N)	G5, S5B	-	-	yes	Known current
Wolverine (S)	G4, S3 (SOC)	-	-	yes	Known current
Wood Duck	G5, S5B	25	10		Known current
Yuma Myotis	G5, S3, potential SOC	17	10		Known current

T=Threatened; S=Sensitive Species; N=Neotropical migratory bird; Natural Heritage Program Rank: G=species range-wide (global); S=state wide; 2=At risk because of very limited and/or declining numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state. 3=Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas. 4=Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. 5=Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range. B=State rank modifier indicating breeding for a migratory species. SOC=Montana Species of Concern.

48 birds

ANALYSIS AREA

SPATIAL BOUNDS

The Glacier Loon Project Area was considered for the evaluation of direct and indirect effects on snag and down woody associated species. This approximately 37,320-acre area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. The actions proposed in the alternatives that could directly or indirectly affect snag or down woody associated wildlife species are contained within this area. The Upper Swan Valley was considered in the cumulative effects analysis. A multi-scale assessment was also conducted to address habitat diversity concerns for dead tree dependent species (USDA 2006).

TEMPORAL BOUNDS

The length of time for effects from the proposed fuels and forest health treatments is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, and the timeframes for related activities.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included project area field visits, research literature, and GIS and dataset information for features, such as general forest attributes, habitat type, and forest type.

MEASUREMENT INDICATORS

The effects analysis will focus on:

1. Effects to snag and down woody habitat, and
2. Potential effects to snag/down woody associated wildlife species.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Forest ecosystems in the western United States have adapted in response to disturbances such as wildfire, insects, disease, and windstorms. Snags and down woody material have always occurred on the landscape, a direct result of these disturbance factors, either on a large scale, or on a very small scale, as individual trees grow old and die. Ritter and others have described snag populations as occurring in either "pulses" of snags following a large disturbance event, or as "continuous" populations of scattered individuals (Ritter et al. 2000).

Historically, in the Swan Valley, snag habitat and down woody material, though always present in varying amounts, experienced greater "pulses" across the landscape and in localized areas as a result of natural disturbances. Warmer and drier areas historically underwent more frequent, lower-intensity fires, and typically supported fewer snags and large down logs than cooler and moister environments, where the stands reached climax conditions before experiencing stand-replacing fire.

EXISTING CONDITION

The Northern Region of the Forest Service estimated snag densities for Western Montana Forests by

56/June

POST-FLEDGING SURVIVAL OF NORTHERN GOSHAWKS: THE IMPORTANCE OF PREY ABUNDANCE, WEATHER, AND DISPERSAL

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Abstract. Effective wildlife conservation strategies require an understanding of how fluctuating environmental conditions affect sensitive life stages. As part of a long-term study, we examined post-fledging and post-independence survival of 89 radio-marked juvenile Northern Goshawks (*Accipiter gentilis*) produced from 48 nests in northern Arizona, USA, during 1998–2001. Information-theoretic methods were used to examine within- and among-year variation in survival relative to environmental (prey abundance, weather), territory (hatching date, brood size), and individual (gender, body mass) sources of variation. The results support age- and cohort-specific differences in survival that were best explained by behaviors occurring at distinct stages of juvenile development, annual changes in the density of primary bird and mammal prey species, and gender-related differences in body mass. Survival between fledging and independence increased linearly with age and varied among annual cohorts of radio-marked juveniles from 0.81 (95% CI = 0.60–0.93) to 1.00 (95% CI = 0.95–1.00) in association with annual differences in prey density; the slope coefficient for the additive effect of prey density on survival was 1.12 (95% CI = 0.06–2.19). Survival declined to 0.71 (95% CI = 0.60–0.93) shortly after juveniles initiated dispersal (weeks 8–12 post-fledging) and moved to more open habitats at lower elevations. Survival was not closely associated with weather or territory-level parameters. A comparison of the predictions of environmental-, territory-, and individual-based models of survival demonstrated that food availability was the primary factor limiting juvenile survival. This finding indicates that forest management prescriptions designed to support abundant prey populations while providing forest structural conditions that allow goshawks to access their prey within breeding areas should benefit juvenile survival.

Key words: *Accipiter gentilis*; Arizona, USA; dispersal; distance sampling; juvenile survival; known-fate models; Northern Goshawk; prey abundance; radiotelemetry; weather.

INTRODUCTION

Understanding how sensitive life history stages respond to changing environmental conditions is a crucial step in developing conservation strategies for wildlife populations. In birds, survival over the first several months of life is perhaps the most sensitive life history component to environmental change, yet it is also one of the most difficult demographic parameters to reliably estimate. As a consequence, little is known about this life history stage and its contribution to population dynamics. Information on juvenile survival is needed to identify those life history parameters that most strongly affect rates of population change (Noon and Biles 1990). Such information can also improve estimates of reproductive success and help to identify important ecological factors that limit population size (Anders et

al. 1997, Thomson et al. 1999). For example, high temporal variation in the number of new individuals entering the breeding segment of a population may result from temporal variation in juvenile survival (Franklin et al. 2000, Reed et al. 2003), which can arise from changes in the environment during sensitive stages of juvenile development (Monrós et al. 2002, Todd et al. 2003).

In birds of prey, it is generally believed that as many as half of the birds that fledge subsequently die in their first year, and that mortality peaks in the first several months after fledging (Newton 1979). During this time, fledglings are typically dependent on their parents for food and stay within the natal area until the initiation of juvenile dispersal (Kenward et al. 1993a). The period of transition from a dependent fledgling to an independent juvenile (the fledgling dependency period) is a critical stage for survival because feather growth is incomplete and flight skills are developing, leaving the young highly susceptible to predation, starvation, and exposure (Anders et al. 1997, Thompson et al. 1999, Naef-Daenzer et al. 2001). Indeed, raptor mor-

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GREATER SAGE-GROUSE
*Ecology and Conservation
of a Landscape Species and Its Habitats*

Steven T. Knick and John W. Connelly, *Editors*

Studies in Avian Biology No. 38

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CHAPTER EIGHTEEN

Factors Associated with Extirpation of Sage-Grouse

Michael J. Wisdom, Cara W. Meinke, Steven T. Knick,
and Michael A. Schroeder

Abstract. Geographic ranges of Greater Sage-Grouse (*Centrocercus urophasianus*) and Gunnison Sage-Grouse (*C. minimus*) have contracted across large areas in response to habitat loss and detrimental land uses. However, quantitative analyses of the environmental factors most closely associated with range contraction have been lacking, results of which could be highly relevant to conservation planning. Consequently, we analyzed differences in 22 environmental variables between areas of former range (extirpated range), and areas still occupied by the two species (occupied range). Fifteen of the 22 variables, representing a broad spectrum of biotic, abiotic, and anthropogenic conditions, had mean values that were significantly different between extirpated and occupied ranges. Best discrimination between extirpated and occupied ranges, using discriminant function analysis (DFA), was provided by five of these variables: sagebrush area (*Artemisia* spp.); elevation; distance to transmission lines; distance to cellular towers; and land ownership. A DFA model containing these five variables correctly classified >80% of sage-grouse historical locations to extirpated and occupied ranges. We used this model to estimate the similarity between areas of occupied range with areas where extirpation has occurred. Areas currently occupied by sage-grouse,

but with high similarity to extirpated range, may not support persistent populations. Model estimates showed that areas of highest similarity were concentrated in the smallest, disjunct portions of occupied range and along range peripheries. Large areas in the eastern portion of occupied range also had high similarity with extirpated range. By contrast, areas of lowest similarity with extirpated range were concentrated in the largest, most contiguous portions of occupied range that dominate Oregon, Idaho, Nevada, and western Wyoming. Our results have direct relevance to conservation planning. We describe how results can be used to identify strongholds and spatial priorities for effective landscape management of sage-grouse.

Key Words: *Centrocercus minimus*, *Centrocercus urophasianus*, extirpated range, extirpation, Greater Sage-Grouse, Gunnison Sage-Grouse, range contraction, sagebrush.

Factores Asociados a la Extirpación del Sage-Grouse

Resumen. Las distribuciones geográficas del Greater Sage-Grouse (*Centrocercus urophasianus*) y el Gunnison Sage-Grouse (*C. minimus*) se han

Wisdom, M. J., C. W. Meinke, S. T. Knick, and M. A. Schroeder. 2011. Factors associated with extirpation of Sage-Grouse. Pp. 451–472 in S. T. Knick and J. W. Connelly (editors). Greater Sage-Grouse: ecology and conservation of a landscape species and its habitats. Studies in Avian Biology (vol. 38), University of California Press, Berkeley, CA.

RESULTS

Differences Between Extirpated and Occupied Ranges

Fifteen of the 22 environmental variables had mean values with nonoverlapping 95% CIs between extirpated and occupied ranges (Figs. 18.2–18.4). These variables included five biotic, three abiotic, and seven anthropogenic variables.

The five significant biotic variables were sagebrush area, patch size of sagebrush, proximity of sagebrush patches, size of sagebrush core areas, and distance to the boundary between occupied and extirpated ranges. Historical locations in occupied range contained almost twice as much area in sage-

brush as those in extirpated range (Fig. 18.2). Mean patch size of sagebrush was >9 times larger, and mean core area >11 times larger, in occupied versus extirpated range (Fig. 18.2). Sagebrush patches also were substantially closer to one another in occupied range (Fig. 18.2). In addition, historical locations in occupied range were closer to the boundary between occupied and extirpated ranges than locations in extirpated range (Fig. 18.2).

The three significant abiotic variables were elevation, soil water capacity, and soil salinity. Elevation was almost 50% higher in occupied range than in extirpated range (Fig. 18.3). Occupied range had lower soil water capacity and higher soil salinity (Fig. 18.3).

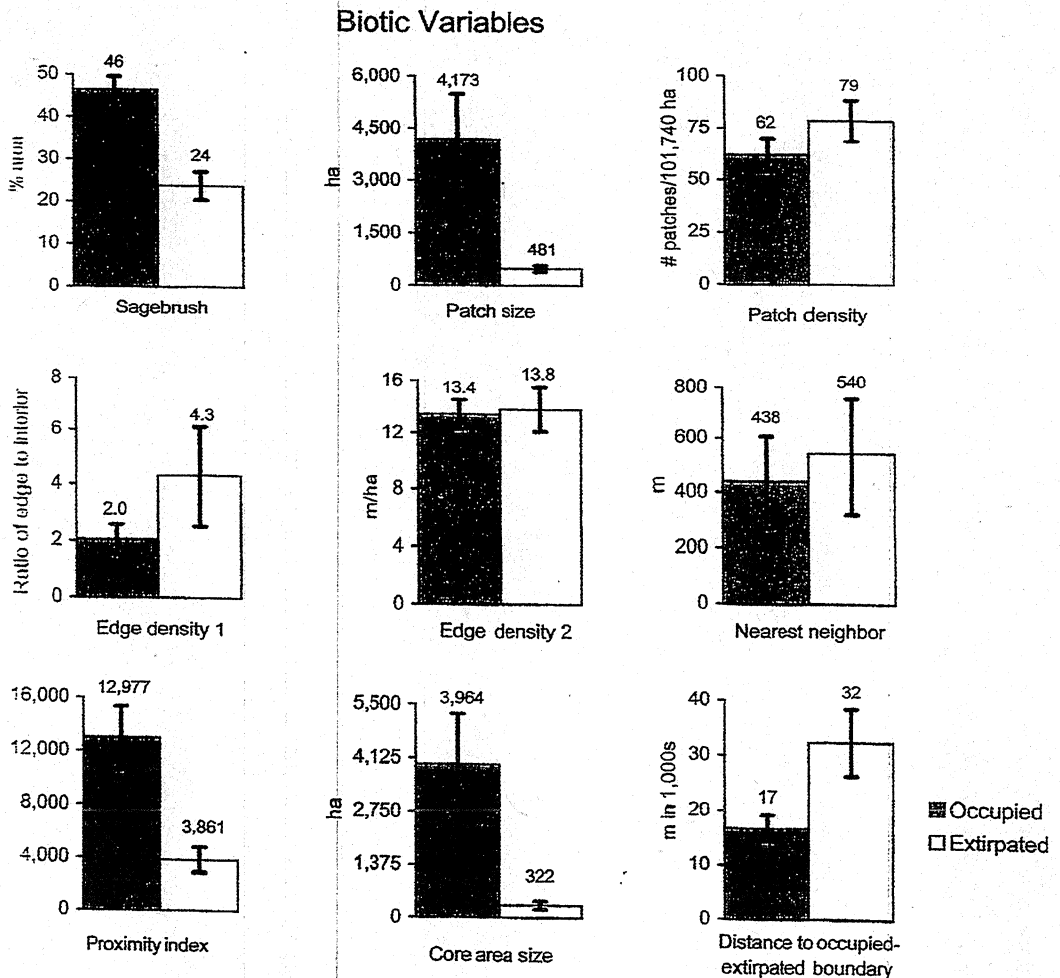


Figure 18.2. Mean values and 95% confidence intervals for nine biotic variables associated with 239 historical locations in occupied range and 136 historical locations in extirpated range for sage-grouse.

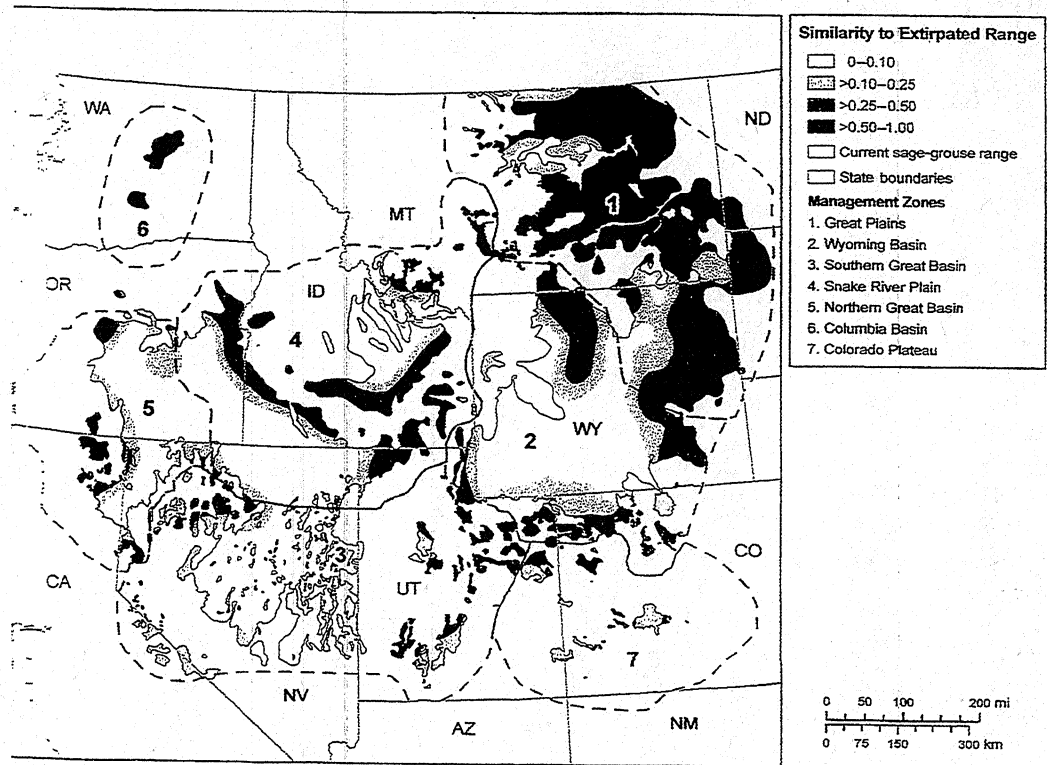


Figure 18.5. Probabilities of environmental similarity of areas currently occupied by sage-grouse with areas where extirpation has occurred, based on estimates from model 2 discriminant function analysis. Probabilities range from 0.0-1.0 and are mapped as a continuous variable. Areas in black show high similarity with extirpated range. Areas in light grey show low similarity.

classes (37%), followed by Colorado Plateau at 10% (Table 18.4). SMZs with lowest similarity to extirpated range were Northern Great Basin, Southern Great Basin, Snake River Plain, and Wyoming Basin. The large majority of occupied range in these four SMZs had probabilities of similarity of ≤ 0.10 . All four, however, had high similarity with extirpated range along range peripheries or in smaller, disjunct areas (Fig. 18.5).

DISCUSSION

Factors Associated with Extirpation

Biotic Variables

Sage-grouse occupation versus extirpation was strongly associated with measures of sagebrush abundance and distribution, including sagebrush area, patch size, proximity of patches, and size of core areas. These results support past studies that identified sage-grouse as a sagebrush obligate,

dependent on sagebrush for persistence (Braun et al. 1976, Schroeder et al. 1999, Rowland 2004).

Sagebrush area was the single best discriminator between occupied and extirpated ranges among the 22 variables evaluated. The DFA model containing this single variable was one of the top-performing models. These results agree with recent findings that sagebrush area is one of the best landscape predictors of sage-grouse persistence (Wisdom et al. 2002c; Walker et al. 2007a, Doherty et al. 2008, Aldridge et al. 2008).

The upper 95% CI for sagebrush area in extirpated range was 27%. Landscapes occupied by sage-grouse with sagebrush <27% would thus have a >97.5% probability of being no different than a random sample of extirpated ranges, suggesting that associated populations in these occupied ranges could be more vulnerable to extirpation. Similarly, the lower 95% CI for sagebrush area in occupied range was 50%. Landscapes occupied by sage-grouse with values above this lower bound thus have a >97.5% probability of being no different than a

random sample of occupied ranges, suggesting a higher capability to support persistent populations.

Recent landscape studies of Greater Sage-Grouse identified similar threshold values for sagebrush area to maintain population persistence. Aldridge et al. (2008:990), using a 30.77-km radius around sampling locations, estimated that at least 25% and preferably 65% of the landscape needed to be dominated by sagebrush for long-term sage-grouse persistence. These estimates mirror our values of 27% and 50% for sagebrush area, with values <27% indicating a high risk of extirpation, and values above 50% indicating a high probability of persistence. Our estimates also are for large landscapes, based on the 18-km radius circles that we analyzed. Similarly, Walker et al. (2007a) estimated that the lowest probability of lek persistence, approximately 40–50%, occurred for landscapes with <30% area in sagebrush within 6.4 km of a lek center. These probabilities declined even more for landscapes with <30% sagebrush that were subjected to energy development (see fig. 5 in Walker et al. 2007a).

Abiotic Variables

Three abiotic variables—elevation, soil salinity, and soil water capacity—also differed between occupied and extirpated ranges. Elevation was a good discriminator, probably because most sagebrush loss has occurred disproportionately at lower elevations where human activities and developments have been concentrated (Hann et al. 1997; Knick et al., this volume, chapter 12; Leu and Hanser, this volume, chapter 13), and where invasive grasses have displaced large areas of sagebrush (Suring et al. 2005b, Meinke et al. 2009). Lower soil salinity and higher soil water capacity in extirpated range also indicate a higher suitability for agricultural development (Knick, this volume, chapter 1), which also was associated with sage-grouse extirpation.

Anthropogenic Variables

Seven of the eight anthropogenic variables differed between occupied and extirpated ranges. The number of these variables, their diversity, and the strength of differences between occupied and extirpated ranges suggest that a variety of human activities and land uses have contributed to or been associated with sage-grouse extirpation. This inference agrees with findings from recent landscape studies that documented negative effects of anthropogenic

variables on sage-grouse populations, including human density and percent agriculture (Aldridge et al. 2008), roads and traffic (Lyon and Anderson 2003, Holloran 2005), and energy development (Holloran 2005; Aldridge et al. 2007; Walker et al. 2007a; Doherty et al. 2008; Naugle et al., this volume, chapter 20). We did not specifically evaluate energy development. However, extirpated range contained almost 27 times the human density, had almost three times more area in agriculture, was 60% closer to highways, and had 25% higher density of roads, in contrast to occupied range. These patterns agree with research cited above that evaluated these or similar variables. Moreover, the four variables of human density, area in agriculture, distance to highways, and road density were part of model 4, which outperformed all models except the top-ranked model 2.

Three additional anthropogenic variables—distance to transmission lines, distance to cellular towers, and landownership—also differed between occupied and extirpated ranges. These variables were the best discriminators among the eight anthropogenic variables considered and ranked among the best of all individual variables. These variables have received little attention in landscape research on sage-grouse—only distance to transmission lines has been formally evaluated (Connelly et al. 2000a, Aldridge and Boyce 2007, Walker et al. 2007a). Transmission lines can cause sage-grouse mortality via bird collisions with lines (Beck et al. 2006, Aldridge and Boyce 2007) and facilitate raptor predation of sage-grouse (Connelly et al. 2000a). In addition, the electromagnetic radiation emitted from transmission lines has a variety of negative effects on other bird species using areas on or near lines (Ferne and Reynolds 2005). Moreover, transmission lines convert habitat to nonhabitat and fragment the remaining habitat, similar to roads (Naugle et al., this volume, chapter 20).

The strong association between distance to cellular towers and sage-grouse extirpation was an especially intriguing result, given that no previous studies of sage-grouse have evaluated this variable. Whether cellular towers function in a cause-effect manner or simply are aligned with other detrimental factors cannot be addressed without additional research. Recent studies, however, suggest possible cause-effect relationships between high levels of electromagnetic radiation within 500 m of cellular towers and reduced population or reproductive performance of a limited

**Appendix B for the Objection against the Forest-wide
Prescribed Fire Restoration Project by NEC, AWR and Y2U on
November 13, 2023.**

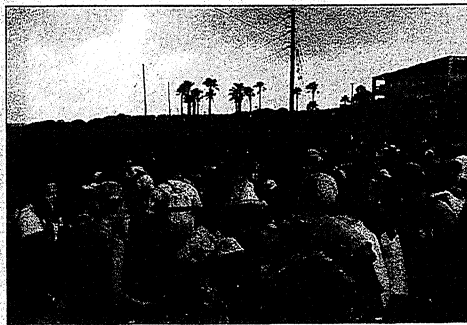
Appendix B contains 4 pages of various recent news articles reporting on the ongoing impacts of climate change.

Europe: The demise of the summer beach holiday

Raging wildfires put a terrifying end to my family's Greek vacation last week, said James Palmer in *The Times* (U.K.). We were on the island of Corfu when my 11-year-old son first saw the smoke—"a narrow plume of white and gray billowing up from the forests." We knew that out-of-control fires were consuming the arid island of Rhodes but had felt relatively safe on cooler, verdant Corfu. Within hours, though, "the smoke had become a line of orange flame gilding the horizon," and our family was among the nearly 2,500 people forced to flee.

Another 20,000 people, half of them British vacationers, were evacuated from Rhodes—the largest emergency rescue in Greek history. So much for a relaxing holiday. "As I write this, planes and helicopters buzz overhead toward the smoking hills, dumping seawater into the forests."

It's not just Greece: Extreme heat and fires are likely to destroy summer vacation as we know it all across southern Europe, said Judith A. Sägerser in the *Stuttgarter Zeitung* (Germany). Last week, German Health Minister Karl Lauterbach concluded as much from his "overheated vacation in Italy," where July temperatures were well over 100 degrees. "If things continue like this, these holiday destinations will have no future," Lauterbach said. "Climate change is destroying southern Europe." Nobody wants to hear that, of course—not the pale German hordes who flock southward each summer and certainly not the Mediterranean countries whose economies depend on them. But Lauterbach "hit the nail on the head." The news all summer



Fleeing the flames in Rhodes

has been full of stories of tourists being airlifted off Italian beaches or rushed by ambulance to Greek hospitals. That's nobody's idea of a restful vacation.

With Spain, Italy, and Greece becoming unbearably hot, where else can Europeans go? asked *Savon Sanomat* (Finland) in an editorial. Try Finland. Sure, our summer "is notoriously short and sometimes rainy," but at least we have few wildfires. Rather than heading south each summer, Europeans should look to the north. In fact, that's already

happening, said Greta Ilekyte in *Lietuvos rytas* (Lithuania). The European Travel Commission says that the number of people traveling to the Mediterranean this summer has dropped 10 percent over last year, while visits to central and northern Europe are up. Maybe Lithuania, where temperatures barely scrape the mid-70s in July and August, will start to look like "an increasingly attractive destination."

A better solution is to forgo this yearly migration altogether, said Igor Danis in *Pravda* (Slovakia). "Mass travel has become a pointless fad," something we do not for fun but for Instagram. And all those airplane trips generate ever more of the carbon emissions that are heating the climate. Every European country has its share of charming getaway spots—why not vacation at home, rather than battling for space on overcrowded beaches that "resemble swarming anthills"? The fires that torched the Greek islands this summer should be "a warning to all of humanity. It's time to hit the brakes, people!"

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Is the Gulf Stream about to stop flowing?

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believed such a catastrophe was a long way off, reports *The New York Times*. But a new University of Copenhagen study, based on sea surface temperatures dating back to 1870, suggests that the system is already critically unstable and could stall out anytime between now and the 2090s. That could have massive consequences, sending North American and European temperatures plunging, further heating the tropics, and disrupting the monsoon rains that billions of people depend on for food in Asia, Africa, and South America. Not all scientists agree that the data indicate such a dire timeline. But "it is very plau-



A photo illustration of the Gulf Stream

sible that we've fallen off a cliff already and don't know it," says marine scientist Hali Kilbourne, who wasn't involved in the study. "By the time any of this is settled science, it's way too late to act."

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Trying to cool off in a Lahore canal

Will Pakistan become unlivable?

Heat waves can already have fatal consequences for vulnerable people, but as temperatures rise, some world cities will become so hot by the middle of the century that even the young and healthy could start dying of heatstroke or kidney failure. That's the conclusion of a new study that estimated how many days a year heat and humidity will be so intense that the human body can no longer cool itself. Only brief stretches of such extreme conditions are expected in the U.S.: about one day a year in Chicago, for example. But Lahore, Pakistan, is likely to pass that threshold for nine to 15 days a year, even under the most conservative warming scenario. Under the worst scenario, those conditions would last for months. "It's when you see these accumulations of weeks or months of this at a time that things become too hot for humans," lead author Daniel Vecellio, from George Mason University, tells *The Washington Post*. The Red Sea port of Al Hudayrah, Yemen, will be even worse off, with deadly heat for a month or two under the best scenario and nearly all year long under the worst. Cities in India, Vietnam, Saudi Arabia, and Iran are also at risk.

Beijing

Deadly flooding: At least 21 people were killed in Beijing this week when Typhoon Doksuri dumped months' worth of rain in just four days, causing landslides and floods that swept away homes and cars. A million people were evacuated from the megacity's western outskirts and neighboring Hebei province, which saw a record 29 inches of rainfall and the worst of the flooding. Military crews were sent to rescue hundreds of people who were trapped in apartment buildings as water filled the lower floors—reaching as high as 13 feet. At the height of the storm, hundreds of train passengers were stranded on waterlogged tracks for 30 hours. "Supplies cannot come in. People are hungry," one traveler told state television.



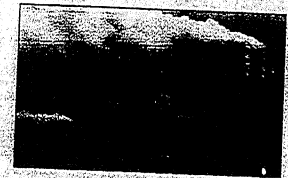
Acres under water

The Week 10/20/23

Noted

■ Global temperatures hit a record high for the third month in a row in September, shattering the previous heat record for that month by 0.9 degrees Fahrenheit—the largest monthly jump ever observed. September's relative heat was "absolutely gobsmackingly bananas," said climate scientist Zeke Hausfather. *The Guardian*

USA Today



■ Carbon dioxide emissions reached a record high of 36.8 gigatons last year. The rebound of air travel and driving from a pandemic lull and a growth in coal-fueled power plants helped drive a 1 percent increase over 2021, but a boom in renewable energy and electric vehicles largely offset the greater use of fossil fuels. *CNBC.com*

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Book of the week

The Heat Will Kill You First: Life and Death on a Scorched Planet

by Jeff Goodell (Little, Brown, \$29)

"More than any other effect of climate change, heat destroys life with an excruciating immediacy," said Peter Holley in *Texas Monthly*. In his best-selling new book, climate journalist Jeff Goodell delivers "a bracing examination of climate change in its most essential form," showing how the planet's rising temperature is unleashing spells of deadly extreme heat and reminding us how vulnerable we are to temperatures like those that have gripped much of the southernmost U.S. in the past week.

"Goodell is at his most effective when he describes how heat affects the human body," said Shannon Osaka in *The Washington Post*. He recounts in detail how a California couple and their 1-year-old all died on a trail in 2021 when a morning hike ended less than 2 miles from safety during a sunbaked climb back to their truck through 100-degree heat. Like the



A traffic warden braves last week's heat wave.

15,000 people who perished in Paris during a 2003 heat wave or the 600 killed in British Columbia in 2021 by a fluke weeklong temperature spike, the California family were victims of the body's surprising vulnerability to internal temperatures above 98.6 degrees. When those internal temperatures hit 102 or 103, a victim can pass out, as the body's attempt to cool off sends blood to the skin, abandoning internal organs, including the brain. Above 107 degrees, "things start to break down at

a cellular level." Cell membranes melt away, unleashing systemic hemorrhaging and fatal heatstroke.

Predictably, the old, sick, and poor are more vulnerable to extreme heat, said Jennifer Szalai in *The New York Times*. But "people who have faith that their resources will spare them are kidding themselves." Heat imperils food supplies because of the hazards it poses to plant and animal life. It also causes forest fires and rising sea levels, and contributes to many deadly storms. And when regions like British Columbia can be hit with triple-digit temperatures, few places on the planet are invulnerable to heat waves and failures of the electric grid that can result in widespread death. *The Heat Will Kill You First* covers all those threats as it surveys much of the planet, and "Goodell's stripped-down style suits his subject. This is a propulsive book, one to be raced through." As it strings together troubling scenes and links the crisis to the burning of fossil fuels, it packs in enough data to terrify "even the most casual reader," said Bethanne Patrick in the *Los Angeles Times*. It reads like "a wake-up call with no snooze button."

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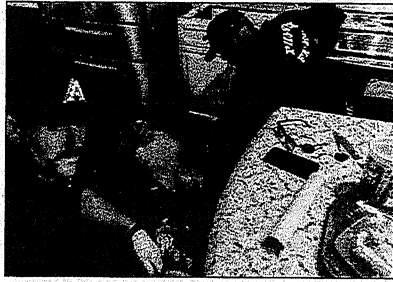
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Talking points

Global boiling: An ominous warning

The era of global warming is over, said Madison Pauly in *Mother Jones*. We're now in the age of "global boiling." That's the term United Nations Secretary-General António Guterres used last week after scientists reported that July was likely the world's hottest month on record, at least 0.4 degrees Fahrenheit above July 2019, the previous warmest. The signs of global boiling are everywhere: wildfires raging in Canada and around the Mediterranean, water temperatures hitting 101 degrees off Florida. This human-caused climate chaos, Guterres warned, is "just the beginning." Perhaps the future will look like Phoenix, said Jack Healy in *The New York Times*. The city has endured a "month in hell"—31 days exceeding 110 degrees. Residents have been hospitalized with burns after falling "on pavement that can heat up to 180 degrees" and the city has deployed "trailer-size coolers to store bodies." Phoenix has reported 25 heat-related deaths this year; another 249 are under investigation.



Treating a heat stroke patient in Phoenix.

can also "exacerbate underlying medical conditions by straining the heart, lungs, and kidneys"; impair sleep; and "worsen depression, anxiety, and suicide rates." Then there's the economic toll, said Coral Davenport in *The New York Times*. In Southern California, Amazon drivers and warehouse workers have gone on strike in part to protest working conditions that can top 100 degrees; in Michigan, "construction crews are working shortened days because of heat." One study found that loss of labor due to heat exposure cost the economy \$100 billion in 2020. That figure is predicted to hit \$500 billion annually by 2050.

The basic rhythms of human behavior are being reordered as the mercury rises, said Scott Simon in *NPR.com*. In Italy, the health ministry has "cautioned people not to walk outside, and to avoid wine and coffee." In normally mild Washington, a growing number of residents are seeking air-conditioned shelter. Summer should be blissful: "School is out. Vacations are planned. We can go coatless, feel carefree." But it's becoming a "season to fear," with festivals, outdoor concerts, and sporting events canceled "because of unsafe heat, and wildfire smoke in the skies." Soon, people may spend July and August longing for January.

Extreme heat "threatens virtually every aspect of human health," said Dr. Leana Wen in *The Washington Post*. Heat stroke, which occurs when ambient temperatures are so high that the body can't cool down, can cause organ failure within minutes. Research shows that high temperatures

Moapa Valley, Nev.

Scorched to death: Two hikers died of suspected heat exhaustion last week at Nevada's Valley of Fire State Park, the latest in a rash of heat-related deaths during a historically sweltering summer. Officials said

Valley of Fire: Hit 118 degrees

Jessica Rhodes, 34, and Diana Matienzo Rivera, 29, had been walking a 4.6-mile trail and ran out of water as temperatures hit 118 degrees. Days earlier at Death Valley National Park, Calif.—about 180 miles west—a 71-year-old hiker died of apparent heat-related causes as temperatures hovered around 120 degrees. At least five people are thought to have died from heat-related causes in national parks since June 1, a higher toll than is typically recorded in an entire year. In the Phoenix area, dozens of people have been hospitalized for burns after falling on sizzling sidewalks. "It only takes a few seconds for you to get a third-degree burn," emergency room doctor Frank LoVecchio said.

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Noted

■ During July, the hottest month on record, global temperatures for the first time blew past a key temperature threshold, rising between 2.7 and 2.9 degrees Fahrenheit (1.5 degrees Celsius) above preindustrial levels. "It's just shocking just how big an excursion this is from anything we've seen before," said climate scientist Zeke Hausfather. *The Washington Post*

The Week 8/11/23

The bottom line

■ In 1980, losses from three U.S. natural disasters—a drought, a flood, and a hurricane—topped \$1 billion each (in 2023 dollars). Last year, there were 18 events across the country that caused \$1 billion or more in damage, including Hurricane Ian, which was responsible for \$114 billion in damage. *Bloomberg*

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■ Phoenix, which recently had a record-breaking 31 consecutive days of temperatures at or above 110 degrees Fahrenheit, is the country's fastest-growing metropolitan area. *The Atlantic*

The Week
8/11/23

■ From June 22 to July 22 nearly 5,000 records for heat and rainfall were broken or tied in the U.S. More than 10,000 records were set globally. *Associated Press*

8/11/23

URUGUAY

Can farmers survive the hot new normal?

Juan Martín Posadas
El País

Even winter has brought South America no relief from global warming, said Juan Martín Posadas. For months, Uruguay has been suffering under a drought like a "biblical punishment." By May, the Paso Severino reservoir, which serves Montevideo's 2 million people, was parched and cracked, "looking like a scene from the Apocalypse," and the water utility was forced to draw from the brackish River Plate. The foul-tasting water in the taps ran brown, and officials warned pregnant women not to drink it. Now, in what should be our coldest month—August down here is like February in the U.S.—temperatures in northwestern Uruguay

hover above 80 degrees, thanks to an extreme heat dome baking South America. In neighboring Argentina they've surpassed 90, while one Chilean town high in the Andes topped 100. These extremes have hit farmers the hardest. Many "lost everything" this harvest season as more than \$1 billion worth of crops dried to dust. If this is the new normal, city dwellers will be fine: We're already building desalinization plants to make river water potable. But in the countryside, "every aspect of life will be disrupted." Farmers will need new livestock breeds, new feeds, new crop varieties. We're in for a "colossal upheaval."