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February 14, 2022

To: Objection Reviewing Officer, U.S. Forest Service, Intermountain Regional Office, 324 25th Street, Ogden, Utah 84401

RE: OBJECTION AGAINST THE CARIBOU PRESCRIBED FIRE RESTORATION PROJECT

1. Objectors Names, Addresses, Telephone Numbers

Lead Objector Sara Johnson, Director, Native Ecosystems Council, [redacted].

Mike Garrity, Director, Alliance for the Wild Rockies, [redacted]

Jason Christensen, Director, Yellowstone to Uintas Connection, [redacted]

Katie Fite, Director, Wildlands Defense, [redacted]

Signed for Objectors this 14th day of February, 2022

Sara Johnson

Sara Johnson

2. Name of the Project, Name and Title of the Responsible Official, National Forest/Ranger District

Caribou Prescribed Fire Restoration Project

Caribou-Targhee National Forest

Responsible Official Melvin Bolling, Forest Supervisor, Caribou-Targhee National Forest

3. Attachments

This Objection includes 2 attachments. Appendix A is a Declaration signed by Dr. Sara Johnson addressing how the project failed to provide a reasonable analysis of project impacts on wildlife, including sensitive wildlife species, and species identified as "at risk" by the Caribou Zone. Appendix B includes some additional references and/or reports not previously provided.

4. Statement Demonstrating Connection between Prior Specific Written Comments on this Project and the Content of the Objection

Objectors have provided extensive written comments on the proposed Caribou Zone burning proposal. On November 26, 2020, Objectors submitted 19 pages of scoping comments on the proposal, along with hard copies of 29 of published literature and/or reports cited in these comments. On September 28, 2021, these same objectors submitted 10 pages of comments on the Preliminary Environmental Assessment (PEA) that was released for public comment. In order to avoid repetition, these PEA comments "incorporated by reference" the extensive scoping comments already submitted on this proposal.

We were not able to find any discussion by the Forest Service of either our scoping or PEA comments, except for a mention of the long fire return intervals known for juniper. However, there was no mention as to whether this information we provided affected the proposed burning program. As such, we are carrying forward into this objection all the concerns and issued we have previously raised. In brief, these include that a programmatic EA is a violation of the NEPA; there was no analysis of wildlife impacts that would result from this massive project; there was no population data provided to support claims of no significant reductions of wildlife populations; there was no information on the current location of wildlife in the project area; there was no documentation provided as to why habitat alterations created by slashing and burning is needed by forest, woodland and shrubland wildlife; there was no information provided on current occupied habitat by wildlife in the project area; there was no documentation provided to support the claim that removing wildlife habitat via slashing and burning represents habitat restoration, when habitat is actually being removed; the RFP needs to be amended so that a thorough analysis of potential impacts to wildlife and other resources can be provided to the public, who can have an opportunity to comment on this new programmatic RFP direction which will require massive reductions in wildlife habitat; the agency has not documented that the planned burning of big game winter ranges will improve and/or maintain this habitat, as is required by the RFP; the severe adverse impacts to migratory birds, including killing of nestlings, is a violation of the Migratory Bird Treaty Act (MBTA) because these impacts were not disclosed by the agency; the agency falsely claims that burning and conifer removal is needed to provide for aspen regeneration, when the likely cause of the problem is livestock grazing; loss of aspen stand viability will be exacerbated by the burning proposal because newly sprouted aspen saplings will be destroyed by livestock browsing; the agency is violating the requirements of the Roadless Area Conservation Rule by implementing adverse actions within 22 IRAs on the Caribou Zone and recommended wilderness areas that will create severe impacts on the roadless qualities without completing an adequate environmental analysis with an EIA; and the agency failed to demonstrate that the RFP direction for old growth will be met with the proposed program.

Since we provided comments for scoping and the PEA, we have obtained additional information that was not available when these comments were provided. This information includes a number of assessment reports that were only recently added to the web page a week before the Objection was due. This new information has been included in various portions of our objection, except for the analysis information on the threatened Canada lynx. This information, as provided in the project's Biological Assessment, was not provided to objectors in spite of a request for such (documentation provided in attached references in Appendix B of this Objection.

5. Remedy

Objectors request that this programmatic proposal be dropped, as it is a violation of the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEP), the Administrative Procedures Act (APA), the Endangered Species Act (ESA), and the Roadless Area Conservation Rule. In addition to these various legal and administrative violations, the Caribou Zone of the Forest Service needs to amend the RFP to address the massive change in fuels management activities being proposed, as this is far outside the existing direction and analysis in the RFP and associated FEIS.

6. Manner in which the Proposed Action will Violate Existing Law , Regulation or Policy.

A. The Forest Service is violating the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA), the Administrative Procedures Act (APA), the Migratory Bird Treaty Act (MBTA), the Endangered Species Act (ESA), the Roadless Area Conservation Rule

(Roadless Rule) and the Bald and Golden Eagle Protection Act due to the planning and proposed implementation of the Caribou Prescribed Fire Restoration Project on the Caribou-Targhee National Forest.

1. The agency refused to provide analysis information to the public on how the proposed project would impact lynx and lynx habitat in the Project Area.

Sara Johnson, Director of Native Ecosystems Council., requested a copy of the projects Biological Assessment to determine what the summary of project impacts on the threatened Canada lynx (hereafter "lynx") were derived. This request was denied, with the agency stating that the reason for not releasing the BA at this time is because changes could still be requested during the consultation process; when this is completed a final BA will be made available to the public. Of course, this will be after the public involvement process. Currently, the only information provided to the public on the projects' effects on lynx is a summary of these effects in the EA pages 13-14. This summary makes a claim that this species would benefit from burning of lynx habitat. The basis for this claim is not provided to the public, even though 132,334 forested acres would be treated with this project, with 30-50% of treatment areas being burned (Existing Condition Assessment Non-Forested and Woodland Vegetation Types at 2). This could include up to 3,000 forested acres in the project area burned annually, provided there would be an even distribution of the targeted 6,000 acres per year of treatment between forest and nonforest vegetation (Vegetation Effects Analysis at 2). It is unclear why the loss of lynx prey species in burned areas, as well as the fragmentation of lynx travel cover, would benefit this species. The BA needs to be provided to the public during public involvement opportunities so that they can understand how agency conclusions were derived.

2. The agency provided different conclusions regarding how many acres of the forest needed restoration with fire.

The initial scoping proposal for the project, released for public comment on 7/27/20, identified 719,000 acres of the forest that needed to be restored with fire. In the draft EA, the agency identified 223,535 acres that need to be restored with fire. However, Table 1 of the EA identifies 266,039 acres that need to be restored with fire. All these numbers indicate that the targeted treatment acres are simply arbitrary decisions being made by the agency based on factors other than vegetation conditions.

3. The scoping documents and preliminary EA were released before the agency had done any analysis to determine acres that needed restoration.

The s coping document was released on 7/27/20, and the preliminary EA was released in August of 2021. Yet the project assessments that were developed to determine treatment targets were not completed until after these public involvement requests were made. The Existing Condition Assessment Non-Forested & Woodland Vegetation Types notes that the purpose of the assessment was to determine opportunities created by the gap between existing and desired future conditions. Yet the Existing Condition Assessment Non-Forested and Woodland Vegetation Types was completed on August 6, 2021. The Idaho Roadless Rule Briefing Paper was completed on April 12, 2021. The Evaluating Project Activity Effects on Roadless Characteristics and Attributes was finalized on May 5, 2021. Evaluating Project Activity Effects on Wilderness Character was finalized on May 12, 2021. The Fire and Fuels Effects Analysis was completed on April 30, 2021. The Vegetation Effects Analysis was completed on June 1, 2021.

It appears that the agency determined how many acres would be targeted for treatment, and then developed documents that would support these treatments. This is consistent with the reduction of planned treatments on 719,000 acres to 266,038 treatments, and yet down to 223,000 acres.

4. The agency has provided a false rationale to the public that burning is needed to restore proper ecological function, when in fact, burning is simply a fuels reduction program with unevaluated impacts on wildlife.

The references to a need to slash/burn forest and non-forested areas on 223,000 acres of the Caribou Zone to restore or improve "ecological function of ecosystems" are provided throughout the NEPA documents (e.g., scoping notice at 1, EA at 2,4, 7, 12, 18, draft Decision Notice at 29, Fire and Fuels Assessment Report 3, 4, 5). **However, the Existing Condition Assessment Non-forested & Woodland Vegetation Types states at page 4 and 6 that the Revised Forest Plan Desired Future Conditions (DFC) upon which treatment targets were based were set because they represent a safe and sustainable condition where the Forest can provide all the goods and services identified during the Forest Planning process (wildlife habitat, water, recreation opportunities, etc.).** The DFCs which are the basis for the proposed treatments are actually fuels reduction goals. This is why there is not a single reference in the RFP to the wildlife objectives for DFCs.

It is clear that the proposed Caribou Zone burning proposal is simply a fuels reduction program which due to the massive impacts this program will have on wildlife and plant resources, requires some type of cover (i.e, ecological restoration is needed). However, the actual intent of the proposal comes through in various areas of the agency's EA, such as where the EA at 7 states that the agency needs to increase the pace of burning activities; as is noted in the EA at 29, without such increases, the fuels on the Caribou Zone will continue to increase which will make fires bigger and more difficult to control. The EA at 11 states that the process of succession will contribute to larger and more intense wildfires; the understories will develop and increase forest floor fuels.

5. The proposed burning program on the Caribou Zone is just a continuation of the agency's long-standing penchant and desire to burn sagebrush habitats to increase forage for private livestock, which is inconsistent with the agency claims referenced in #4 above that burning in needed for ecological restoration.

As per the Existing Condition Assessment Non-Forested & Woodland Vegetation Types at page 2, there are 84,794 acres of non-forested vegetation included in treatment blocks. This would be sagebrush and sagebrush/mountain brush communities. This report states that the RFP identifies an DFC for sagebrush with 40% of these communities having a canopy cover of 15% as in the HRV. It is noted that there is a shortage of sagebrush with a canopy cover below 15%, and too much sagebrush with a canopy cover over 15%. As is noted in a table on page 4 of this report, the RFP DFC is to have from 50-70% of the sagebrush with a canopy cover below 15%**. A canopy cover below 15% actually means that sagebrush stands have no canopy due to burning; burning does not thin sagebrush, it kills it; that is why the agency states that sagebrush will be burned in a "mosaic."** So the proposed sagebrush burning program is being justified by the RFP DFC. Meeting the RFP DFC would direct the burning of 84,794 acres of sagebrush/mountain brush habitats in the project area. This means that half of these acres of sagebrush/mountain brush will be destroyed with fire, since sagebrush burning involves patch burning, not thinning. There is no analysis in the EA or associated documents as to how this large-scale sagebrush burning program would impact birds, including migratory birds. In fact, **the Existing Condition Assessment report at 5 notes that managing landbird populations is not the purpose and need for this burning project.**

As per the Existing Condition Assessment the RFP requires that 30-50% of watersheds be comprised of sagebrush blocks of at least 320 acres in size. This report notes that this requirement can easily be met with the proposed burning as there are 130,000 acres of these large sagebrush blocks in the 17 watersheds that overlap the proposed burning blocks. So apparently the agency goal will be to reduce these sagebrush blocks down to the minimum, possibly 30%. Meeting this RFP standard is apparently the only restriction on sagebrush burning in the project area, as there are no standards for wildlife, except the sage grouse. It is noteworthy that in the above report, there is no analysis provided as to how the Greater Sage-Grouse Amendment to the RFP will be met with burning and fragmenting 84,794 acres of sagebrush. Also, there is no analysis as to how burning in 84,794 acres of sagebrush will create ecological restoration of this habitat and associated wildlife, including migratory birds. So agency conclusions that wildlife will not be significantly adversely impacted by this sagebrush burning program are not supported with any actual analysis. Wildlife impacts are claimed to be minimal due to "mosaic" burning. With up to half of sagebrush/mountain brush habitats burned in a treatment unit, the agency does not define why losing half of this localized habitat, as well as the extensive fragmentation that will result from mosaic burning, will have no significant adverse impact on landbirds. The claimed benefits to wildlife are based on an assertion that the fuels reduction program will protect remaining habitats from fire, although no references were ever provided for this claim.

6. The RFP requires, as is stated in the RFP FEIS at 3-101, that impacts to juniper be assessed at the site-specific level for project planning.

It is not clear how the RFP requirement that juniper treatments will be assessed at the site-specific level for project planning is consistent with the Caribou Zone proposal for significant slashing/burning of juniper habitats. This specific requirement for juniper management is noted in the Vegetation Effects Analysis at page 1. However, at present, there is no site-specific analysis of any juniper treatments for the Caribou Zone burning proposal. Juniper woodlands occur on 11,900 acres of the forest (this would be roughly 1% of the Caribou Zone) but on 6,463 acres in the project area. So over half of the juniper on the Caribou Zone can be treated in this proposed burning program (30-50% treatment targets per burn unit). It seems logical that if a site-specific analysis of juniper burning projects is required, this analysis is needed prior to when a decision is implemented. However, there has been no site-specific analysis completed for any types of planned vegetation treatments, including juniper. This RPF direction for juniper is not being met by this proposal as a result.

7. The agency acknowledged that the estimates of fire regimes upon which DFC in the RFP are based do not include some of the current best science.

The Vegetation Effects Analysis at page 8 notes that the RFP DFC for vegetation management is based on fire regimes, which are used to determine what the historical seral stages of vegetation will be. High fire frequencies would create more younger seral stages, while longer fire cycles would create more older vegetation on the landscape. However, determining the "average" amounts of various structural stages, including for sagebrush as well as forests, requires that fire cycles are accurately estimated. The Forest Service has clearly used a limited amount of very outdated science to claim that fire cycles were much higher historically than at present, even though they acknowledged the existence of more current information. For example, at page 18 of this report, the agency acknowledges the public's submission during public involvement opportunities that fire cycles in juniper are very long, up to 400 years as documented by 4 references. Yet there was no change in the proposed treatments of juniper woodlands for the burning project. In addition, all the cited references that the Caribou Zone forests and rangelands have had very high fire frequencies, including extensive understory burning, include references dated 1994 , 1973, 1977, 1997, 1992). These outdated fire references used for the current proposed burning program, which is based on fire regimes to derive DFC, is based largely on the use of the RFP and associated FEIS, finalized in 2003, as the basis for the development of the RFP DFC and hence justification for the proposed burning program.

It is also noteworthy that the agency claims that much of this planning for DFCs in the Scoping Notice at page 3 that the LANDFIRE datasets were used to evaluate vegetation condition class to identify major departures from the pre-settlement or historical fire regimes. This LANDFIRE reference is dated 2014, while the

National Interagency Fuels Fire and Technology Transfer System is dated 2010. Both of these references are up to or over 10 years since the RFP was developed, and could not have been used in the development of RFP DFCs. So it is unclear which information was actually used to define HRV and DFC for this project. If more current information was used, then the RFP DFCs were not actually used for project planning.

8. The agency needs to complete a significant Forest Plan revision to address the massive increase that is planned on prescribed burning, since this increase in far beyond anything that has previously been implemented as per the 2003 RFP.

As is noted in the Vegetation Effects Analysis at page 11, the Caribou Zone has treated about 14,000 acres between 2003 and 2016; this equates to about 1,000 acres per year, including 12,149 total acres of prescribed burning (an average of 868 acres per year). This is about a third of what was predicted in the RFP, or an average of 2,000 acres/year of burning. The proposed action would burn up to 6,000 acres per year, or almost 7 times the past levels, and 3 times the 2003 level identified in the RFP. This huge increase in planned burning, including for sagebrush habitats and continued burning of juniper habitats, needs to be evaluated in the programmatic EIS for a Forest Plan amendment.

9. The timeline for the project greatly exceeds the timeliness requirements of the NEPA, violates the monitoring requirements of the NFMA, and could not meet Forest Plan direction due to revision of Forest Plans.

Although the agency failed to actually identify how long the proposed decision is expected to last, treating an average of 6,000 acres per year on up to 266,039 acres (project EA Table 1) would require 44 years. Project evaluations that exceed 5 years are "stale" as per the NEPA, since these would not include any current best science, Forest monitoring information, or changing status of wildlife, from sensitive to threatened and endangered plants and animal species, for example. A 44-year implementation period would cover roughly 2 NFMA planning periods as well, which means the project would occur outside any new Forest Plan requirements. A 44-year project would also exclude application any of the Forest Plan monitoring information provided during these 44 years. Excepting the project from any Forest Plan monitoring requirements is a violation of the NFMA.

10. The agency does not appear to be concerned about how Forest Plan monitoring will affect implementation of a 44-year prescribed burning program, given that the Caribou Zone appears to be doing almost no monitoring except for the Curlew National Grasslands.

The agency's web page provides one monitoring report for the Caribou Zone, which was dated 2003. We could find no monitoring results on the agency's web page as to how logging and burning of forests, slashing and burning of woodland habitats, including juniper, and how burning of sagebrush has affected wildlife, even though now the Caribou Zone is proposing a massive increase in burning sagebrush, juniper and mountain brush habitats, and those forests where logging would not be allowed or feasible, such as within Inventoried Roadless Areas and recommended wilderness areas. So when the agency claims they will monitor impacts of the new burning program, their failure to do any actual monitoring of past projects on wildlife indicate these new promises are meaningless.

The 2022 monitoring report for the Curlew National Grasslands did include surveys for 73 bird species done by the Bird Conservancy of the Rockies from 2017-2020. These results indicate local declines of 4 bird species associated with sagebrush, including the sage thrasher, greater sage-grouse, green-tailed towhee, and Loggerhead shrike, while populations of the Brewer's sparrow remained relatively stable. The monitoring report did not address how the bird trends were related to 2 ongoing programs to "improve wildlife habitat." There was one juniper treatment noted in the 2022 monitoring report for the Curlew National Grasslands for sage grouse habitat improvement in Sheep Creek, with juniper removal potentially on 1,025 acres. Treatments in the Caribou Zone burning proposal would likely be similar to these past treatments, including removal of junipers with chainsaws and mastication. Bird monitoring in this treatment area was not identified in the monitoring report. Also, the report noted that Russian olive removal had occurred as a wildlife habitat improvement project on 145 acres. It is possible that these habitat removal projects affected bird trends in those locations. For example Russian olive berries are an extremely valuable food resource for many birds, including sharp-tailed grouse, as well as providing nesting sites. And juniper not only provides a key forage resource for birds (juniper berries) but also provide hiding cover from predators and thermal cover in inclement weather, as well as snags for nesting. Removing Russian olive and juniper treatments eliminate important habitat for birds, and would not be classified as improvement by any valid measures.

This monitoring report also failed to make any connection between the claim that sagebrush habitats are "highly departed" from disturbance regimes and the bird monitoring program. For example, are fragmented sagebrush patches more productive for birds, as is the goal for the Caribou Zone burning proposal. As well, no actual information was provided on how a high departure level of sagebrush was determined. As with the Caribou Zone burning proposal, "departed" conditions are claimed to exist when there is not a balance of sagebrush structural stages. What this balance of structural stages should look like has not ever been defined by the agency. There is as yet no description by the agency, as well, as to why changing sagebrush habitats to have a diversity of age classes will benefit wildlife. This claimed need is simply a justification to burn sagebrush, since burned areas where sagebrush is removed supposedly creates structural diversity. This is a disingenuous means of defining habitat diversity, which is based on replacing high quality habitat with habitat of very limited value. The resulting "balance" of structural stages will have a much lower carrying capacity for wildlife. In essence, the agency is claiming that replacing some high quality habitat with low quality habitat increases diversity, and thus benefits wildlife.

The monitoring report for the Curlew National Grasslands is merely a summary of acres treated, without any connection made to how this affected wildlife, so this monitoring program does not comply with the NFMA, which requires agencies to determine how agency actions are affecting wildlife.

11. The agency's failure to monitor effects of management activities on weeds and invasive annuals, or to control noxious weeds and invasive annuals, demonstrates that the claimed control/prevention of expansion of these plants on the 266,039 acres that would be burned over the next 44 years is unlikely to happen; the serious ecological impacts that will be exacerbated by the burning proposal are simply being swept under the rug.

The RFP at 2-5 states that there are 142,000 acres of noxious weeds on the Caribou Zone. This would be roughly 14% of the Caribou Zone. That was in 2003. The current infested acreage on the Caribou Zone was not addressed in the burning project EA. As well, the acreage of these plants in the proposed 266,039 acres to be treated with slashing and/or burning was also not defined in the project EA. The EA claims at page 10 that 28 species of nonnative invasive plant species will be targeted for weed management, and at page 18, that the overall risk of increases of these plants is "expected" to be low. What does this mean? What increased acreage of non-native plants should the public expect from this proposal? The agency's failure to provide a quantitative estimate of increases of non-native plants from the proposed project is concerning, since this information would likely not support claims of non-significant impacts of the project on non-native plants. Given that the agency makes repeated claims that the proposed slashing and burning will "restore" ecosystems, promoting non-native plants as a part of this restoration program is a clear contradiction of this stated purpose.

In order to provide the public with "high quality" information on weed management on the proposed treatment acres, all past weed treatment activities on these acres needs to be summarized, along with effectiveness of these measures. Also, the public needs to be provided a quantitative estimate of how these acres may increase due to burning activities, regardless of control measures. Since control measures seem to be generally limited or ineffective, the overall effectiveness of controlling and/or eradicating new or expanded weed infestations due to the proposed burning program also needs to be defined to the public. If past measures to control/eradicate non-native annuals on these lands have failed, what will happen with this burning program that will be different to increase control/eradication methods, including for cheatgrass.

12. It is not clear where in the NEPA regulations that the Forest Service can implement a programmatic decision, including for up to 44 years, and simply provide the public with annual reports of individual projects as they are completed.

The proposed burning of 266,039 acres over roughly 44 years has been defined to the public only with project sideboards which the agency states they will follow. This is similar to the function of a Forest Plan, which outlines general management direction for areas without providing any site-specific analysis of environmental impacts. Yet the Caribou Zone burning proposal is not a Forest Plan. It is being presented as a programmatic EA. This programmatic EA will extend over 2 or more planning periods. It has no legal requirements for any monitoring. The agency states that they will provide the public with annual summaries of projects that have been completed, or implemented, but there is no NEPA or NFMA procedure for such plans. Nor do these plans provide any public involvement opportunity for the public. Instead, the public is only going to be "informed" of the agency's assessment of ongoing activities. Thus the proposed burning program on the Caribou Zone is a clear violation of the NEPA, because the public is not being provided any on-the-ground information as to how the projects will met all the identified side-boards and RFP direction. Simply listing these side-boards is not the same as showing the public how they are going to be implemented. The public also is not being provided any information as to how mitigation measures will be implemented based on site-specific inventories, including for wildlife, sensitive, threatened and endangered plants, and non-native annuals.

The intention of the agency to evade public involvement is clear, given the size of the proposed activity. First, as noted in the EA, there are 22 different projects planned with this programmatic EA. It would be impossible for the public to review any more than several of the proposed treatment blocks prior to a decision being finalized by the agency. So public review of proposed treatment areas is largely prevented. Second, the public cannot assess the validity of wildlife surveys that the agency claims they will do, because these surveys have not yet been done. And since the wildlife surveys have not yet been done, the claimed mitigation measures that are needed to meet the RFP direction to protect nesting areas have also not been identified and mapped. So the public is being prevented from assessing whether agency mitigation measures on wildlife will be valid and thus effective as per the current best science. This means that the public is being prevented from assessing agency management of sensitive wildlife species, including the great gray owl, boreal owl, flammulated owl, and northern goshawk. We also note that the sideboards identified for the Caribou Zone burning program state that the agency will determine whether wildlife surveys will be needed for site-specific projects (e.g., EA 44). Why wouldn't they be needed? Does this mean that many of the proposed projects will actually not have wildlife surveys completed? And even if surveys will be conducted, it is not clear these will be valid surveys. The work requirements for surveying wildlife and threatened-endangered-sensitive plants for 6,000 acres per year will be tremendous. Yet the EA does not address how these massive surveys requirements will be met by the agency. Will this involve massive increases in personnel to do this work? What if the funding is not adequate to enable valid surveys and post-project monitoring? Does this mean that burning activities will proceed without such? In effect, the public is not being provided any actual assurances that valid surveys will be done for plants and animals, even though such surveys are essential to prevent significant adverse impacts on resources. Since the agency cannot demonstrate these surveys will be done, they also cannot claim that there will be no significant adverse impacts to wildlife due to mitigation measures that will protect nesting sites and locations of sensitive, threatened and endangered plants.

The EA at 38 says that suitable habitats will be surveys at least once prior to burning. How can valid surveys be done just once? The agency already seems to understand that surveys will be marginal at locating sensitive wildlife and plants. The EA at 37 states that during project implementation, personnel will report any active nests and/or dens in order to determine what to do. This is key information that the public needs to have. The public does not know why some areas will not require wildlife surveys.

The draft DN at 29 states that in the past, planning for burning projects has taken decades to accomplish. Given that so few acres were treated in the past in comparison to what is now being planned for the Caribou Zone burning proposal, it is not clear how adequate wildlife and plant surveys can be done.

The agency did not provide a valid rationale as to why such a large programmatic project needs to immediately go forward without the public's ability to review and comment on the agency's environmental analysis and site-specific information. The agency claims (e.g. EA at 7) that the pace and scale of the burning program needs to be increased, or as is noted in the draft DN at5 29, fuels will continue to increase in forested areas, making future fires larger and more difficult to control. However, the assertions that immediate action is needed to prevent massive catastrophic wild fires across the Caribou Zone were never supported with any analysis and current best science, as is required by the NEPA. The agency failed to demonstrate that the proposed fuels reduction activities will significantly prevent wild fires in the proposed treatment areas. The apparent justification for the agency to exclude public involvement in this massive fuels reduction program is that there is a fire emergency on the Caribou Zone that will be fixed by this program. However, the laws/regulations that allow exemptions from the NEPA were never identified by the agency, including for this massive burning proposal.

13. The agency is violating the Roadless Area Conservation Rule and the Wilderness Act by claiming that management intervention is required with large expanses of roadless lands in order to restore ecosystems.

The agency is planning a large majority of the proposed slashing/burning program within Inventoried Roadless Lands (IRAs). This includes forest stands that are currently ineligible and/or unsuitable for logging. 81% of the proposed burning blocks are within 20 IRAs (216,178 acres as per EA at 10). 4,367 acres of proposed burning are in recommended wilderness. Thus the total burning planned for this program (220,367 acres) is 83% in currently unroaded, undisturbed areas of the Caribou Zone. Each burning block will burn the understory or possibly the overstory as well on 30-50% of the units. The agency claims this will "mimic" natural burns, although no references were ever cited to demonstrate how this was determined.

The agency claims that the proposed management intervention in roadless lands is consistent with the Roadless Rule because the cutting of trees is "incidental" to the burning program. Actually, cutting of trees to simply get rid of them is one purpose of the burning program. The agency wants to get rid of these trees. The EA at page 18 refers to getting rid of trees as "noncommercial thinning." In addition, dead trees are being used to create fuels for burning smaller trees, shrubs, and other vegetation. Trees will also be masticated to create fuels for burning. So cutting trees is also needed in order to get burns to burn. In forested vegetation, cutting of trees will occur to reduce fuels and prevent more severe fires. In addition, trees will be burned. This constitutes killing trees in IRAs. This comes to the question as to whether any burning, whether it is trees or other vegetation, is actually allowed in IRAs and consistent of maintaining natural, unmanaged landscapes. This can only be done if the agency can demonstrate that this burning is needed to achieve ecological restoration. Although this claim was repeated many times in the EA and associated reports, the reason that fires will restore undefined ecological conditions in IRAs was never identified (see attached Declaration by Dr. Sara Johnson). The Roadless Rule can not simply be dismissed with the use of unsupported rhetoric. This allows the rule to be essentially meaningless.

In addition to the agency's claim that tree cutting is incidental to burning, and thus allowed by the Roadless Rule, and that burning will restore ecosystems in

IRAs, the agency somehow dismisses the requirement of IRAs and proposed wilderness areas to be "untrammeled" and natural in appearance. The massive impacts that will be required in IRAs and proposed wilderness areas will reduce the appearance of these areas for many years after projects are completed, while creating massive disturbances during project implementation, which may be repeated over many years. The EA at 20 references future treatments, indicating these projects will be never-ending in IRAs and recommended wilderness areas. The Vegetation Analysis Assessment for this project, at page 12, notes that over time, continued treatment efforts will gradually convert additional acres to seedling/sapling stages and reduce mature and late seral stands. The EA at 5 notes that there may be "maintenance burning" of treatment areas over time.

These disturbances will include motorized vehicles, mastication machines, helicopters, and chain-saw activity. Localized soil erosion is expected as a result. All these activities are prohibited by the public, yet the agency has determined that these do not apply to them. It is not clear how these exemptions are being allowed. The miles of fire line construction that will be created in IRAs and recommended wilderness was never identified by the agency. The long-term existence of these fire lines will indicate management activities. The tree stumps that will remain will indicate management activities. The noxious weeds that will develop or expand in burning areas and fire lines, as well as ATV activity, will indicate management activities. The burn piles left from burning trees will create severe impacts to soil properties, as well as create eyesores to the public for years. The fire lines and cross-country ATV use from burning activities will create new trails for illegal ATV use by the public, who will see that the agency is using ATVs for management, so why would this activity be prohibited for the public?

The agency notes once burns are done, there will be rehabilitation of fire lines, including return of areas to the original contours, as well as rehabilitation of safety zones and staging areas. Scarification may be needed to eliminate soil compaction created by various burning activities. Measures may be needed to block access for illegal ATV use on fire lines.

The EA notes at 3 that there are 176,000 acres of elk and deer winter range in proposed burning areas, and that these areas will be burned to improve habitat. However, no science or monitoring was cited to demonstrate winter ranges will be improved with burning. This activity does not appear to have been followed with any Forest Plan monitoring to date, in order for the agency to demonstrate burning winter ranges increases big game populations and use of these areas.

Management interventions in IRAs require the agencies to complete an EIS. This proposal includes intervention into 22 IRAs as well as recommended wilderness areas. Even if the agency claims that these interventions will benefit wildlife and ecosystems, the interventions are a significant change from past management as well as the general requirement that natural ecosystem processes occur in these landscapes. As such, the proposed interventions into individual IRAs requires an EIS.

14. The agency is mixing programmatic and site-specific decisions in the same NEPA document/proposal, while at the same time not informing the public as to how the results of various site-specific reviews post-decision will be provided to the public.

The EA at 6 states that if logging projects are planned in proposed treatment areas, there will be a separate NEPA decision made for any such projects. The EA at 32 states there will be site specific review and discussion with associated regulatory agencies prior to implementation of projects, including with the U.S. Fish and Wildlife Service. According to the RFP FEIS at 3-101, areas for juniper treatment will require at a site-specific analysis level to determine management objectives and treatments; the same applies to maple cover types. This is a RFP guideline. So it is unclear why some activities, such as consultation with the U.S. Fish and Wildlife Service, will be required for each project, but general public involvement is not required for the same projects. And there was no information ever provided as to how separate NEPA decisions will require public involvement for juniper treatments. No such separate public involvement requests were ever made to any proposed juniper treatments. It is unclear how this RPF direction will be met within the scope of the larger project, where no site-specific public involvement is being allowed. Also, since a site-specific Biological Assessment (BA) will be required for each project as per consultation with the U.S. Fish and Wildlife Service, what procedure is in place to release these BAs to the public? What is the procedure for releasing the consultation results provided by the U.S. Fish and Wildlife Service for each site-specific project?

15. The agency's assessments on the proposed Caribou Zone burning proposal does not include any information on past fires on the forest, or how these fires impacted resources.

The Curlew National Grassland monitoring report at 17 states that in 2006, 10,000 acres of sagebrush burned. Restoration efforts have included planting sagebrush, plowing and broadcasting sagebrush seeds. It was noted that the agency can speed up re-establishment of sagebrush with a lot of effort, funding and coordination between agencies. This monitoring reports brings up a number of public concerns. First, if sagebrush has burned and is not coming back, why is the agency proposing extensive additional burning of sagebrush in the Caribou Zone burning proposal? Second, why are dollars being targeted for more sagebrush burning if restoration of already burned areas has not been completed? The relationship of past sagebrush burns to the current proposal was never addressed by the agency, including treatment successes and priorities for funding. For example, how many acres of burned sagebrush on the forest require restoration efforts, and how are these efforts being coordinated with the Caribou Zone burning proposal?

16. No actual analysis is ever provided as to why the proposed burning is needed for wildlife.

The EA at 33 states that low intensity burning, as planned, will kill 1/3rd to 2/3rds of the vegetation, while the EA at 47 states that low intensity burning will remove 6-25% of the vegetation. The EA at 41 states that moderate intensity burning will remove about 80% of the prefire ground cover which will be consumed or charred. The EA at 47 states that mixed severity fire will remove 25-75% of the vegetation. The EA at 48 notes that a low severity fire can maintain a given successional class, and can remove up to 25% of the dominant upper canopy layer in a successional class. There is never any information provided in the EA or associated documents, including the wildlife biological evaluation, as to why this vegetation removal is needed for and will benefit wildlife (see Declaration by Dr. Sara Jane Johnson in Appendix A of this Objection).

17. The agency did not demonstrate how the RFP standard to maintain 15% old growth in conifers and aspen forests will be met with the proposed Caribou Zone burning proposal.

The EA at 26 claims that the agency will not burn any old growth, while the EA at 37 states that no target stands will be treated unless these treatments will enhance old growth characteristics. The Vegetation Effects Analysis at 19 states that burning will improve old growth. It appears that old growth stands will not be protected from burning, as the agency can simply claim this burning will improve old growth characteristics. As defined earlier on the amount of vegetation that will be removed in burning, it is not clear what reductions of vegetation in current old growth stands qualifies as improvement for wildlife.

The EA does not address whether the Caribou Zone is currently complying with RFP plan direction to manage 15% of conifer and aspen stands as old growth. The Caribou RFP FEIS at 3-227 states that one assessment for old growth in 1985 reported 24% old growth, while a more recent assessment using the methods implored by the Targhee Zone indicated on 14% old growth. Appendix D of the RFP FEIS, Table 8, indicates that there was approximately 15.7% coniferous old growth in 2003 (61,095 acres of old growth on 386,703 acres of conifer forests). The RPF standard for old growth is 15%. So this standard may or may not being met on the Caribou Zone at this time.

The Existing Condition Assessment for the proposed burning program at page 2 notes that 132,334 acres in proposed burning blocks is forested, although it is not clear which portion of this acreage is aspen, mixed conifer, or conifer forests. So there is a potential for significant degradation of existing old growth, either conifer, aspen, or aspen/conifer forests, to result from the proposed burning program. In addition, the current best science for old growth management for wildlife recommends at least 20-25% old growth. So management of old growth in the proposed burning program is a critical analysis requirement that has not been met by the agency, either in regards to RFP adherence, or impacts on wildlife.

20. The agency claims that removing conifers from aspen stands benefits wildlife, but no data was provided as to why straight aspen stands rather than aspen stands mixed with conifers provides better wildlife habitat.

One objective of the Caribou Zone burning proposal is to stop the succession of conifers into aspen stands to benefit wildlife (EA at 9, 25, 26). As per the RFP FEIS at page D-20, 50% of the forested habitats on the Caribou Zone are comprised of aspen, while only 5% of these forested habitats are comprised of aspen/conifer forests. Thus the aspen/conifer forests are relatively rare not only on the Caribou Zone, but in comparison to pure aspen stands. The rationale for increasing this dominant composition of pure aspen stands, at the cost of the rare aspen/conifer forests, is unclear, as this has never been addressed in the RFP, the FEIS, or for this current burning proposal. In addition to the limited amount of aspen/conifer forests on the Caribou Zone, the agency has also only identified one Species-at-Risk as being associated with aspen. The RFP FEIS at D-64 only identifies the ruffed grouse as a Species-at-Risk associated with aspen. Although aspen provides a unique tree species in forests, including an abundance of nesting cavities due to the high incidence of rot that typifies aspen (Saab et al. 2012), conifer trees greatly increase the habitat diversity within aspen stands by providing dense foliage for both hiding and thermal cover, including for nest concealment. They provide a large volume of conifer seeds, used by many forest birds. They provide much larger snags, than aspen, for cavity-nesting birds that require large snags for nesting. And conifer trees provide a wide range of forest insects, including bark beetles, that also provide forage to birds. There is no reason to remove conifers from aspen stands to promote songbird habitat.

Restoration of aspen habitats is needed across the Caribou Zone, not because of the presence of conifers, but because of the presence of livestock. The problems that livestock create on aspen due to repeated annual grazing of aspen sprouts prevents stands from regenerating (e.g., Earnst et al. 2012).

Appendix A for the Objection filed by NEC, AWR, WD and Y2U on February 14, 2022 against the Caribou Prescribed Fire Restoration Project.

Appendix A contains a Declaration written by Sara Jane Johnson, Director of Native Ecosystems Council, addressing the impacts the proposed burning program will have on neotropical migratory birds.

Declaration of Dr. Sara Jane Johnson

Pursuant to 28 USC Section 1746, I, Sara Jane Johnson, declare as follows:

1. I am over 18 years of age and competent to provide this declaration.

2. I am an experienced wildlife biologist, with 2 graduate degrees in general biology. My Master's Degree at the University of South Dakota included research on the screech owl. My Ph.D. degree from Montana State University included research on the red-tailed hawk.

3. I worked 14 years for the U.S. Forest Service, from 1974 into 1988. This included working 6 years on the Targhee National Forest, where I completed 2 bird inventories during 2 summers, in the Big Hole Mountains Planning Area, and the Medicine Lodge Planning Area. During the 8 years I worked as a wildlife biologist on the Gallatin National Forest (1980-1988) I spent one summer monitoring songbird use of old growth forests in the Bridger Mountains. I therefore have a good general knowledge of bird habitat use forests, woodlands and sagebrush vegetation in the western United States.

4. I am providing the following review of the Caribou Prescribed Fire Restoration Project (hereafter "Caribou Fire Program") in regards to its potential impacts to wildlife, particularly birds. I have reviewed Environmental Assessment (EA) for this project, as well as a number of supporting documents, such as the Terrestrial Biological Evaluation (BE) and Wildlife Specialist Report, the Vegetation Effects Analysis, the Existing Condition Assessment for Non-Forested & Woodland Vegetation Types, the Fire and Fuels Effects Analysis, the Idaho Roadless Rule Briefing Paper, the Evaluating Project Activity Effects on Roadless Characteristics and Attributes, and Evaluating Project Activity Effects on Wilderness Character. I am also familiar with the Revised Forest Plan (RFP) for the Caribou Zone of the

Caribou-Targhee National Forest, as well as the associated Final Environmental Impact Statement (FEIS) and its Appendices.

5. The agency repeatedly claims that the Caribou Fire Program is needed in order to restore natural ecological functions to various vegetations, from forest to non-forest types. For example, this is noted in the Project EA at pages 1, 2, 4, 7, 9, 18, and 29. This claim is also repeated multiple times in the Fire and Fuels Effects Analysis at pages 3-5. This restoration of ecological function would supposedly be achieved by returning forest, woodlands and shrubland vegetation types to their historical levels of age classes (forests and woodlands) or canopy densities (shrublands). These historical levels are defined in the Caribou RFP as "desired conditions", or "desired future conditions" (DFCs). For forested ecosystems, these desired conditions are to have 30-40% of the forests in the mature and old forest age classes (e.g., RFP FEIS 2-66, Table 2.79). The current condition was defined as 50-80% mature and old forests. In order to achieve the desired condition, old and mature forest stands would have to be reduced in the Project Area for the Caribou Burning Program. The Project EA at 25 states that forests are 84% late seral, and 11% mature, which would create 95% mature and old forests. The agency claims that this level of mature and old forests is over double the desired level in the RFP. No historical levels of juniper woodlands was provided by the agency in either the Caribou Zone RFP or the EA for the Caribou Fire Program.

6. For non-forested vegetation, primarily sagebrush, the desired condition is to have 40% of the acres with a canopy cover of 15% or greater, and to have 50-70% of the acres with a canopy cover below 15% (RFP FEIS Appendix B-39); at that time, it was assumed that 50% of sagebrush habitats exceeded a 15% canopy cover level; in order to achieve the desired conditions for sagebrush habitats, prescribed burning would be required to remove sagebrush to create a 0-5% age class. However, in the Project Area for the proposed Caribou Fire Program, sagebrush is now claimed to have 81% of the stands with a canopy cover over 15% (Project EA at 27). This 81% is roughly double the RFP desired conditions.

7. These RFP identifications of desired conditions is the basis for agency claims that the Caribou Fire Program would restore forest and non-forest ecological function. Since the Caribou RFP was developed in 2003, the Forest Service has started using a newer term, departed, to identify needs for prescribed burning. The glossary for the Caribou Fire Program EA at page 47 defines departure as the amount that current vegetation has departed from simulated historical vegetation reference conditions. These departure conditions are then defined at page 49 as (1) within the natural range of variability, with very low to low departure levels, (2) moderately departed from the historical regime, and (3) highly departed from the historical regime. For moderate to highly departed conditions, the vegetation is defined as having moderate to highly altered structure and composition of the vegetation.

8. The historical range of variability (HRV) defines a range of forest, woodland and shrubland age classes that varied over time as driven by fires. With more fires, there would be more younger age classes on the landscape. With fewer fires over time, there would be more older forests during that period. The Forest Service in both the Caribou RFP and the EA for the Caribou Fire Program never identified why a particular composition of age classes of forest and/or woodlands and shrublands is required for ecological function, or for wildlife. The agency has never tied the management of wildlife to these desired conditions in the RFP or the Caribou Fire Program EA. This lack of any actual association between ecosystems management, wildlife, and desired conditions was acknowledged in the Existing Condition Assessment for the proposed burning project. Pages 4 and 6 of this Assessment note that "The RFPs DFC's were set because they represent a safe and sustainable condition where the Forest can provide all the goods and services identified during the Forest Planning Process (wildlife habitat, recreation opportunities, water, etc.)." This is consistent with what the actual purpose of the Caribou Fire Program is, which is fuels reduction.

9. The basis for agency definitions of historical levels of various age classes over time is unclear. Comparison of the agency's estimates with published literature was not available in the RFP, or for the Caribou Fire Program EA and

associated reports. In addition, the manner in which the agency's estimated age structures for vegetation were provided makes it impossible for the public to assess it's accuracy in regards to old growth. The old growth category was combined with mature forest. It is possible that the Caribou portion of the Caribou-Targhee National Forest is currently below the historical level of old growth forests. Lesica (1996) reported in a scientific publication that by evaluating fire regimes in the Northern Rockies, old growth forests ranged from 20-50% of the forested landscapes. On the Caribou Zone of the Caribou-Targhee National Forest, there may only be 14-16% old growth. The RFP FEIS at 3-227 noted that estimates of old growth ranged from 25% in 1985, to 14% for the plan revision due to use of more stringent criteria. In the Caribou Zone RFP FEIS at D-14, old growth forests would comprise 15.8%, including conifer/aspen forests (61,095 acres out of 386,703 forested acres). This would indicate that there is a deficiency, not surplus, of older forest habitat on the Caribou Zone, when compared to historical times, as is being claimed by the agency.

10. Six lynx experts in a Forest Service publication released by the Rocky Mountain Research Station summarized what historical landscapes of the Northern Rockies would have looked like based on fire regimes (McKelvey et al. 1999). In Table 15-1 of this article, they noted the following: in forests with a fire return interval of 100 years, 36% of the forests would be over 100 years in age; in forests with a fire return interval of 150 years, 51% of the forests would be over 100 years in age; in forests with a fire return interval of 200 years, 60% of the forests would be over 100 years in age; and in forests with a fire return interval of 300 years, 71% of the forests would be over 100 years in age. This would indicate that depending on the fire cycle in a given landscape and forest type, forests in the Northern Rockies could have historically been dominated by mature and old growth forests, since fire cycles would range up to 300 years.

11. The amount of older forests on the landscape will be important to many wildlife species. The Flathead National Forest recently provided a summary of wildlife species associated with old growth (USDA 2018), many species which would also occur on the Caribou-Targhee National Forest. This included 34 species

of forest birds. The Caribou Zone RFP FEIS at D 62-63 identified 54 species of birds that were considered "Species at Risk." Six of these species are old growth species as per the Flathead National Forest summary (USDA 2018). These include the northern goshawk, boreal owl, three-toed woodpecker, flammulated owl, brown creeper, and Hammond's flycatcher.

12. The Flathead National Forest also identified 14 species of forest birds associated with snags (USDA 2018). Seven of these species are included in the Caribou Zone RFP FEIS at D 62-63 identifying Species at Risk. These include the Lewis woodpecker, Williamson's sapsucker, three-toed woodpecker, boreal owl, flammulated owl, brown creeper, and northern pygmy owl.

13. Saab and Rich (1997) at pages 58-59 identified 43 bird species in the Interior Columbia River Basin that are associated with shrubsteppe habitats, including sagebrush. Twelve of these bird species as identified as Species at Risk in the Caribou Zone RFP FEIS at D 62-63. These include the Swainson's hawk, Ferruginous hawk, golden eagle, prairie falcon, burrowing owl, gray flycatcher, Lark sparrow, sage sparrow, Brewer's sparrow, rock wren, Loggerhead shrike, and sage thrasher.

14. Saab and Rich (1997) at page 59 also identified 43 bird species associated with juniper woodlands and wooded shrublands. These include twelve bird species that were identified as Species at Risk in the Caribou Zone RFP FEIS D-62-63. These include the Ferruginous hawk, golden eagle, Swainson's hawk, Lark sparrow, burrowing owl, gray flycatcher, prairie falcon, sage thrasher, Loggerhead shrike, Virginia's warbler, black-throated gray warbler, and rock wren.

15. The Caribou Fire Program would remove extensive habitat for forest birds, birds associated with shrubsteppe habitat, and birds associated with juniper woodlands and wooded shrublands. The Caribou Zone contains roughly 565,504 acres of forests, which covers 52% of the total forest landscape (Caribou Fire

Program Existing Condition Assessment at 1). The Caribou Fire Program project area contains 132,334 acres of forest (*Id.* at 2). All of these forested acres could be treated over time with implementation of the Caribou Fire Program (*Id.* at 12). These burning treatments could thus affect 23% of the forested acres on the Caribou Zone (132,334 acres divided by 565,504 total forested acres).

16. Juniper habitats comprise only 1% of the Caribou Zone landscape, for 11,900 acres (Program Vegetation Effects Analysis at 9, 18). Juniper woodlands occur on about 6500 acres within the Caribou Fire Program project area *(Id.* at 16). The Caribou Fire Program could treat up to 6,463 acres of juniper habitats (*Id.* at 18). This program would thus impact roughly half of the entire juniper habitats on the Caribou Zone. The agency currently has no identified DFCs for juniper woodlands.

17. Non-forested vegetation types on the Caribou Zone have been summarized as 396,781 acres (Caribou Fire Program Existing Condition Assessment at 2). Within the Caribou Fire Program project area, there are an estimated 84,794 acres of shrubsteppe habitat, which is 21% of all forest shrubsteppe habitats (84,794 divided by 396,781 acres). Acres of this shrubsteppe habitat that are targeted for prescribed burning was not actually disclosed by the agency. It was noted that the Caribou Zone RFP direction to maintain from 30-50% of sagebrush habitats in blocks of 320 acres or greater in size per watershed can easily be met by the proposed burning program (Project Existing Condition Assessment at 5). This Assessment Report notes there are 130,000 acres of large sagebrush blocks in watershed overlapping the Caribou Fire Program project area. If all 84,794 acres of shrubsteppe habitat that occurs in the project area were burned throughout this program, this would reduce the acreage of large shrubsteppe blocks down to 35% (130,000 total acres reduced by 84,794 acres, leaving 45,206 acres of large shrubsteppe blocks). Thus the agency could burn and destroy vast larger tracts of shrubsteppe habitat and still meet the Caribou Zone RFP direction. Indeed, the Project Existing Condition Assessment at page 5 states there is ample opportunity to meet the landbird guideline, but this is not the purpose or need of the Caribou prescribed fire project.

18. The impacts the proposed Caribou Fire Program will have on wildlife associated with conifer forests, aspen/conifer forests, juniper woodlands, and shrubsteppe habitats will certainly be massive, with the progressive degradation and/or direct removal, as well as fragmentation of wildlife habitat on up to 266,039 acres on the Caribou Zone. Yet even the severe impacts this proposal would have on sagebrush habitats was dismissed by the agency, in spite of a Forest Service report published by the Pacific Northwest Research Station in 2007 titled "Sagebrush in Western North America: habitats and species in jeopardy" (Thompson 2007). This report noted that sagebrush habitats are declining rapidly across western North America, with over 350 associated plant and animal species at risk of local or reginal extirpation. More recently, the Forest Service published a report titled "Sage-grouse on the edge: understanding and managing western landscapes for their survival (Parks 2012). This report summarized research that has demonstrated that persistence of sage grouse across a given landscape requires a threshold level of 50% tall, mature sagebrush habitat. This is directly counter to the Caribou Fire Program claims that sagebrush needs to be restored to ecological function by fragmenting existing patches with burning to create a diversity of age classes and structure. This burning program is based on scientifically-indefensible claims.

Signed this 14th day of February, 2022.

Sara Jane Johnson

Dr. Sara Jane Johnson

Literature Cited:

McKelvey, K., K. Aubry, J. Agee, S. Buskirk, L. Ruggiero, and G. Koehler. 1999. Lynx conservation in an ecosystem management context. Chapter 15 in Ecology and conservation of the lynx in the United States. USDA Forest Service, Rocky Mountain Research Station, Gen. Tech. Report RMRSK-GTR-30WWW.

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Parks, N. 2012. Sage-grouse on the edge: understanding and managing western landscapes for their survival. Science Findings Issue 142, May 2021. USDA Forest Service, Pacific Northwest Research Station.

Saab, V., and T. Rich. 1997. Large-scale conservation assessment for neotropical migratory land birds in the Interior Columbia River Basin. USDA Forest Service, Pacific Northwest Research Station, Gen. Tech. Report PNW-GTR-399.

Thompson, J. 2007. Sagebrush in Western North America: habitats and species in jeopardy. Science Findings Issue 91, March 2007. USDA Forest Service, Pacific Northwest Research Station.

USDA. 2018. Glacier Loon fuels reduction and forest health project Environmental Assessment. USDA Forest Service, Flathead National Forest.

Appendix B for the Objection filed by NEC, AWR, WD and Y2U on February 13, 2022 against the Caribou Prescribed Fire Restoration Project

Appendix B contains the relevant portions of reports and/or publications cited in the Objection as well as in the Declaration submitted by Dr. Sara Johnson in Appendix A for the Objection.

Earnst, S., D. Dobkin, and J. Ballard. 2012. Changes in avian and plant communities of aspen woodlands over 12 years after livestock removal in the Northwestern Great Basin. Conservation Biology 26:862-872.

McKelvey, K., K. Aubry, J. Agee, S. Buskirk, L. Ruggiero, and G. Koehler. 1999. Lynx conservation in an ecosystem management context. Chapter 15 in Ecology and conservation of lynx in the United States. USDA Forest Service, Rocky Mountain Research Station, Gen. Techn. Report RMRS-GTR-30WWW.

Parks, N. 2012. Sage-grouse on the edge: understanding and managing western landscapes for their survival. Science Findings Issue 142, May 2012. USDA Forest Service, Pacific Northwest Research Station.

Saab, V., and T. Rich. 1997. Large-scale conservation assessment for neotropical migratory land birds in the Interior Columbia River Basin. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-399.

Saab, V., J. Dudley, and M. Dresser. 2012. Habitat characteristics at woodpecker nest locations and at non-nest random locations in the Elkhorn Mt, Helena National Forest before (2002-2006) and after a mountain pine beetle outbreak

(2009-2011). Progress Report submitted by the Rocky Mountain Research Station and Montana State University to the Helena National Forest October 2012.

Thompson, J. 2007. Sagebrush in Western North America: habitats and species in jeopardy. Science Findings Issue 91, March 2007. USDA Forest Service, Pacific Northwest Research Station.

USDA. 2022. E-mail from Dylan Johnson to Sara Johnson documenting the addition of requested project file reports to the project website. February 8, 2022.

USDA. 2022. E-mail from Dylan Johnson to Sara Johnson documenting that the Biological Assessment for the Caribou Zone burning project was not available for public review.

Conservation Biology

261 862-872

Contributed Paper

Changes in Avian and Plant Communities of Aspen Woodlands over 12 Years after Livestock Removal in the Northwestern Great Basin

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Abstract: *Riparian and quaking aspen* (Populus tremuloides) *woodlands are centers of avian abundance and diversity in the western United States, but they have been affected adversely by land use practices, particularly livestock grazing. In 1990, cattle were removed from a 112,500-ha national wildlife refuge in southeastern Oregon. Thereafter, we monitored changes in vegetation and bird abundance in years 1–3 (phase 1) and 10–12 (phase 2) in 17 riparian and 9 snow-pocket aspen plots. On each 1.5-ha plot, we sampled vegetation in 6 transects. Three times during each breeding season, observers recorded all birds 50 m to each side of the plot's 150-m centerline for 25 minutes. We analyzed data with multivariate analysis of variance and paired t tests with p values adjusted for multiple comparisons. In both periods, riparian and snow-pocket aspen produced extensive regeneration of new shoots ($\bar{x} = 2646$ stems/ha and 7079 stems/ha, respectively). By phase 2, a 64% increase in medium-diameter trees in riparian stands indicated successful recruitment into the overstory, but this pattern was not seen in snow-pocket stands, where the density of trees was over 2 times greater. By phase 2 in riparian and snow-pocket stands, native forb cover had increased by 68% and 57%, respectively, mesic shrub cover had increased by 29% and 58%, and sagebrush cover had decreased by 24% and 31%. Total avian abundance increased by 33% and 39% in riparian and snow-pocket aspen, respectively, ground or understory nesters increased by 133% and 67% and overstory nesters increased by 34% and 33%. Similarly, ground or understory foragers increased by 25% and 32%, aerial foragers by 55% and 57%, and overstory foragers by 66% and 43%. We interpreted the substantial regeneration of aspen shoots, increased densities of riparian forbs and shrubs, and increased avian abundances as a multitrophic-level response to the total removal of livestock and as substantial movement toward recovery of biological integrity.*

Keywords: aspen, avian abundance, Great Basin, habitat recovery, livestock grazing, riparian woodland, snow-pocket aspen

Cambios en las Comunidades de Aves y Plantas en Bosques de Álamo a lo Largo de 12 Años Después de la Remoción de Ganado en la Gran Cuenca Noroccidental

Resumen: *Los bosque ribereños y de Populus tremuloides son centros de abundancia y diversidad de aves en el occidente de Estados Unidos, pero han sido afectados adversamente por prácticas de uso de suelo, particularmente pastoreo de ganado. En 1990 se removió el ganado de un refugio nacional de vida silvestre de 112,500 ha en el sureste de Oregon. Desde entonces, monitoreamos cambios en la vegetación y la abundancia de aves en los años 1–3 (fase 1) y 10–12 (fase 2) en 17 parcelas ribereñas y 9 de álamo. En cada parcela de 1.5 ha muestreamos la vegetación en 6 transectos. Tres veces durante cada época reproductiva,*

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observadores registraron durante 25 minutos a todas las aves 50 m a cada lado de la línea central de cada parcela. Analizamos los datos con análisis multivariado de varianza y pruebas pareadas de t con valores de p ajustados para comparaciones múltiples. En ambos períodos, los bosques ribereños y de álamo produjeron una regeneración extensiva de rebrotes nuevos ($\bar{x} = 2646$ tallos/ha y 7079 tallos/ha, respectivamente). En la fase 2, un incremento de 64% en el diámetro promedio de árboles en los bosques ribereños indicó un reclutamiento exitoso en el dosel, pero este patrón no se observó en los bosques de álamo, donde la densidad de árboles fue más de 2 veces mayor. En la fase 2 en bosques ribereños, la cobertura herbácea nativa había incrementado en 68% y 57%, respectivamente, la cobertura arbustiva mésica había incrementado en 29% y 58%, y la cobertura de artemisa había decrecido en 24% y 31%. La abundancia aviar total incrementó en 33% y 39% en bosques ribereños y de álamo, respectivamente, las especies que anidan en el suelo o en el sotobosque incrementaron en 133% y 67% y las especies que anidan en el dosel incrementaron en 34% y 33%. Similarmente, las aves forrajeras de suelo o sotobosque incrementaron en 25% y 32%, los forrajeadores aéreos en 55% y 57% y los forrajeadores de dosel en 66% y 43%. Interpretamos la regeneración sustancial de rebrotes de álamos, el incremento de las densidades de hierbas y arbustos ribereños y el incremento en las abundancias de aves como una respuesta a nivel multitrófico de la remoción total de ganado y como un avance sustancial hacia la recuperación de la integridad biológica.

Palabras Clave: abundancia de aves, álamo, bosque ribereño, Gran Cuenca, pastoreo de ganado, *Populus tremuloides*, recuperación de hábitat

Introduction

Riparian woodlands composed of deciduous trees and shrubs occupy <1% of the western United States, but they support higher diversity and abundance of birds than other cover types (Dobkin & Wilcox 1986; Knopf et al. 1988; Skagen et al. 1998). Similarly, in the 11 western U.S. states (hereafter the West), aspen (*Populus tremuloides*) woodlands harbor greater avian diversity and abundance than surrounding vegetation (Turchi et al. 1995; Griffis-Kyle & Beier 2003; Hollenbeck & Ripple 2007).

Both aspen and riparian woodlands are greatly affected by land-use practices, and aspen are declining in much of the West because of altered fire regimes, succession to conifers, ungulate herbivory, drought, disease, and insect outbreaks (Romme et al. 1995; Kay & Bartos 2000; Worrall et al. 2008). Livestock grazing, primarily by cattle, has a pervasive influence on riparian areas in the West (Fleischner 1994; Belsky et al. 1999), including approximately 90% of the region's extensive federal lands (Fleischner 2010). Besides direct consumption of vegetation, trampling by cattle can cause soil compaction, reduced bank stability, channel widening, increased groundwater depth, and decreased abundance of stream macroinvertebrates (Belsky et al. 1999; Fleischner 1994, 2010). Through direct and indirect effects, cattle and wild ungulates (especially elk [*Cervus elaphus*]) can dramatically impair aspen's ability to regenerate (Fitzgerald & Bailey 1984; Kay & Bartos 2000; Kaye et al. 2005) in riparian and nonriparian settings.

Avian abundance in aspen and other deciduous riparian habitats in the West is reduced in the presence of cattle (Saab et al. 1995; Tewksbury et al. 2002; Earnst et al. 2005). Ground- and shrub-nesting birds tend to be most affected by cattle, as expected from the greater effect that cattle have on low-growing vegetation (Saab et al. 1995), but effects throughout the avian community have been documented in cases where cattle have highly altered vegetation (Tewksbury et al. 2002; Krueper et al. 2003).

In the high-desert riparian areas of Hart Mountain National Antelope Refuge (HMNAR) in southeastern Oregon (U.S.A.), cattle were contributing to the poor condition of riparian areas and were removed from the refuge after >120 years of grazing (USFWS 1994). The removal of cattle from this relatively large landscape (112,500 ha) in 1990 and subsequent monitoring of vegetation and avian abundance in years 1–3 and 10–12 after cattle removal, provide a unique opportunity to investigate long-term consequences of cattle removal at a landscape scale (Earnst et al. 2005). During the first 3 years after cattle removal, herbaceous cover and avian abundance, especially that of ground and understory specialists began to increase (Dobkin et al. 1998; Tewksbury et al. 2002). We compared vegetation structure and abundance of breeding birds in riparian and snow-pocket aspen 1–3 (phase 1) and 10–12 (phase 2) years after livestock removal.

Methods

Study Area

HMNAR is in the northwestern Great Basin in southeastern Oregon (42°25'N, 119°40'W) and is predominantly sagebrush (*Artemisia* spp.) shrubsteppe. Hart Mountain is a fault block that rises gradually from the east to 2438 m and drops as a steep escarpment to the west. Riparian woodlands and snow-pocket aspen stands provide the only trees except for a few stands of mountain mahogany (*Cercocarpus ledifolius*) and western juniper (*Juniper occidentalis*) (USFWS 1994). Of the 134 linear km of riparian habitat and snow-pocket aspen on

HMNAR, 29% is aspen along perennial streams, 10% aspen in snow pockets (small, relatively high-elevation depressions where snow collects), 11% willow (*Salix* spp.), 12% mixed deciduous, 29% sedge or grass meadow, and 9% sagebrush shrubsteppe (Earnst et al. 2005). Annual precipitation, primarily snow, is generally 20–30 cm on the tableland and 30–46 cm on the mountain (USFWS 1994).

Study Plots

The 4324-ha study area encompassed most aspen stands on the east side of the escarpment. We excluded 1 drainage with aspen from the study area due to difficult access and 1 drainage in which a prescribed burn was planned. Within the study area, the 17 riparian and 9 snow-pocket plots were well distributed throughout areas with aspen, and 3–10 plots were in each of the 5 drainages ($\bar{x} = 5.2$). Most riparian-aspen plots were in mature stands ($n = 13$). Two were in stands with little regeneration and a large proportion of dead trees, and 2 were in a young, dense, even-aged stand that had burned in a 1972 wildfire. Average elevation of riparian and snow-pocket plots was 1951 m (range 1873–2121 m) and 2145 m (2042–2212 m), respectively.

Plots were 1.5 ha (150 × 100 m) and separated by at least 125 m. The width of the aspen stand was often <100 m, and the remainder of the plot consisted of shrubsteppe vegetation. The center line of the plot, which was marked at 50-m increments with permanent steel fence posts, ran near and parallel to the stream.

Vegetation Measurements

On each of the 26 plots, 6 100-m vegetation transects were placed perpendicular to and bisected by the 150-m center line. Vegetation transects were 25 m apart, and location of the first was chosen at random within the first 12.5 m of the center line. The same vegetation transect locations were used in each phase. At 10-m intervals along vegetation transects, we measured canopy cover with a spherical densitometer and estimated percent ground covered by herbaceous vegetation, litter, and bare ground within a 0.125-m^2 sampling frame. We measured shrub cover (identified to species) as the percentage of the vegetation-transect line that was intercepted by live shrubs below 2 m (gaps <10 cm were ignored). We pooled riparian shrub species for analyses. We estimated tree density by counting all woody stems within 2 m of each vegetation transect line and recorded species, height, and diameter at breast height (dbh). We classified aspen stems as shoots if they were ≤1.5 m in height and as small- (0.1–6.0 cm dbh), medium- (6.1–18.0 cm dbh), or large- (>18.0 cm dbh) diameter trees if they were >1.5 m in height.

Within each set of vegetation measurements (ground cover, shrub cover, and aspen stem density), we tested for an overall difference between phases with a repeated-measures multivariate analyses (MANOVA). In each MANOVA, we tested for differences between phases within categories (such as shrub cover) with paired *t* tests, and we adjusted for multiple comparisons as in Benjamini and Hochberg (1995). Because plots were fairly evenly distributed throughout aspen on the east slope and plots were placed in aspen vegetation irrespective of drainage, we analyzed the data as a simple one-stage sample. We used only vegetation measurements taken within the wooded zone of each plot. Each 10-m section of the vegetation transect was defined as being within the wooded zone if it contained any tree stems or canopy cover. Both avian and plant data are given as means per wooded hectare.

For descriptive purposes, we report percent change between phases ([phase 2–phase 1]/phase 1 × 100%) in the text and phase 1 and phase 2 means in the figures. We used mean differences (the mean across plots of each plot's phase 2 minus phase 1 difference) and the standard error of the difference in statistical comparisons (Supporting Information).

We obtained precipitation data from a weather station at HMNAR headquarters. We pooled these data for October through June (when 86% of annual precipitation falls) annually (1941–2002) and used them as an index of moisture available to plants in a growing season (Dobkin et al. 1998).

Avian Surveys

We conducted modified fixed-width transect surveys during which observers walked slowly through the center of each plot for 25 minutes and recorded all birds detected by sight or sound within 50 m of the transect (Dobkin & Rich 1998). Surveys were conducted between 0.5 and 3.5 h after sunrise. In phase 1, each plot was surveyed 6 times, once on each of 2 consecutive days in each of 3 survey rounds. In phase 2, each plot was surveyed once in each of 3 survey rounds. Surveys were conducted during phenologically similar periods each year, 7 May–9 July in phase 1 (87% prior to 27 June) and 8 May–27 June in phase 2. In each year, a plot was surveyed by 2 or 3 different observers, and each was responsible for approximately the same total number of surveys and plots. The order in which plots were surveyed within a day alternated between consecutive visits.

For each of the 26 plots, we averaged mean number of individuals detected per visit within a year and among years within each phase (i.e., 1991-1993 and 2000–2002). We then calculated the mean difference in individuals per visit between phases for each plot and each species and conducted a paired *t* test (with plot as the sampling unit) to determine whether the difference for each species was significantly different from zero. As a means of restricting analyses to those species with a sample size sufficient to provide a reasonable power to detect a difference, we used only species that occurred on at least 5 plots and had an average of ≥ 0.013 individuals/ha in either phase (32 species in riparian aspen, 23 in snow-pocket aspen). In addition, we analyzed only passerines, doves, and woodpeckers that nest or forage primarily in woody-riparian and snow-pocket areas on HMNAR. Avian nomenclature follows the most recent revision to the American Ornithologists' Union checklist (Chesser et al. 2011).

We assigned species to nesting guilds (ground and understory cup nesters, overstory cup nesters, and cavity nesters) and foraging guilds (ground and understory, overstory, aerial, and bark foragers) (Ehrlich et al. 1988) (Supporting Information). Change in number of individuals in each nesting and foraging guild per hectare (i.e., phase 2–phase 1) was calculated by pooling individuals for all species within each guild and treating the plot as the primary sampling unit. We used repeated measures multivariate tests (SAS Institute 2004) to test for an overall difference between phases (first among guilds and then species). If the difference was significant, we used a paired t test to test for a difference between phases for each guild and each species. We adjusted resulting p values for multiple comparisons with Benjamini and Hochberg's (1995) false discover rate to ensure that $\leq 5\%$ of rejected hypotheses were rejected falsely. We made this adjustment because it is more powerful than holding the family-wise error rate at $p = 0.05$ and because the error rate is acceptable when an overall significant difference has been established and when one seeks to describe which species comprise the difference (Westfall et al. 1999).

Results

Riparian and snow-pocket aspen differed in stand structure, but both exhibited substantial regeneration (i.e., production of new shoots) ($\bar{x} = 2646$ stems/ha for riparian and 7079 stems/ha for snow-pocket aspen, phase 1 and 2 average) (Supporting Information). In both phases, aspen in snow-pocket plots were considerably denser than in riparian plots, primarily because they had 3.5 times more shoots and 2.3 times as many small-diameter trees per ha than riparian aspen (Supporting Information). Tree size was strongly skewed toward small trees in snow-pocket aspen, with shoots (<1.5 m in height) and small stems (<6 cm dbh) comprising 93% of all stems in snow-pocket plots and 77% of all stems in riparian plots. Snow-pocket plots tended to have more forb cover and less grass and sedge cover, but similar cover of riparian shrubs, sagebrush, and aspen canopy relative to riparian plots (Supporting Information). In both stand types,

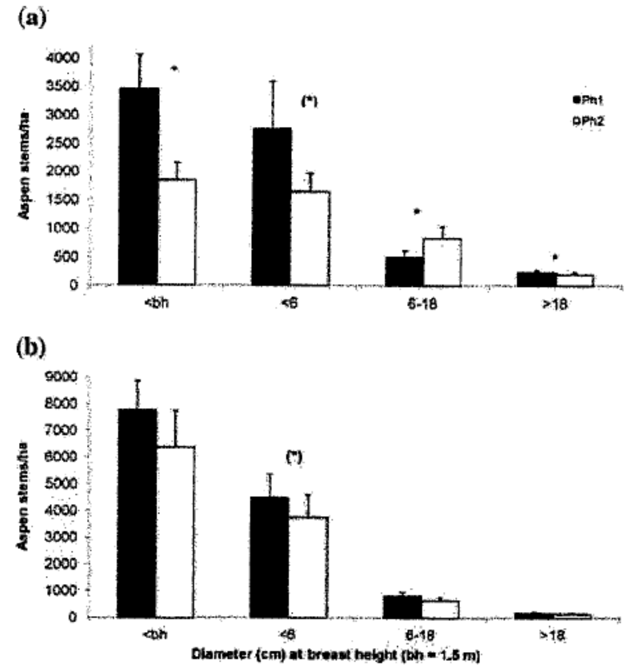

*Figure 1. Density of live aspen stems in 4 size classes (<bh, 1.5 m in height; other classes are >1.5 m in height and unit of measure is diameter at breast height in centimeters) in (a) riparian aspen plots (*n *= 17;* $F_{48,3}$ *= 6.1,* p *= 0.001) and (b) snow-pocket aspen plots (*n *= 9;* $F_{24,3}$ *= 1.1,* p *= 0.36) in years 1–3 (Ph1) and years 10–12 (Ph2) after cattle removal (multivariate repeated measures analysis and paired* t *tests with adjustment for multiple comparisons: (*)*p *< 0.10; **p *< 0.05; ***p *< 0.01; ****p *< 0.001).*

herbaceous and shrub communities were composed of native species.

Riparian plots had more than twice as many total individual birds per hectare as snow-pocket plots (27.2 [SE 2.0] versus 13.0 [1.6], respectively; $t = 5.5$, $p < 0.0001$, 33 species pooled), and the difference was evident across all nesting and foraging guilds. Most species (27 of 32) were more common in riparian than snow-pocket aspen plots (on the basis of phase 2 means) (Supporting Information). The identity of 8 of the 10 most abundant species was the same in riparian and snow-pocket plots.

Change in Vegetation Structure and Composition

Riparian stands exhibited substantial changes in stand structure between phase 1 and phase 2, including decreases in the density of shoots (47% change from phase 1 to phase 2, $p = 0.02$), small diameter trees (40%, $p = 0.06$), and large diameter trees (16%, $p = 0.02$), and a 64% increase in medium diameter trees ($p = 0.02$) (Fig. 1a). The density of snags >18 cm in diameter (33.3 versus 33.8 stems/ha, phases 1 and 2, respectively; $t = 0.04$,

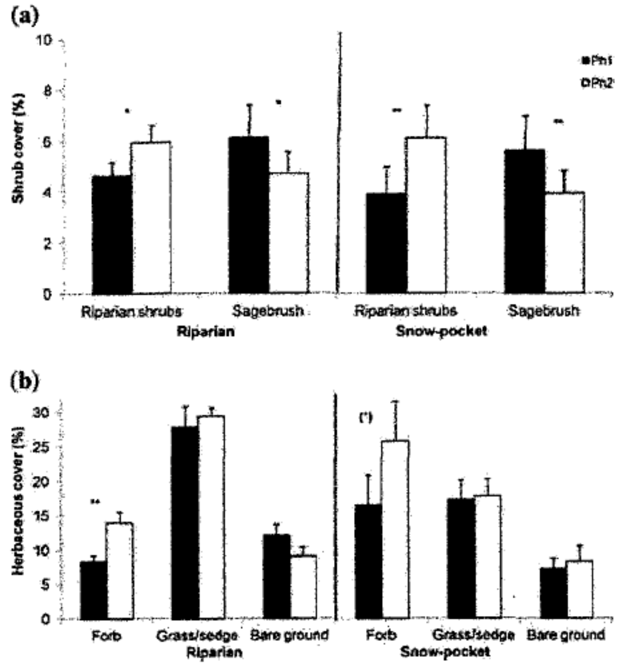

Figure 2. Percent cover of (a) shrubs in riparian ($n = 17$*,* $F_{16,1} = 24.2$*,* $p = 0.0002$*) and snow-pocket aspen plots (*$n = 9$*,* $F_{8,1} = 25.5$*,* $p = 0.001$*) and (b) herbaceous vegetation in riparian (*$F_{32,2} = 4.1$*,* $p = 0.03$*) and snow-pocket aspen plots (*$F_{16,2} = 2.3$*,* $p = 0.01$*) in years 1–3 (Ph1) and years 10–12 (Ph2) after cattle removal (multivariate repeated measures analysis and paired* t *tests with adjustment for multiple comparisons: (*)*$p < 0.10$*; **$p < 0.05$*; ***$p < 0.01$*; ****$p < 0.001$*).*

$p = 0.97$) and canopy cover (54% versus 53%, $t = 0.71$, $p = 0.49$) did not change.

In snow-pocket stands the relative distribution of trees among size classes was unchanged from phase 1 to phase 2; however, there were consistent but nonsignificant decreases in the density of live stems in all classes (shoots, 18% decrease, $p = 0.25$; small diameter, 17%, $p = 0.24$; medium diameter, 19%, $p = 0.24$; large diameter, 14%, $p = 0.25$) (Fig. 1b). The density of snags >18 cm in diameter increased significantly (11.1 versus 29.7 stems/ha, $t = 3.79$, $p = 0.004$), and canopy cover declined significantly (55% versus 49%, $t = 2.71$, $p = 0.02$).

In riparian and snow-pocket plots, riparian shrub cover increased significantly (29% [$p = 0.03$] and 58% [$p = 0.008$], respectively) and sagebrush cover decreased significantly (24% [$p = 0.03$] and 31% [$p = 0.009$] respectively) (Fig. 2a). Cover of forbs increased substantially in riparian and snow-pocket plots (68% [$p = 0.006$] and 57% [$p = 0.08$], respectively) (Fig. 2b), and bare ground decreased nonsignificantly in riparian aspen (25% [$p = 0.12$]) (Fig. 2b). The combined category of grasses and sedges provided substantial cover in riparian and snow-pocket aspen plots (29% and 18%, respectively) and did not change significantly between phases (5% [$p = 0.62$] and 3% [$p = 0.89$], respectively).

Change in Bird Abundance

By 10–12 years after cattle removal, pooled avian abundance had increased by 33% in riparian aspen (from 20.4 to 27.2 individuals/ha, $p = 0.001$) and by 39% in snow-pocket aspen (from 9.3 to 13.0 individuals/ha, $p = 0.004$). Most species in both riparian aspen (69%, 22/32) and snow-pocket aspen (70%, 16/23) increased (Table 1). In riparian aspen, abundances of 10 species increased significantly and 2 decreased significantly after adjusting for multiple comparisons. In snow-pocket aspen, abundances of 4 species appeared to increase significantly and 1 to decrease significantly, but no differences remained significant after adjusting for multiple comparisons (Table 1).

Among nesting guilds, significant increases in avian abundance occurred in both riparian and snow-pocket aspen. Ground and understory nesters increased by 133% and 67%, and overstory nesters increased by 34% and 33% in riparian and snow-pocket aspen, respectively (Fig. 3a). Abundance in most foraging guilds also increased significantly: ground and understory foragers increased by 25% and 32%, aerial foragers by 55% and 57%, and overstory foragers by 66% and 43% in riparian and snow-pocket aspen, respectively (Fig. 3b). Neither the bark-gleaning foraging guild nor the cavity-nesting guild increased significantly in either plot type.

Most species that increased significantly in abundance between phases became more abundant in plots where they had been present in phase 1 (9 of 10 species) and were present on more plots than in phase 1 (5 of 10 species; Table 1). Likewise, the 2 species that decreased significantly in abundance between phases decreased in abundance in plots where they had been present in phase 1 and were present on fewer plots than in phase 1 (Table 1). Cavity-nesting species also were present in fewer plots in phase 2 than in phase 1 (5 of 8 cavity nesters in riparian aspen and 5 of 7 in snow-pocket aspen).

Total precipitation (1 October through 30 June) was greater, but not significantly, in phase 1 than in phase 2 (32.25 cm [SE 6.17] versus 19.48 cm [2.31], $t = 1.94$, $p = 0.12$). The tendency for higher rainfall in phase 1 was the opposite of that expected if the increase in bird abundance were related to increased precipitation. The total number of individuals per hectare (species pooled, averaged across plots) did not increase as precipitation increased, either within or between phases (Fig. 4a). Total precipitation increased nonsignificantly from 1941 to 2002 ($p = 0.08$, Fig. 4b).

For most species, increases in avian abundance at HMNAR did not reflect regional Breeding Bird Survey (BBS) trends in the Great Basin Bird Conservation Region

Table 1. Mean change in avian abundance from years 1–3 to years 10–12 after cattle removal on riparian and snow-pocket aspen plots ($n = 17$ and 9, respectively).

Abundance status[a] *and common name*	Scientific name	*Riparian aspen* change in individuals/ha[b]	*Riparian aspen* change in presence[c]	*Snow-pocket aspen* change in individuals/ha[b]	*Snow-pocket aspen* change in presence[c]
Increasing					
Yellow Warbler	*Setophaga petechia*	1.64^{***}	1	$0.45^{[***]}$	2
White-crowned Sparrow	*Zonotrichia leucophrys*	1.37^{**}	1	0.37	0
Warbling Vireo	*Vireo gilvus*	0.80^{***}	3	0.35	0
Tree Swallow	*Tachycineta bicolor*	0.79	2	$0.28^{[*]}$	2
Dusky Flycatcher	*Empidonax oberholseri*	0.70^{**}	0	0.76	0
Empidonax spp.[d]	*Empidonax spp.*	0.31^{***}	7	$0.24^{[*]}$	1
Yellow-rumped Warbler	*Setophaga coronata*	$0.28^{[*]}$	2	0.01	−2
Song Sparrow[e]	*Melospiza melodia*	0.27^{*}	5		
Western Tanager	*Piranga ludoviciana*	0.26^{*}	1	0.09	4
Cassin's Finch	*Carpodacus cassinii*	0.24	1	−0.04	−2
Mourning Dove[e]	*Zenaida macroura*	0.24^{*}	4		
Spotted Towhee[e]	*Pipilo maculatus*	0.23^{*}	8		
House Finch[e]	*Carpodacus mexicanus*	0.20^{*}	7		
Dark-eyed Junco	*Junco hyemalis*	$0.19^{[*]}$	6	$0.37^{[**]}$	3
American Robin	*Turdus migratorius*	0.17	0	0.10	0
MacGillivray's Warbler[e]	*Geothlypis tolmiei*	$0.16^{[*]}$	5		
Black-headed Grosbeak	*Pheucticus melanocephalus*	0.12	−1	0.05	−3
Lazuli Bunting[e]	*Passerina amoena*	0.12	2		
Western Wood-Pewee	*Contopus sordidulus*	0.09	−1	0.05	0
Orange-crowned Warbler	*Oreothlypis celata*	0.08	−1	0.11	0
Hairy Woodpecker	*Picoides villosus*	0.07	−4	−0.01	−4
Fox Sparrow	*Passerella iliaca*	0.02	−2	−0.05	−1
Decreasing					
European Starling[e]	*Sturnus vulgaris*	-0.70^{*}	−1		
Bullock's Oriole	*Icterus bullockii*	-0.35^{**}	−9	$-0.06^{[*]}$	−6
House Wren	*Troglodytes aedon*	−0.28	−1	0.18	−1
Northern Flicker	*Colaptes auratus*	−0.10	0	0.10	−1
Swainson's Thrush[e]	*Catharus ustulatus*	−0.07	−5		
Hummingbird spp.[e,f]	*Selasphorus/Stellula*	−0.03	−1		
Mountain Bluebird	*Sialia currucoides*	−0.03	2	0.19	0
Brown-headed Cowbird	*Molothrus ater*	−0.01	0	−0.04	−2
Downy Woodpecker	*Picoides pubescens*	−0.01	−4	−0.04	−3
Sapsuckers[g]	*Sphyrapicus nuchalis, S. ruber*	−0.001	−1	−0.03	−4

[a] *For ease of presentation, increasing or decreasing status assigned on basis of riparian plots.*
[b] *Significance on the basis of paired t tests with adjustment for multiple comparisons:* $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; *[], differences significant before adjustment but not after.*
[c] *Change in presence is the change in number of plots in which the species was present.*
[d] *Species include Hammond's* (E. hammondii), *Cordilleran* (E. occidentalis), *Pacific-slope* (E. difficilis), *Willow Flycatchers* (E. traillii), *and unidentified* Empidonax *flycatchers. Dusky Flycatchers were analyzed separately.*
[e] *Species was too rare for meaningful analyses in snow-pocket stands. Criteria for inclusion were an average of* ≥ 0.013 *individuals/ha and occurring on* ≥ 5 *plots in either period.*
[f] *Hummingbird species includes Broad-tailed* (Selasphorus platycercus), *Rufous* (S. rufus), *and Calliope Hummingbirds* (Stellula calliope), *and unidentified hummingbirds.*
[g] *Sapsucker species includes Red-naped Sapsucker* (Sphyrapicus nuchalis), *Red-breasted Sapsucker* (S. ruber), *hybrids, and those recorded as unidentified.*

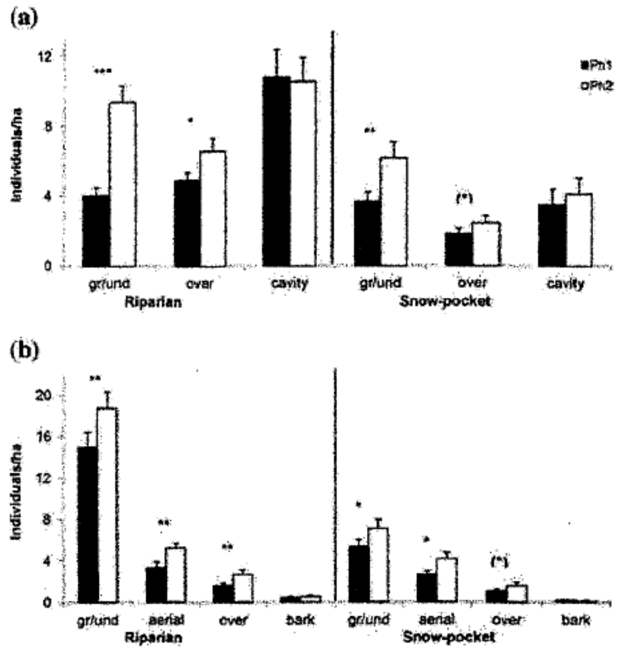

Figure 3. Avian abundance in years 1–3 (Pb1) and years 10–12 (Pb2) after cattle removal for (a) nesting guilds in riparian ($n = 17$*,* $F_{32,2} = 15.9$*,* $p < 0.0001$*) and snow-pocket aspen (*$n = 9$*,* $F_{16,2} = 6.2$*,* $p = 0.01$*) plots and (b) foraging guilds in riparian (*$F_{48,3} = 10.7$*,* $p < 0.0001$*) and snow-pocket aspen (*$F_{24,3} = 9.0$*,* $p = 0.0004$*) plots (multivariate repeated measures analysis and paired* t *tests with adjustment for multiple comparisons: (*)*$p < 0.10$*, **$p < 0.05$*, ***$p < 0.01$*, ****$p < 0.001$*).*

for 1991–2002 (Sauer et al. 2008). Of the 10 species with abundances that increased significantly in riparian plots, 3 increased significantly in the Great Basin (Mourning Dove [*Zenaida macroura*], Song Sparrow [*Melospiza melodia*], and Warbling Vireo [*Vireo gilvus*]), and 2 decreased significantly (Dusky Flycatcher [*Empidonax oberholseri*] and other *Empidonax*) (Supporting Information).

Discussion

Ours is the first study to quantify the response of avian and plant communities in aspen woodlands to the removal of livestock across ecologically informative spatial and temporal scales in the semi-arid Intermountain West and to illustrate the response at multiple, interrelated organizational levels. The increase in avian abundance across the 12 years following cessation of >100 years of livestock grazing was large and widespread throughout foraging and nesting guilds.

Increases in forb and shrub cover from phase 1 to phase 2 and the high density of aspen shoots and small trees

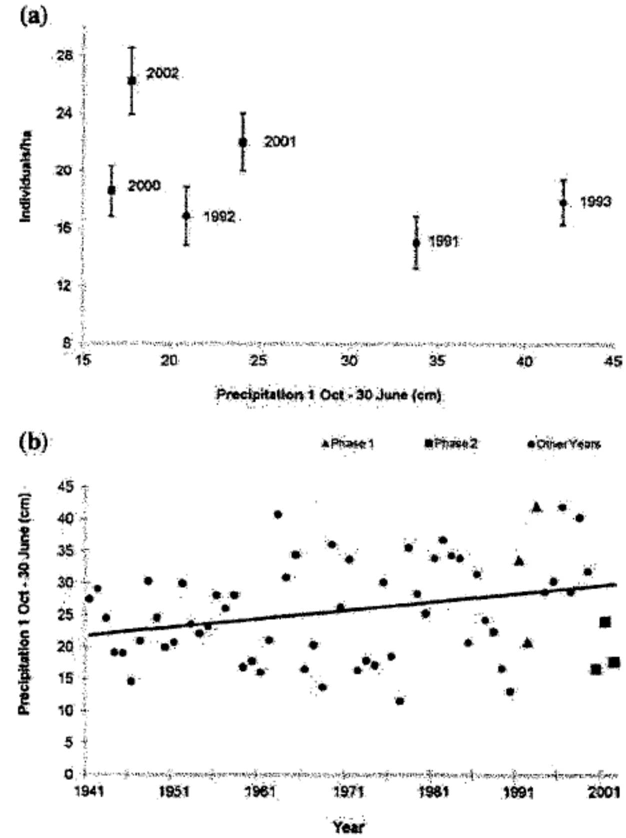

Figure 4. Total precipitation relative to (a) mean (SE) avian abundance (all species pooled) per plot visit each year and for (b) the 62 years preceding and during this study (1941–2002) (phase 1, 1–3 years after cattle removal; phase 2, 10–12 year after cattle removal). Mean total precipitation was 25.5 cm, and the slope of the long-term trend was 0.10 (SE 0.05) ($t = 1.8$*,* $p = 0.08$*).*

in both phases created a structurally robust understory of native species. The recovering understory vegetation is the most parsimonious explanation for the strong increases that we documented in guilds of species that nest or forage in the understory (Saab et al. 1995; Tewksbury et al. 2002). Understory vegetation is adversely affected by livestock grazing (Belsky & Blumenthal 1997) and is an often overlooked component of habitat structural diversity that contributes substantially to avian diversity and abundance in aspen and riparian woodlands (Hobson & Bayne 2000; Scott et al. 2003; Dickson et al. 2009).

Overstory nesters and overstory and aerial foragers also increased significantly in our study. Other studies have documented effects of grazing throughout the avian community, especially when vegetation was altered extensively (Tewksbury et al. 2002; Krueper et al. 2003). Such widespread changes in avian communities may be expected if invertebrate abundance is affected by altered vegetation (Pettersson et al. 1995; McIver &

McInnis 2007) and if insectivorous avian communities mirror changes in their prey (Croonquist & Brooks 1991; Seagle & Sturtevant 2005).

Exceptions to the trend of increasing abundance were bark gleaners and cavity nesters, neither group increased significantly in either plot type. This result is consistent with the loss of 14%–16% of large-diameter trees in riparian (significant) and snow-pocket (nonsignificant) plots. Cavity nesters prefer aspen rather than other trees for nesting in boreal woodlands (Martin et al. 2004), and at HMNAR they preferentially nested in the largest aspen, both living and dead (Dobkin et al. 1995). Among cavity nesters in our study, only the European Starling (*Sturnus vulgaris*) decreased significantly. In addition, 6 of 8 cavity nesters in riparian aspen exhibited nonsignificant declines, including sapsuckers and the Northern Flicker (*Colaptes auratus*), which are the 2 primary excavators and keystone species in this cavity-nesting community (Dobkin et al. 1995; Martin & Eadie 1999).

Most aspen stands on HMNAR before livestock exclusion had either 1- or 2-layered aspen canopies (USFWS 1994), which reflected the episodic nature of successful recruitment of shoots into the canopy over many previous decades. This structural pattern is not uncommon in aspen woodlands in the West (Mueggler 1989; Suzuki et al. 1999; Wall et al. 2001) and is often attributed to extensive herbivory, either by wild ungulates or livestock (Kay & Bartos 2000; Ripple & Larsen 2000; Kaye et al. 2005), although insects, disease, or drought may also contribute to this episodic pattern (Kurzel et al. 2007).

We interpret the very high density of aspen shoot regeneration on most plots during phase 1 as an immediate response to release from grazing, but we discuss alternate explanations below. Similar large pulses in shoot density are well documented after other types of disturbance such as cutting or burning (Bartos & Mueggler 1981; Crouch 1983; Prévost & Pothier 2003). We documented a large decrease in shoot density from phase 1 to phase 2, which is consistent with density-dependent mortality expected among shoots at high density during recovery from a major disturbance (Bartos & Mueggler 1981; Crouch 1983), including ungulate browsing (Baker et al. 1997).

The canopies of riparian aspen stands became more layered during the 12 years following cattle removal, as evidenced by the 64% increase in medium-sized trees. The relatively low number of medium-sized trees in phase 1 indicates that conditions were not conducive to shoot regeneration and survival of stems to >6 cm diameter for several decades before phase 1. Likewise, the net loss of large-diameter trees indicates recruitment of medium- into large-diameter trees was inadequate to compensate for natural mortality in the latter, further indicating a paucity of medium-sized trees in prior decades. Elsewhere, the lack of a multilayered aspen canopy and gradual loss of large-diameter trees has been attributed to prolonged herbivory that limited the growth and survival of suckers in previous decades (Kay & Bartos 2000; Martin 2007; Hollenbeck & Ripple 2008).

Unlike riparian aspen stands, snow-pocket stands exhibited a slight thinning of all size classes rather than a change in relative stem size composition. Snow-pocket stands, relative to riparian stands, exhibited less self-thinning of shoots and small trees and did not exhibit an increase in medium-sized trees. The latter result suggests slower growth of small stems or lower survival of small stems into medium stems. Snow-pocket stands, which are denser, often on hillsides, and usually do not contain surface water, may have been used less by cattle (e.g., Roath & Krueger 1982) or may have a different optimal, or ecologically stable, stand structure and thus a different recovery trajectory (Laycock 1991; Strand et al. 2009). The statistically nonsignificant loss of large-diameter stems in snow-pocket stands was proportionately similar to that in riparian stands and appears characteristic of natural senescence after decades of limited regeneration (e.g., Martin 2007).

Browsing by wild ungulates, especially by elk in winter, negatively affects aspen regeneration and stand structure (Baker et al. 1997; Suzuki et al. 1999; Kaye et al. 2005). However, elk occurred only incidentally on HMNAR, and neither elk nor the relatively small mule deer (*Odocoileus hemionus*) population (800–1000 individuals) remain in the area during winter (Oregon Department of Fish and Wildlife, unpublished data), when most ungulate browsing of aspen occurs (e.g., Suzuki et al. 1999). Furthermore, mule deer abundance was fairly stable preceeding and during phase 1 (1985–1994) and declined somewhat between phases, and thus does not appear to explain changes in the density of aspen shoots, which was high in phase 1 and decreased between phases.

Little evidence links annual variation in precipitation and aspen regeneration (Ripple & Larson 2000; Hessl & Graumlich 2002; Martin 2007). Although phase 1 had higher precipitation and regeneration, the lack of multilayered aspen canopies in phase 1 stands does not appear consistent with multiple precipitation-induced peaks in regeneration that would be expected from long-term precipitation patterns (Fig. 4b) (Baker et al. 1997). Extreme and prolonged drought can contribute to stem mortality of larger size classes, especially as seen in sudden aspen dieback (Hogg et al. 2008; Worrall et al. 2008). However, our stands did not exhibit visual signs of insect or disease outbreaks or drought stress (S.L.E. and D.S.D., personal observation) or rapid crown dieback and cohort loss, which are characteristic of sudden aspen dieback (Worrall et al. 2008). Self-thinning is characteristic of some self-sustaining stands and need not indicate stress (Smith & Smith 2005). Furthermore, conditions during phase 2 were not those of an extreme or prolonged drought; precipitation increased over the long term and was above average before phase 2. Cattle removal remains the most likely primary driver of the changes we documented, although aspen stand dynamics result from a complex interaction of processes (Romme et al. 1995) and interpretation will benefit from further dendrochronological and longitudinal studies.

Across the 12 years of livestock exclusion, aspen woodlands on HMNAR showed substantial movement toward recovery of biological integrity (as defined by Angermeier & Karr 1994). Relative to elsewhere in the Intermountain West of the United States, most of our stands exhibited high densities of regeneration in both phases (Mueggler 1989; Strand et al. 2009) and substantial recruitment of stems into the overstory (Suzuki et al. 1999; Wall et al. 2001; Rogers et al. 2010). The increased native forb and riparian shrub cover, with a concomitant decrease in sagebrush cover, indicate increased groundwater availability and improved riparian condition (Dobkin et al. 1998; Wright & Chambers 2002). The increased avian abundance and relatively high nesting success (Heltzel & Earnst 2006) illustrate a positive multitrophic-level response to livestock removal. Our study area serves as a landscape-level livestock exclosure (Bock et al. 1993) and can potentially provide comparison to ecologically similar sites in the vast semiarid, grazed ecosystems of western North America.

Federal land-management agencies operate under a mandate to manage for ecological values on lands grazed by livestock (e.g., BLM 2001), but these agencies are faced with the dilemma that livestock exclusion is generally the most effective means of improving degraded riparian areas (Elmore & Kauffman 1994). Nonetheless, given that livestock are present on ~90% (Fleischner 2010) of the 1.5 million km^2 of federally owned land in the West, reducing the negative effects of livestock on federal lands could potentially help restore large expanses of western ecosystems. Similarly, there is growing evidence that the presence of large predators, especially wolves (*Canis lupus*), affect wild ungulate abundance and behavior and initiate a trophic cascade that improves regeneration, health, and persistence of aspen and other deciduous vegetation (Ripple & Larsen 2000), an effect that could be spatially and temporally extensive in the West (Beschta & Ripple 2009). In addition to immediate benefits, diminishing the effects of domestic and wild ungulate populations is likely to improve the resilience of aspen and other woody riparian ecosystems as climate-mediated stressors such as wildfires and drought-induced mortality change in frequency.

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Supporting Information

Data on avian abundance in phases and the difference in abundance between phases (Appendix S1) and cover and aspen stem density in phases and difference between phases (Appendix S2) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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Ecology and Conservation of Lynx in the United States

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Chapter 15

Lynx Conservation in an Ecosystem Management Context

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Abstract—In an ecosystem management context, management for lynx must occur in the context of the needs of other species, watershed health, and a variety of products, outputs, and uses. This chapter presents a management model based on the restoration of historical patterns and processes. We argue that this model is sustainable in a formal sense, practical, and likely to provide for the needs of a variety of species, including lynx. Because our knowledge of lynx biology and disturbance ecology is limited, implementation of this model will be experimental and must be accompanied by a well-planned monitoring program.

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disturbance stochasticity; one drainage may burn frequently, whereas an adjacent drainage may avoid fire for centuries. For example, within a burned drainage variation in wind patterns may leave unburned patches, and diurnal variation in moisture and temperature during a fire may result in some areas having high tree survival, whereas others do not. This stochastic process leads to a landscape with a mosaic of conditions at various spatial scales. A very large, stand-replacing fire has little mosaic within its boundaries (Eberhart and Woodard 1987), but viewed at the spatial scale of the region and the temporal scale of 100 years, it represents a patch in a fire mosaic on the landscape. Such an event produces a large, contiguous area of young forest but, in the larger context, there will be areas of very old forest as well.

Johnson et al. (1995) and Agee (Chapter 3) argue that naturally occurring age distributions in forested landscapes, especially landscapes composed of boreal and subalpine forests (Johnson et al. 1995), often fit negative exponential functions, indicating a constant-probability stochastic process. While this model may not always produce the best fit (Chapter 3), all stochastic processes produce a characteristic signature in the resulting age distribution, including asymptotic "tails" in the older age classes (Fig. 15.1a; Van Wagner 1978; McKelvey and Lamberson 1994). In contrast, cyclic processes, such as even-aged rotation forestry, truncate the age distribution (Fig. 15.1c). In a cyclic system, there is no formal mechanism to generate stands or elements older than rotation age. However, in a forested landscape with a negative exponential stand-age distribution, about 36% of the landscape will be older than the average stand age, about 13% older than twice the average stand age, and about 5% older than three times the average stand age (Table 15.1). Although there is no maximum stand age in this system (Finney 1994), old stands that have not burned will be subject to other sources of mortality, such as insects and disease.

Table 15.1—Equilibrium time since disturbance for forests with a negative exponential stand age distribution. Where time since disturbance exceeds the longevity of individual trees, the stand ages will be younger than are indicated in this table, and the forests will be characterized by "gap" processes due to overstory mortality.

Fire return interval (average stand age)	Percent of area (by age class) <50	50-100	100-200	200-300	>300
100 years	40	24	23	9	4
150 years	29	20	25	13	13
200 years	23	17	24	14	22
300 years	16	13	20	15	36

= 36% > 100 yr
= 51%
= 60%
= 71%

The retention of older stands essentially mimics the process of ecological "escape" in systems characterized by large-scale disturbances. In a catastrophic fire, variation in fire intensities and the vagaries of weather allow forest elements at many scales to survive, including individual trees, small groups of trees, stands, or entire watersheds. As multiple fires overlap over many years, there will be small areas embedded in larger areas of younger forest that have, by chance or location, survived multiple fires. This escape of older elements is not effectively mimicked by embedding fixed reserves in a landscape of cyclic management. In a stochastic system, with each new disturbance event, older forests may be destroyed or altered, or they may be left intact; thus, late-successional stands are not spatially assigned and maintained, but emerge dynamically within the disturbance process. A variety of other differences, some of them dramatic, also distinguish fixed-rotation from stochastic systems. For example, if a natural fire-return interval is 100 years, and a 100-year clearcut rotation is implemented to mimic natural rates of disturbance, the average stand age in the managed forest will be 50 years. In a stochastic system with a negative exponential stand-age distribution, however, the same landscape would have an average stand age equal to the fire-return interval, or 100 years.

Assuming that the scale of disturbance corresponds with the movement capabilities of individual lynx, landscapes generated through these stochastic processes would provide an amenable environment for lynx by producing areas of young, dense forest without removing the older elements. If the natural fire regime can be estimated for an area that is to be managed for lynx, then it is logical to use this rate to design management strategies. The overall rate of disturbance would be an aggregate of the cumulative effects of timber harvest, fire, and other natural disturbances (catastrophic windthrow or insect epidemics) on age structure. Therefore, in areas subjected to large wildland fires, or where inholdings are managed for short-rotation timber yield using even-aged management, timber harvest (including salvage) may be inappropriate for decades. In some regions, significant amounts of wilderness or National Park land will be part of the planning area, and management of natural fires must be incorporated into planning. We assume here that fire and timber harvest are similar processes in their capacity to initiate secondary succession. In addition, we would argue for a planned rate of disturbance somewhat less than the historically derived estimate. It is easy to increase the disturbance rate if desirable, but much harder to recover old-growth forests removed through overly aggressive management.

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INSIDE

Science FINDINGS

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"Science affects the way we think together."

Lewis Thomas

Sage-Grouse on the Edge: Understanding and Managing Western Landscapes for Their Survival

"Conservation of our natural resources and their proper use constitute the fundamental problem which underlies almost every other problem of our national life."

—Theodore Roosevelt

C. Kramer

As sagebrush habitat declines, so do sage-grouse populations. Scientists have identified the amount of sagebrush coverage needed to support sage-grouse in a given area.

With its spiky tail feathers, luxuriant ruff resembling fur more than plumage, and a mating dance unique in the avian world, the greater sage-grouse is an icon of North American sagebrush landscapes. But these birds, which once ranged across 17 states and parts of Canada, have undergone dramatic declines during the last several decades. By some estimates, their overall population has plummeted from about 1.1 million before Euro-American settlement to about 142,000 today—a decrease of more than 80 percent. Nearly a third of that loss has occurred since 1985. Sage-grouse currently inhabit about 56 percent of their historical range, with populations in Washington, Oregon, Idaho, Montana, North Dakota, Eastern California, Nevada, Utah, Colorado, South Dakota, Wyoming, and the Canadian Provinces of Alberta and Saskatchewan.

Although local trends vary—with sage-grouse numbers holding steady in some areas and losing ground rapidly in others—the species' future has become a growing concern for wildlife biologists, land managers, and a host of conservation organizations. The situation has prompted numerous legal actions under the Endangered Species Act (ESA). In 2010, the U.S. Fish and Wildlife Service (USFWS) determined that although the greater sage-grouse warrants ESA protection, the need to address other species facing more immediate extinction threats precludes listing it at this time.

"Species like the sage-grouse that have been so wide-ranging and historically abundant often are taken for granted," says Michael Wisdom, a research wildlife biologist with the Pacific Northwest Research Station, based in La Grande, Oregon. "It may seem that with

IN SUMMARY

Populations of greater sage-grouse have declined dramatically across their North American range for many decades in response to harmful effects of a variety of human activities and land uses, prompting legal actions to protect the species under the Endangered Species Act. To evaluate the impacts of landuse and habitat changes on sage-grouse, Michael Wisdom, a research wildlife biologist, and his colleagues used novel landscape modeling methods to carry out a comprehensive, rangewide analysis that considered 22 environmental factors in areas currently inhabited by sage-grouse compared to areas where the species is locally extinct. The researchers identified threshold values for the amount of sagebrush critical to sage-grouse persistence, addressing a key question about the species' habitat requirements.

The assessment also revealed the potentially negative impacts of tall-tower structures on sage-grouse occurrence. The findings highlighted the urgency of integrating efforts among public agencies and private landowners at all resource management levels to counter the cumulative and synergistic threats to sage-grouse conservation. In combination with related studies, this research has expanded the scientific knowledge base for resource managers and other decisionmakers concerned with designing and implementing landscape strategies for sage-grouse recovery.

tens of thousands of these birds remaining, the situation is good. But the cumulative, harmful effects of a variety of human activities and land uses have exacted a heavy toll on populations and their habitat. And once habitat and populations become fragmented, downward spirals can occur suddenly."

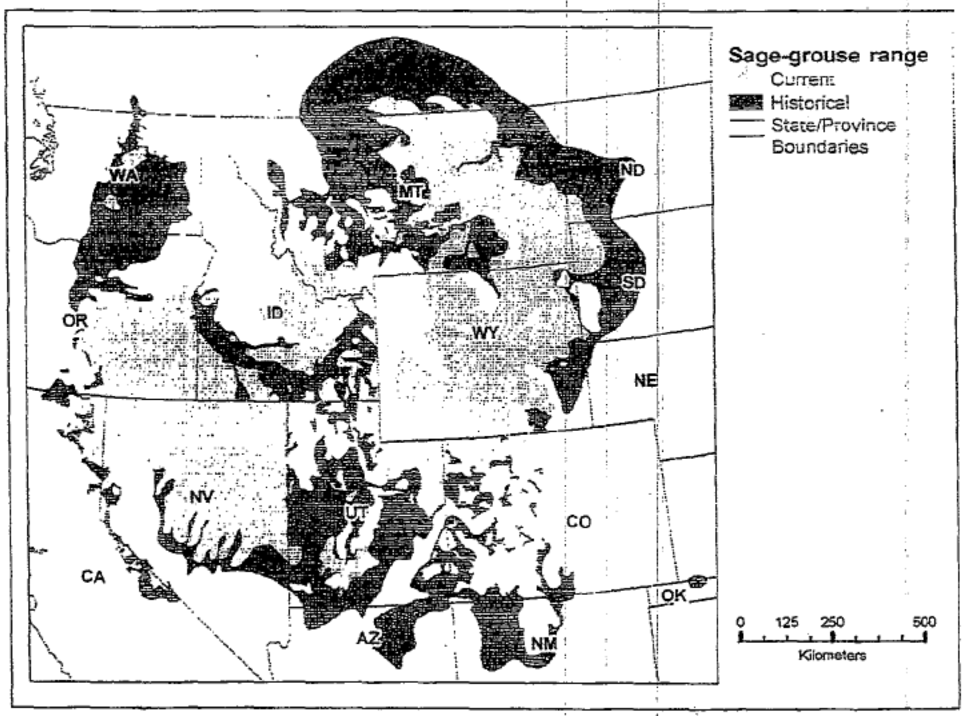
To shed light on this subject, Wisdom and colleagues conducted a novel range-wide analysis of the landscape factors—natural and human induced—potentially affecting the birds' habitat and population levels. One of the most comprehensive landscape assessments ever conducted for a terrestrial species, it demonstrated the interplay among an array of environmental dynamics across some 125 million acres. The analysis was a fundamental part of a larger body of research that the USFWS used in making its 2010 ruling. Recently published as a scientific monograph, this compendium offers the most authoritative basis for sage-grouse conservation and habitat management.

KEY FINDINGS

- The persistence of sage-grouse populations strongly depends on the amount of sagebrush across a landscape. When managing landscapes 250,000 acres or larger, a minimum of 50 percent of area in sagebrush cover appears to be required for long-term survival of a population, whereas less than 27 percent area in sagebrush cover portends a high risk for local extinction.
- Compared to areas currently occupied by sage-grouse, zones where their populations are locally extinct are found mainly at lower elevations, closer to power lines and communication towers, and on private land. Areas of local sage-grouse extinction largely correspond with fragmented habitat and the edges of the current range.
- Sage-grouse habitats are very sensitive to human disturbances, which are accelerating habitat declines across vast expanses of the species' range. Key threats in the western portion of sage-grouse range include the pervasive spread of invasive plants and associated changes in wildfire regimes.
- In the eastern portion of sage-grouse range, the proliferation of oil and gas development negatively affects huge areas of habitat far beyond actual development sites.
- Conventional management approaches to maintaining and restoring vulnerable habitats have not succeeded.

SAGE-GROUSE RANGE, PAST AND PRESENT

Teasing out the reasons for sage-grouse population losses requires knowledge of where they once thrived and how conditions there compare with areas still supporting the species. Wisdom's team began with maps of historical and current sage-grouse range, compiled in 2004. They selected 375 (out of more than 1,300) historical sage-grouse locations: 239 were in areas of current (occupied) range, and 136 were in extirpated (formerly occupied) range. Around each location they mapped a circular area of roughly 250,000 acres. The circles served as sampling units for analyzing and comparing the conditions for 22 environmental variables likely to differ between occupied and extirpated areas.



Current sage-grouse habitat is about 56 percent of what it was before Euro-American settlement of the American West.

"Nine variables were biological measures, such as total area of sagebrush, patch size, and density," Wisdom explains. "Five were abiotic, including precipitation, elevation, and soil characteristics. The other eight variables were related to human activities, such as agriculture, population density, and the presence of roads and other developments."

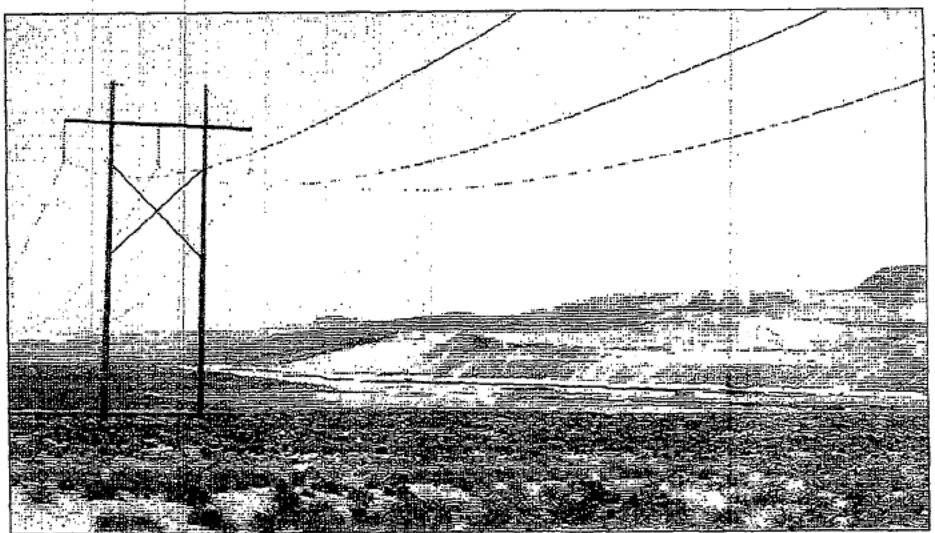
The researchers collected spatial data on each of these environmental features across sage-grouse range. Because continuous "layers" of data were necessary for the analysis, two potentially significant factors—livestock grazing and energy extraction—could not be included. "Unfortunately there are no consistently accurate measures of grazing across sage-grouse range," Wisdom says, "and the collection of spatial data hasn't kept up with the rapid expansion of energy development activities since the early 2000s across sage-grouse range. However, other studies complementary to ours have used accurate spatial data to evaluate energy development impacts in smaller sections of the range."

All this detailed information was used to design several experimental computer models that tested different combinations of variables to determine which ones best differentiated between occupied and extirpated range. Creating a model that accurately reflected current conditions "on the ground" provided a tool for predicting places where sage-grouse might be at risk for local extinction and areas where habitat and populations are stable.

CULPRITS FOR EXTIRPATION

The modeling revealed five prime indicators for the presence or absence of sage-grouse: the amount of sagebrush, elevation, proximity to transmission lines and to cellular towers, and landownership. "We found that areas of extirpation had less sagebrush, were at lower elevations, were situated closer to power transmission lines and to communication towers, and were privately owned," Wisdom says. More often than not, extirpated areas corresponded with fragmented habitat or the periphery of sage-grouse range, where environmental conditions are changing most rapidly.

Although it may seem obvious that the overall amount of sagebrush cover is the strongest predictor of sage-grouse habitation, Wisdom says that "up to the point of this analysis, many public-interest groups questioned, in court and elsewhere, whether these birds are true sagebrush obligates. Our work established clearly that without adequate sagebrush, they will not persist." Similar to previous studies, the results showed that in landscape areas of 250,000 acres or larger, an area with at least 50 percent sagebrush cover is likely to support sage-grouse. When sagebrush coverage is less than 27 percent, sage-grouse are absent. "Fortunately, federal and state agencies now can access accurate maps of sagebrush cover to estimate these threshold values, and such assessments are underway in some areas," he notes.



M. Wisdom

Areas where sage-grouse have been extirpated have less sagebrush and tend to be at lower elevation, a likely proxy for human development, and closer to power lines and communication towers.

Sagebrush prevalence is closely tied to elevation, which represents a suite of conditions that contribute to quality habitat, Wisdom explains. "Sagebrush habitats at higher elevations receive more precipitation and thus have more vibrant native plant communities and better resistance to invasive exotic plants. Also, these areas have less human activity and development, and if it does occur, the land is more resilient to the effects." In contrast, at lower elevations, former expanses of sagebrush have succumbed to widespread change, such as conversion to livestock forage, agriculture, urban development, and natural resource extraction. And, invasive plants—particularly cheatgrass, a rapid colonizer of disturbed zones that easily outcompetes slower-growing sagebrush—thrive in warmer, drier areas that characterize lower elevations.

The team was surprised at the relatively high significance of power transmission lines and communication towers. "This is an emerging line of research, and we weren't sure what our analysis would show, but clearly the distance to these tall structures helps explain sage-grouse occurrence." Sage-grouse are more likely to be found as distance from power lines and communication towers increases. "Without the inclusion of these data, the modeling is less accurate," Wisdom says.

It's plausible that sage-grouse would be shy of structures so foreign to the environment in which they evolved. And although sage-grouse aren't known as champion fliers, at times they do take to the sky, resulting in lethal encounters with towers and lines. "Studies have documented 5- to 10-mile migrations in some populations that shift habitat use seasonally between different elevation zones. But overall we don't know much about these behavioral patterns or the birds' migratory pathways," Wisdom notes.

Still, given the fairly small percentage of land occupied by transmission lines and cell towers, the mechanism for their negative effects remains obscure. "It could be that tall towers are proxies for concentrated human land use or clusters of environmental conditions we didn't directly measure. Once you have roads into these sites, for example, all kinds of opportunities open up for other disturbances—water development for livestock, the spread of exotic plants, human-caused wildfires, and so on. Individually the effects of these lines and towers don't seem dramatic, but over decades they can be cumulative and synergistic," Wisdom says. It's also possible that electromagnetic radiation from transmission lines are affecting sage-grouse, as studies have demonstrated harmful effects—particularly reproductive ones—in other avian species using areas close to power lines.

The proliferation of tall towers is one of the fastest growing sources of human disturbance in the West. Some places reportedly offering the highest potential for wind energy development coincide with some of the best remaining sage-grouse habitat. As well, plans abound for amplifying and expanding electric grids and saturating the region with cell phone coverage. "If we're going to seriously address the range-wide conservation of sage-grouse, it's crucial that we consider these structures in both research and management," Wisdom says. As a member of a national working group on tall towers, he serves as a technical authority on sage-grouse relations with transmission lines, communication towers, and other intrusive structures.

Purpose of PNW Science Findings

To provide scientific information to people who make and influence decisions about managing land.

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USDA United States Department of Agriculture

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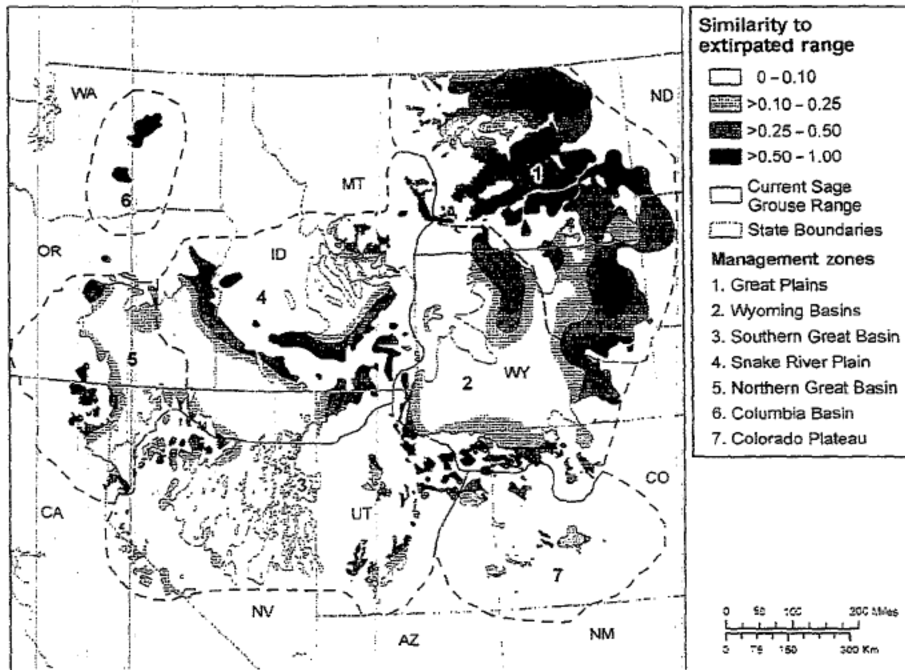
MANAGING FOR ENDURING SAGE-GROUSE POPULATIONS

The greatest losses in sage-grouse numbers and habitat have occurred on private land, where the most sweeping landuse changes have taken place. With nearly 40 percent of remaining sage-grouse habitat privately held, private landowners have an important role to play in conserving the species. "Some landowners have initiated very effective habitat management efforts on their own—for example, sustainable livestock grazing systems that maintain sagebrush cover and native bunchgrasses," Wisdom notes. Additional opportunities exist for public-private partnerships under a program developed by the USDA Natural Resources Conservation Service to manage and improve sage-grouse habitat across the species' range.

Most of the currently occupied habitat, however, is on public land—50 percent managed by the Bureau of Land Management and 9 percent managed by the Forest Service—and this means what happens on the public portion of sage-grouse range likely will determine the species' fate. Successful management for sage-grouse conservation will also benefit nearly 50 other animal species found in sage-grouse range, Wisdom adds.

The challenges of responding to sage-grouse needs and addressing threats to its survival on a range-wide scale are enormous. But it's clear to Wisdom that the situation demands a change in course, as conventional management efforts have met with little or no success. "Take recent attempts to reestablish native grasses and sagebrush after wildfires in areas formerly occupied by cheatgrass, for example.

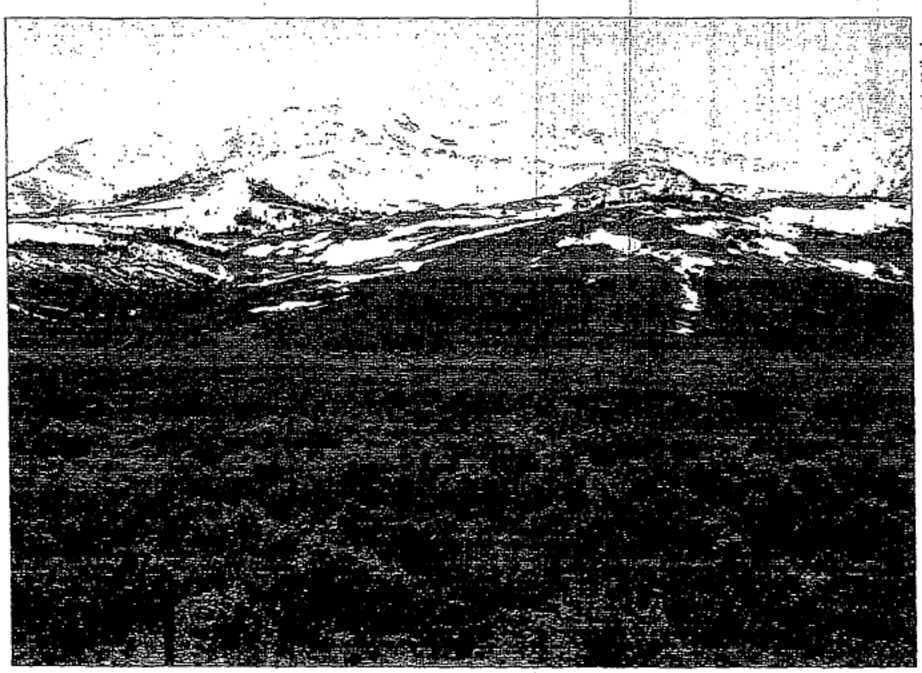


The most vulnerable sage-grouse habitat is shown in black: areas in light gray are the least vulnerable. This output comes from a model that evaluated environmental similarities between current sage-grouse habitat and areas where the species no longer exists.

Reseeding needs to happen quickly to keep cheatgrass from recolonizing, but it also should be timed with rainfall, which is sparse and unpredictable, so the chances are slim for all the right conditions to come together," he says.

Given financial limitations, Wisdom believes that using agency resources to modify land uses to maintain sage-grouse-friendly conditions where they still exist may be more effective than trying to repair ruined habitat. "We've ignored factors associated with land uses and human activities that by themselves don't seem so detrimental but in combinations have cumulative, synergistic effects," Wisdom explains. "Immense changes have taken place across a huge species range that spans innumerable land ownerships and agency administrative boundaries. The situation calls for integrative management to improve conditions. Management actions are implemented locally, but they must fit appropriately into a well-considered, overarching plan to maximize their effectiveness. That's probably the greatest challenge in terms of research and management."

The kind of holistic landscape analysis Wisdom's team performed is especially helpful in providing the "big picture" needed for understanding large-scale processes and environmental patterns affecting the species. And it can be applied on smaller, local scales. For example, resource managers will be able to use the models developed for the analysis to test the effects of actions they are considering for a given area. "It may take some time for the necessary technology transfer to happen," Wisdom says, but that's the aim of science-management partnerships: to adapt tools used for research to more specific management situations."



M. Wisdom

Sagebrush habitats at higher elevations receive more precipitation, which helps the native plant communities be more resistant to invasive exotic plants.

The analysis also produced maps that can be used to identify sage-grouse strongholds—large areas of intact habitat where habitats and populations appear stable. Two extensive strongholds have been identified. One lies in the western part of the range, encompassing parts of Oregon, Nevada, and Idaho; the other spans nearly half of Wyoming. "These are key areas for focused management," Wisdom says. "By concentrating on the specific threats that pose the highest risk in each stronghold, we have a good shot at sustaining sage-grouse populations over the long term. In the western strongholds, this means minimizing all human disturbances that facilitate the spread of invasive annual grasses. In eastern strongholds, new mitigation methods are required to ensure the maintenance of very large tracts of sagebrush habitats and minimize the negative effects of human activities and land uses—particularly widespread energy development."

Wisdom acknowledges that this kind of "triage" strategy—which favors channeling resources to population strongholds in favor of other areas where sage-grouse are seriously threatened—is controversial. But agency budgets are far too limited for mounting intensive management programs across sage-grouse range, he says, and priorities must be set. "It's a difficult issue that must be discussed and dealt with objectively, and we need to study the tradeoffs between different management proposals."

The road ahead for the sage-grouse will doubtless continue to be a bumpy one, but Wisdom's research and the other monograph studies have added considerably to the knowledge needed for conserving the species. Since the 2010 USFWS decision, these findings have been used in county, state, and federal planning activities across western North America. The federal Departments of the Interior and Agriculture have committed to adopting new multiagency strategies for landscape management related to sage-grouse, and the USDA Natural Resources Conservation Service is using the monograph to guide the development of regional and national strategies for private land management of sage-grouse habitats.

LAND MANAGEMENT IMPLICATIONS

- Reversing the ongoing losses in sage-grouse populations and habitats across their range will require planning and coordination among public agencies and private landowners. Opportunities exist for local management to be integrated with overarching landscape strategies.
- Focusing management efforts on sage-grouse strongholds, where populations and habitats remain robust, is likely the most effective strategy for long-term conservation of the species. This will require concerted efforts to address specific threats posing the highest risks in different areas of the range.
- Preserving vulnerable areas currently occupied by sage-grouse calls for adaptive management strategies, including research to design, implement, and evaluate the effectiveness of restoration management.
- Through integrated management, the synergistic effects of detrimental human activities affecting sage-grouse habitats and populations can be reduced. Implementing holistic landscape strategies can help ameliorate effects from tall-tower structures and other disturbances that have not yet been addressed in a cohesive way.

"Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise."

—Aldo Leopold

N. Hedges

The Washington ground squirrel is one of about 50 other species that would benefit from sagebrush habitat conservation.

FOR FURTHER READING

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145-184; 203-251; 451-472; 549-563

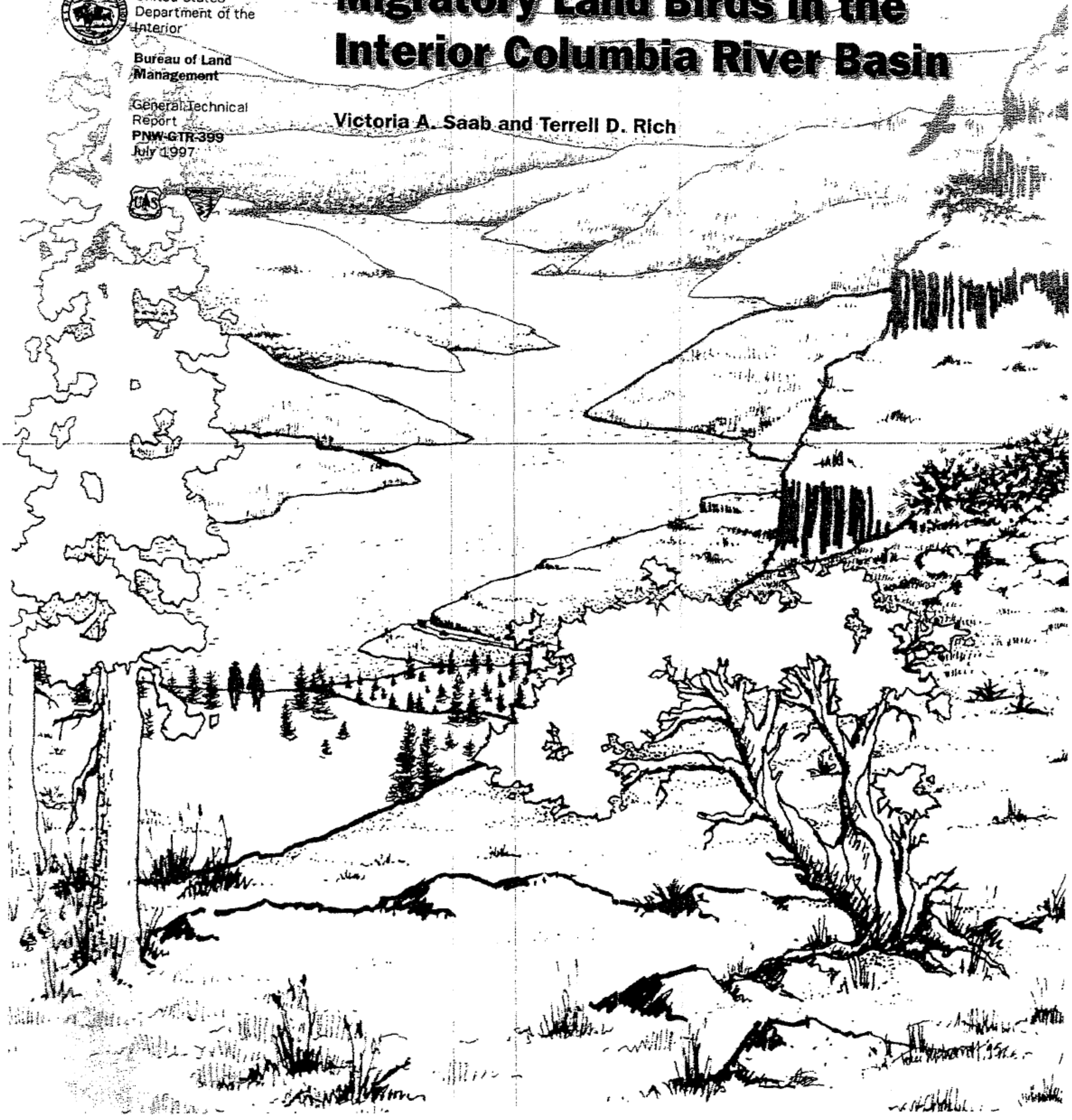
USDA United States Department of Agriculture
Forest Service
Pacific Northwest Research Station

United States Department of the Interior
Bureau of Land Management

General Technical Report
PNW-GTR-399
July 1997

Large-Scale Conservation Assessment for Neotropical Migratory Land Birds in the Interior Columbia River Basin

Victoria A. Saab and Terrell D. Rich



pg 47- sum of spp high concern

pg 30 sage brush reserves

Loggerhead? 32

Tech Rept PNW-GTR-399. P. NW Research Station

ABSTRACT

1997.

Saab, V. and T. Rich. 199X. Large-scale conservation assessment for neotropical migratory landbirds in the Interior Columbia River Basin. Gen. Tech. Rep. PNW-GTR-XXX. Portland, OR.

Large blocks 30

Brewers 31

see pg 47 high spp of concern

The status and habitats of neotropical migratory landbirds (NTMB) are evaluated within the Interior Columbia River Basin (CRB). Objectives are to examine population trends, estimate NTMB responses to alternative management activities and provide recommendations by habitat and species that will lead to long-term persistence of NTMB populations. Among 132 NTMBs that breed in the Interior CRB, 38 species showed significant population trends over two time periods, 1968-1994 (26-year), and 1984-1994 (10-year). Fourteen species had significant declines over the 26-year period and 13 over the 10-year period. Thirteen and 12 species showed significant increases over those periods, respectively. Among 16 defined habitats, riparian vegetation was used by more species (64 percent) than any other habitat. Other habitats used by relatively many species included young coniferous forest (38 percent) and old growth/mature forest (35 percent). Nine habitats had more species with significantly decreasing than increasing populations (26-year period) and seven habitats had more increasers. Five habitats (riparian, old growth forests, shrubsteppe, grasslands, and juniper) are identified for management priorities based on species declines, vulnerability to human activities and habitat loss. Among the four management themes considered, more species (63) were of high concern under Consumptive

Table 5 - pg 47 high concern

Juniper - 32

Falco peregrinus
American Kestrel
Short-eared Owl
Asio flammeus
Burrowing Owl
Athene cunicularia
Common Poorwill
Common Nighthawk
White-throated Swift
Aeronautes saxatalis
Western Kingbird
Tyrannus verticalis
Say's Pheobe
Sayornis saya
Horned Lark
Eremophila alpestris
Bobolink
Dolichonyx oryzivorus
Brown-headed Cowbird
Western Meadowlark
Sturnella neglecta
Brewer's Blackbird
Euphagus carolinus
Vesper Sparrow
Pooecetes gramineus
Savannah Sparrow
Passerculus sandwichensis
Grasshopper Sparrow
Ammodramus savannarum
Lark Sparrow
Chondestes grammacus
Clay-colored Sparrow
Sage Sparrow
Amphisipiza belli
Lark Bunting
Calamospiza melanocorys
Cliff Swallow
Hirundo fulva
Loggerhead Shrike
Lanius ludovicianus
Rock Wren
Salpinctes obsoletus
Blue-gray Gnatcatcher
Mountain Bluebird

SHRUBSTEPPE

Long-billed Curlew
Mourning Dove
Turkey Vulture
Northern Harrier
Red-tailed Hawk
Swainson's Hawk
Ferruginous Hawk
Golden Eagle
Prairie Falcon
Peregrine Falcon
Merlin
American Kestrel
Short-eared Owl
Burrowing Owl
Common Poorwill
Common Nighthawk
White-throated Swift
Black-chinned Hummingbird
Western Kingbird
Ash-throated Flycatcher
Myiarchus cinerascens
Say's Phoebe
Gray Flycatcher
Horned Lark
Brown-headed Cowbird
Western Meadowlark
Northern Oriole
Icterus galbula
Brewer's Blackbird
Lesser Goldfinch
Carduelis psaltria
Vesper Sparrow
Grasshopper Sparrow
Lark Sparrow
Brewer's Sparrow
Spizella breweri
Black-throated Sparrow
Amphispiza bilineata
Sage Sparrow

Green-tailed Towhee
Lark Bunting
Cliff Swallow
Northern Rough-winged Swallow
Stelgidopteryx serripennis
Loggerhead Shrike
Sage Thrasher
Oreoscoptes montanus
Northern Mockingbird
Mimus polyglottus
Rock Wren
Mountain Bluebird

JUNIPER WOODLANDS = 43 species

Mourning Dove
Turkey Vulture
Red-tailed Hawk
Swainson's Hawk
Ferruginous Hawk
Golden Eagle
Prairie Falcon
Merlin
American Kestrel
Long-eared Owl
Burrowing Owl
Northern Flicker
Common Poorwill
Common Nighthawk
White-throated Swift
Broad-tailed Hummingbird
Ash-throated Flycatcher
Say's Phoebe
Gray Flycatcher
Western Meadowlark
Cassin's Finch
Lesser Goldfinch
Pine Siskin
Vesper Sparrow
Lark Sparrow
Chipping Sparrow
Dark-eyed Junco
Sage Sparrow
Green-tailed Towhee
Lazuli Bunting
Western Tanager
Piranga ludoviciana
Cedar Waxwing
Bombycilla cedrorum
Loggerhead Shrike
Virginia's Warbler
Black-throated Gray Warbler
Dendroica nigrescens
Sage Thrasher
Rock Wren
Ruby-crowned Kinglet
Blue-gray Gnatcatcher
Townsend's Solitare
American Robin
Western Bluebird
Mountain Bluebird

ALPINE

Golden Eagle
Northern Flicker
Rufous Hummingbird
Calliope Hummingbird
Olive-sided Flycatcher
Chipping Sparrow
Dark-eyed Junco
Lincoln's Sparrow
Melospiza lincolnii
Fox Sparrow
Lazuli Bunting
Wilson's Warbler
Wilsonia pusilla
American Pipit
Anthus spinoletta
Hermit Thrush
Mountain Bluebird

FRESH WATER MARSHES, PONDS, LAKES

Long-billed Curlew

Appendix 4b. Rationale for habitat risk rankings under the Consumptive Demand Theme over a 100-year period, developed by CRB staff biologists.

Habitat	Rank	Rationale
1. Old Growth/Mature Coniferous Forest	5	High levels of concern for old growth. Policy for old growth protection not established. Old growth ponderosa pine of particular concern. Logging rate of old growth will continue at high levels.
2. Young Coniferous Forest	1	Not limiting.
3. Clearcut/Seedling/Shrub Coniferous Forest	1	Not limiting.
4. Mountain Shrub/Prairie Brush field	4	High levels of grazing and fire suppression in combination with the high risk of invasion of exotics leave this community at risk.
5. Grasslands	5	Rare habitat type with patchy distribution within the assessment area. High levels of grazing and fire suppression activities in combination with the high risk of invasion/introduction of exotics leave this community at high risk.
6. Shrubsteppe	5	Same as habitat type 5.
7. Juniper Woodlands	5	Similar risks as in type 5 however, risk of afforestation (control of pioneering juniper) as well as logging of old stands of juniper also of concern.
8. Alpine	3	Though somewhat protected mostly in wilderness areas, there is a risk due to livestock grazing as well as invasion of exotics through non-native livestock (including pack animals). Very fragile ecosystem.

Habitat Characteristics at Woodpecker Nest Locations and at Non-nest Random Locations in the Elkhorn Mt, Helena National Forest Before (2002-2006) and After a Mountain Pine Beetle Outbreak (2009-2011)

PROGRESS REPORT

October 2012

Submitted by

Vicki Saab, Jonathan Dudley, & Matt Dresser (Rocky Mountain Research Station & Montana State University)

To

Denise Pengeroth (Helena National Forest)

Nest Surveys: Nest surveys were conducted from 15 May - early July along belt transects (approximately 0.2 x ~0.8 km) (Dudley and Saab 2003). Transects were surveyed with the aid of playbacks, two times during the season. Birds that were detected during surveys were subsequently followed until their nests were found. A GPS location and notes describing the location were taken to allow for future visits. Once an occupied nest cavity was determined, nests were monitored every 3-4 days until fledging or failure.

Preliminary Results (see Table 1a)

Snag densities: Vegetation was measured annually at nest locations, and once before and once after the outbreak at random locations. Measurements were completed at 89 before (2002-2006) and 124 nest locations after (2009-2011) the outbreak, and at 76 non-nest random plots once before (2002-2003) and once after (2010) the outbreak. In 2010, large (> 9" dbh) live tree (all spp.) densities were reduced by nearly half (90.3 vs. 47.7 trees/ac), while large snag densities increased > 15 times (3.5 vs. 50.3 snags/ac) compared with pre-outbreak conditions at random locations. These changes are representative of average conditions on the landscape.

Pre-outbreak, all woodpecker species selected locations of higher large snag densities than those measured at random. Post-outbreak, however, snag densities at woodpecker nests were variable compared with random locations. Post-outbreak snag densities were significantly higher at three-toed woodpecker nests compared with random locations (73.3 ± 4.6 vs. 50.3 ± 3.1 snags/ac). Higher snag densities near their nests likely provided greater foraging opportunities for this beetle-foraging woodpecker.

Tree Species: Ponderosa pine (PIPO) is the dominant tree species (> 60% of tree composition) in our study units. Aspen (POTR) is rare on the landscape (≤ 3% of all tree species) but has been highly favored for nesting substrate, particularly pre-outbreak. Once conifer snags were recruited as a result of the outbreak, Hairy and three-toed woodpeckers shifted and expanded their nesting use of primarily aspen to ponderosa and lodgepole pines. Williamson's and Red-naped sapsuckers, downy woodpecker, and Northern flicker favored aspen as nesting substrate throughout the study.

Tree Diameter: Tree diameters were apparently not limiting to nesting woodpeckers in our study area. Average nest tree diameters were similar in size as those measured at random locations.

Discussion

Snag densities and diameters were similar between nest and random locations in the Elkhorn's study area except at nest locations of the Three-toed Woodpecker, a species selecting high densities of large snags. Three-toed woodpeckers specialize in foraging on bark beetle larvae and higher snag densities surrounding their nests likely provided greater foraging opportunities. This result suggests that high snag densities after beetle outbreaks are necessary for successful breeding of American three-toed woodpecker. Another notable result was the importance of aspen to nesting woodpeckers, particularly before the beetle outbreak when conifer snags were rare. The value of

aspen woodlands for cavity-nesting birds and other wildlife has been well-established (e.g., Newlon & Saab 2011) and the Elkhorns

Introduction

Recent epidemics of mountain pine beetles (*Dendroctonus ponderosae*; MPB) will fundamentally alter Rocky Mountain forests, impacting management decisions related to fire, logging, and wildlife habitat. We are studying effects of a recent MPB outbreak on nest-site selection and nest survival of 6 woodpecker species, and on occupancy dynamics of 46 avian landbird species in the Elkhorn Mountains, Helena National Forest. Here we report a summary of habitat characteristics measured at woodpecker nest locations before (n = 89; 2003-2006) and after the outbreak (n = 124; 2009-2011). We descriptively compare habitat characteristics at nest locations to non-nest random locations (n = 76), which characterize the average conditions on the landscape in our Elkhorns study area.

Methods

Habitat Measurements: To quantify the habitat changes associated with the MPB epidemic, we measured habitat characteristics at each of our 76 non-nest random point stations once before the beetle epidemic (in 2002-03) and again after the epidemic (2010). We measured the same vegetation characteristics annually at nest locations. Data were collected in 2012 at both random and nest locations but not included in this summary because the data entry is ongoing and incomplete as of October 2012. At each random and nest location, the vegetation plot was 2.5 ha in size and consisted of intersecting nested plots within 20m x 100m rectangles in a cross plot design (Saab et al. 2006; Figure 1). These vegetation plots were centered on focal trees at point count surveys (i.e. random locations) and nest trees at nest locations. Snags were defined as any standing dead (at least 50% of the needles dead or missing) tree ≥ 1.4 m in height measured in 2 size classes (small ≥ 3-9" [≥ 8-23 cm] and large > 9" [>23 cm]) in diameter at breast height (dbh). Small snags and trees within 1 m, large snags within 10m, and large trees within 3m to either side of a 50m transect were tallied at each vegetation plot . These measurements were repeated in each cardinal direction. The total number of snags/trees counted per plot was then divided by the total area surveyed (e.g., 20x50x4 = 4000m^2 per plot for large snags) to create the snag/tree density measurement. Species and dbh of the nest tree or focal tree at random locations was also recorded.

(e.g., Newlon and Saab 2011), and the Elkhorns study area is no exception.

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Science FINDINGS

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INSIDE

"Science affects the way we think together."
Lewis Thomas

SAGEBRUSH IN WESTERN NORTH AMERICA: HABITATS AND SPECIES IN JEOPARDY


M. Wisdom

The sagebrush ecosystem is one of the largest ecosystems in the United States. It is also considered highly imperiled.

"Peel the outer skin, and surprises lurk beneath first impressions. The landscape reveals itself... The Great Basin reminds us to take nothing for granted."
—Stephen Trimblé, *The Sagebrush Ocean*

One of the largest ecosystems in the United States is suffering a death by a thousand cuts. Alhough it may be hard to imagine, we are witnessing the collapse of the American sagebrush ecosystem. Invasive species, overgrazing, fire suppression, and many other insults have combined to bring this habitat to its knees. Now, hundreds of species are imperiled, and only the most dedicated campaign of conservation and restoration can secure their future.

Sagebrush ecosystems once encompassed up to 150 million acres—virtually half of the American West. They were home to sage grouse, pronghorn, and collared lizards. In the past century, this ocean of sagebrush was degraded from all sides and much of it transformed into rangelands, whose primary utility was livestock grazing. And alas, sagebrush isn't palatable to cows.

It wasn't until the 1980s that attitudes toward sagebrush really started to change. Before then, it was routinely "improved," meaning: dug up, chained, burned, or sprayed with herbicides to make room for better cattle forage—crested wheatgrass, usually. Just about the same time that sagebrush was being reconsidered as a valuable native species as opposed to a weed, it was also discovered that intact sagebrush habitats were disappearing fast, and reversing their decline would be a Herculean task.

IN SUMMARY

Sagebrush habitats are declining rapidly across western North America, with over 350 associated plant and animal species at risk of local or regional extirpation. The sagebrush ecosystem is one of the largest in the United States, and it is vulnerable to a litany of threats. Chief among them is invasion of cheatgrass into the understory, followed by high-severity fires that cheatgrass promotes. The expansion of pinyon-juniper woodlands into sagebrush habitat and other human impacts, such as overgrazing by livestock and energy development, are also major sources of concern.

Regional studies of sagebrush habitats during the 1990s and 2000s conducted in the interior Columbia Basin, the Great Basin, and the Wyoming Basins have identified areas with high potential for conservation and restoration, as well as those areas most vulnerable to degradation. The resulting maps and analyses have provided scientists with new methods of landscape analysis and provided managers with information for conserving and restoring sagebrush habitats and species. The analyses have also examined the efficacy of sage grouse as an "umbrella species" for the conservation of other sagebrush-associated species. Findings suggest that although some species would benefit from this approach, many would not.

"The ills of the sagebrush ecosystem are well documented," says Michael Wisdom, a wildlife biologist at the PNW Research Station in La Grande, Oregon. "It is considered to be one of the most imperiled of all ecosystems in the United States. Millions of acres have been converted to agriculture, cities, roads, energy developments, exotic plants, and woodlands. Worse yet, management intervention has been ineffective at even abating the loss, let alone reversing it."

"Even though you can see sagebrush everywhere," says Mary Rowland, a wildlife biologist, also based at the Station's La Grande Lab, "less than 10 percent of the remaining habitat is unspoiled, in terms of historical structure and composition. As a result, more than 350 plant and animal species are at risk of local or regional extirpation."

Working right in the heart of sagebrush country, Wisdom and Rowland for the past 10 years, have been investigating the decline of sagebrush habitat and species. They have collaborated on several major landscape analyses including the Interior Columbia Basin Ecosystem Management Project, the Great Basin Ecoregional Assessment, and the Wyoming Basins Ecoregional Assessment. These projects have transformed perspectives regarding sagebrush habitat and have provided managers with information for conserving and restoring sagebrush.

KEY FINDINGS

- More than 10 million acres of existing sagebrush habitat in the Great Basin are at moderate or high risk of displacement by cheatgrass. More than 2 million acres of existing sagebrush in eastern Nevada and western Utah are at moderate or high risk of displacement by pinyon-juniper woodlands.
- Moderate to strong habitat declines for sagebrush-associated species have been documented for nearly half of the watersheds in the interior Columbia Basin. Declines are associated with grazing, invasion of exotic plants, altered fire regimes, and conversion to agriculture.
- Despite declining habitat trends for many sagebrush species, potential exists to conserve and restore native sagebrush where large-scale loss and degradation have not yet occurred. Intensive management practices, however, are needed for sufficient restoration in many areas.

The approach taken by Wisdom, Rowland, and their colleagues has involved broad-scale modeling of environmental conditions on both public and private lands. Sophisticated vegetation simulation models designed to run on millions of acres, and literally hundreds of state-and-transition models, were used to assess past and current conditions, and to predict effects of future land management scenarios on sagebrush and grassland-associated vertebrates in the interior Columbia Basin.

"The first time anybody really looked at this ecosystem—about 15 years ago in the interior Columbia Basin—it was clear that the status and trends of species in sagebrush habitat mirrored those of other species in other ecosystems that were already listed as threatened or endangered. This sparked a widespread change in research and management thinking about the ecosystem's status, particularly because conditions were not predicted to improve," says Rowland.

M. Rowland

A variety of land uses and undesirable processes pose a threat to sagebrush habitats and species of concern.

HIT FROM ABOVE AND BELOW

If you had to pick just one, cheatgrass invasion is perhaps the greatest threat to sagebrush habitat. A scourge to land managers, this exotic annual grass has been reshaping the West since the late 1870s, when it arrived from Eurasia. The name cheatgrass is a reference to its life history strategy, which uses a headstart early in the spring, thereby outcompeting native grasses for needed water and nutrients, and "cheating" livestock out of valuable forage.

"Cheatgrass can live out its entire life cycle in just a few weeks in spring," says Wisdom. "After that, it's useless as forage and becomes a dangerous fuel-bed for wildfire. By midsummer, it is tinder waiting to fuel a high-severity fire, which can kill the overstory sagebrush and clears the way for more cheatgrass in following years."

Cheatgrass perpetuates itself through fire. Many native species of sagebrush, forbs, and bunchgrasses are not adapted to frequent, intense fire. Cheatgrass exploits that characteristic to get the competition out of the way. It then relies on its tremendous seed production to fill in the gaps, eventually creating monocultures of cheatgrass.

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To provide scientific information to people who make and influence decisions about managing land.

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"Once an area has succumbed to dense cheatgrass invasion, there isn't much you can do," says Rowland. "People have tried restoration on small scales, but once a threshold is crossed, restoration is nearly impossible without tremendous inputs."

From their landscape assessments in the Great Basin, Wisdom and Rowland estimate that more than 50 percent of existing sagebrush habitat has been invaded by cheatgrass. That's more than 10 million acres. About 10 percent of that is likely a cheatgrass monoculture.

The problem is at its worst at lower elevations. In the colder, moister environments of higher elevations, sagebrush habitat is being assaulted by a wholly different plant community—and this time it's native.

"Pinyon-juniper woodlands have expanded throughout the West and have displaced millions of acres of sagebrush habitat," explains Wisdom. Whereas the problem was too much fire at low elevations, up high the problem is, in part, owing to the absence of fires that once burned every decade or two, keeping woodlands in check.

M. Rowland

Once a site has converted to a cheatgrass monoculture it is nearly impossible to restore the native sagebrush ecosystem.

"Fire suppression, cattle grazing, and global warming have a combined effect of increasing the amount of pinyon-juniper woodlands," he says. "And as woodlands expand, sagebrush habitat contracts."

Often, at moderate elevations, the insult is twofold. Cheatgrass and pinyon-juniper woodlands encroach together, extirpating sagebrush habitat. Eventually intense, cheatgrass-driven fires kill the woodlands too, and exotic grass is all that's left.

A SAGE ICON

Greater sage grouse are the signature species of sagebrush ecosystems. They are the largest grouse in North America and have beautiful courtship displays every spring. Like the ecosystem they depend on, sage grouse were once so abundant that their current plight would have been unimaginable. Settlers called them "sage chickens," and ate them alongside domestic poultry. The past notwithstanding, sage grouse are in trouble.

"Their life cycle is tightly linked to the composition and structure of native sagebrush habitat," explains Rowland. "When cheatgrass enters the system, native understory plants are quickly displaced and with them go the insects. Sage grouse, in turn, are deprived of the forbs and protein that are the primary food sources needed for raising their young. Sagebrush itself is the grouse's only food source throughout the winter. Without healthy sagebrush habitat, there is simply no way to support the sage grouse."

The association between sage grouse and its habitat has prompted land managers to nominate sage grouse as an "umbrella species." The idea is: if we protect the sage grouse, we will simultaneously be protecting all the lesser known species that also rely on sagebrush habitat. Protections designed for the grouse, it is hypothesized, could shelter the entire ecosystem.

Gary Kramer

For many, sage grouse are synonymous with the sagebrush ecosystem.

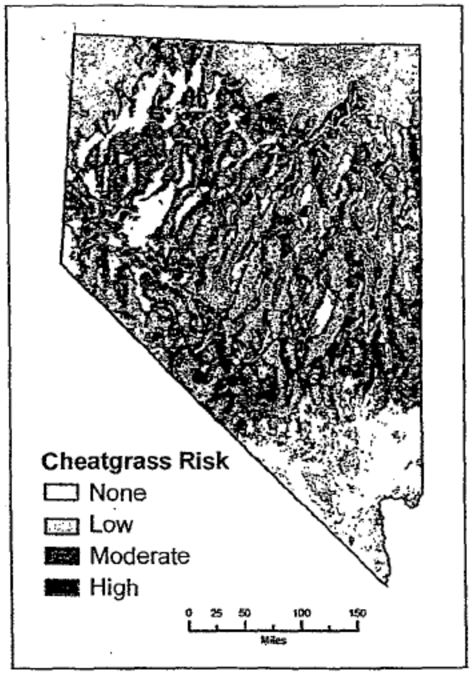
Rowland and Wisdom wanted to know exactly which species would benefit from this approach; they wanted to understand whether sage grouse can function as a sufficiently large umbrella.

"If the objective is to conserve and restore multiple species through the improvement of habitats for the umbrella species, several criteria need to be met. The first, of course, is co-occurrence. A species will only benefit from grouse conservation if it is found in the same general location. Also, specific resource requirements must overlap with the sage grouse, and management strategies must benefit all the targeted species," says Rowland.

Wisdom, Rowland and several colleagues examined the potential conservation coverage of 39 sagebrush-associated vertebrate species from sage grouse habitat conservation. They mapped the range of habitats for all the species to determine spatial overlap with sage grouse and evaluated similarity in habitat associations. They also used a cheatgrass risk model to delineate regions likely to be lost as sagebrush habitat altogether.

"We found that management for sage grouse habitat likely would offer relatively high conservation coverage for sagebrush obligates, such as the pygmy rabbit, but far less protection for other more generalist species, such as the lark sparrow," says Rowland. "Most species of conservation concern in our analyses would benefit only marginally from conservation and restoration of sage grouse habitats. About half the species considered had a neutral response to the umbrella strategy."

"Our analyses suggest that the paradigm of sage grouse as an umbrella for other sagebrush species may need to be reevaluated," adds Wisdom.



Cheatgrass is predicted to displace existing sagebrush and other susceptible land cover types in much of Nevada during the next 30 years. Over half of Nevada is mapped as moderate or high risk area for displacement.

RESTORATION POTENTIAL

The vast area of sagebrush at risk of displacement by cheatgrass and pinyon-juniper poses daunting challenges for conservation of sagebrush species. The trick for land managers is determining which areas to focus their energy on.

Wisdom and Rowland have pioneered methods for landscape assessment in sagebrush ecosystems that are helping managers prioritize sites for protection and conservation. According to Wisdom, by mapping sagebrush habitats that are highly vulnerable to invasion by cheatgrass, versus areas that are highly vulnerable to encroachment by pinyon-juniper woodlands, they can provide spatially specific knowledge needed to target each threat with the appropriate management prescriptions.

"Despite declining habitat trends for many sagebrush species, there is potential to conserve native sagebrush where large-scale loss and degradation have not yet occurred, and to restore degraded communities that retain native components," says Rowland.

"Understory vegetation communities in high-risk areas—usually low elevations and warmer, drier sites—are likely to be dominated by cheatgrass, and these sites may convert to pure cheatgrass in the near future if nothing is done," says Wisdom.

"Intensive management practices, including changes in livestock grazing, are needed for sufficient restoration in many areas," he says. "Sagebrush habitats at high risk of displacement by pinyon-juniper woodlands require immediate management attention through the use of prescribed fire or mechanical treatments to reduce density of encroaching woodlands."

Most areas with high potential to maintain or restore sagebrush communities are concentrated in Wyoming, eastern Idaho, and northern Nevada. Areas with low potential are concentrated in Washington, parts of Oregon, western Idaho, and much of Nevada.

Wisdom's and Rowland's methods and findings have recently been published as a book, which has been distributed to federal and private land managers throughout the West.

A GLIMMER OF HOPE?

"There is an ecologically driven urgency to start now," says Wisdom. "This ecosystem is so vulnerable to threshold effects that, once crossed, are nearly impossible to reverse. It is far easier to prevent the system from reaching thresholds than it is to mitigate them after the fact."

"Unlike some other ecosystems, a hands-off approach simply won't work. Exotic plants, altered fire regimes, and historical land use effects all will continue to degrade the sagebrush ecosystem if we don't intervene," says Wisdom. "If we don't actively manage, then one of the largest ecosystems in North America will disappear."

Reversing the trend of habitat loss will take a massive commitment. Indeed, one simulation study that Wisdom and Rowland were involved with found that even a six-fold increase in the areas treated with active restoration in the interior Columbia Basin would only slow the decline of sagebrush habitat, not reverse it.

Thankfully, and in part owing to Wisdom's and Rowland's research, momentum has been building toward finding solutions in sagebrush. In fact, a grant of $13 million was recently awarded by the Joint Fire Sciences Board to over 20 scientists, representing four federal agencies and six universities, who are collaborating on integrated sagebrush research across the Great Basin.

"We've seen throughout the past decade an upsurge in interest in sagebrush ecosystems. This trend toward increasing management budgets and research is exactly what is needed. And it must continue," says Wisdom.

"To further belabor the many ills of the sagebrush ecosystem is to ignore the real question of importance: What can be done to improve the situation?"

"I listened carefully for clues whether the West has accepted cheat as a necessary evil, to be lived with until kingdom come, or whether it regards cheat as a challenge to rectify its past errors in land-use. I found the hopeless attitude almost universal."

—Aldo Leopold, *A Sand County Almanac*, 1949

LAND MANAGEMENT IMPLICATIONS

- Passive restoration, such as changes in management of livestock, coupled with active fire suppression at lower elevations and exotic plant management (e.g., herbicides followed by native plant seeding), can be used to restore native grasses and forbs in the understory of sagebrush habitats within 30 to 50 years.
- Sagebrush at high risk of displacement by pinyon-juniper requires immediate management attention through the use of prescribed fire or mechanical treatments to reduce density of encroaching woodlands.
- Management of sage grouse habitats is likely to provide substantial conservation coverage for other species tightly linked to sagebrush, but less coverage for species with more general habitat requirements. This suggests that the paradigm of sage grouse as an umbrella for other, nonobligate sagebrush species may need to be reevaluated.

I am asking why the Forest has released a draft decision without being able to also provide the public with a biological assessment, since there is no information in the biological evaluation on lynx. I believe that this species "may be present" on the Caribou as per the U.S. Fish and Wildlife Service. Am I wrong?

Sara Johnson

On Tuesday, February 8, 2022, 01:57:31 PM MST, Johnson, Dylan -FS <dylan.johnson@usda.gov> wrote:

Sara,

We are in the process of adding the requested documents to the project website, should be available to you by end of the day . However, we will not be able to post the biological assessment until the document is finalized. Once finalized we will post to the project website. If you need further information or have questions you can email me or call [redacted] Thanks

Dylan Johnson
Forest Fuels Specialist

Forest Service
Caribou-Targhee National Forest

[redacted]
dylan.johnson@usda.gov
322 N. 4th Street
Montpelier, ID 83254
www.fs.fed.us

Caring for the land and serving people

From: Sara Johnson [redacted]
Sent: Tuesday, February 8, 2022 11:01 AM

To: Johnson, Dylan -FS <dylan.johnson@usda.gov>
Subject: [External Email]Project information

[External Email]
If this message comes from an **unexpected sender** or references a **vague/unexpected topic;**
Use caution before clicking links or opening attachments.
Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

HI Dylan,

I have not yet received a response from you on my request for the supporting documentation on the Caribou Prescribed Fire Project. I would like to get electronic copies of the following reports noted in the preliminary EA, including:

1. Biological Assessment for Wildlife and whitebark pine
2. Roadless Area Worksheet
3. Idaho Roadless Committtee Worksheet
4. Wilderness Character Worksheet
5. Vegetation Effects Analysis
6. Non-forest - woodland analysis
7. Fire and fuels analysis.

As I previously noted this analysis information is not currently available on the project web site, although it needs to be available to the public.

If you have any questions regarding this request, you can all me at [redacted]

Sara Johnson

RE: [External Email]Project information

From: Johnson, Dylan -FS (dylan.johnson@usda.gov)

To: [redacted]

Date: Tuesday, February 8, 2022, 10:13 PM MST

Sara,

Releasing the draft decision and associated environmental assessment is part of the administrative review process. The reason for not releasing the biological assessment at this time is because changes could still be requested during the consultation process. When this is completed, a final biological assessment will be made available to the public. For your reference, a summary of the biological assessment can be found in the Environmental Assessment on pages 13-14. If you have any other question feel free to contact me. I will be out of office tomorrow but in the rest of week. Thanks.

From: Sara Johnson [redacted]
Sent: Tuesday, February 8, 2022 3:38 PM
To: Johnson, Dylan -FS <dylan.johnson@usda.gov>
Subject: Re: [External Email]Project information

On Tuesday, February 8, 2022, 03:38:06 PM MST, Sara Johnson [redacted] wrote:

Hi Dylan,