From: info@gatewaywesteis.com
To: Gateway BLM
Subject: A final EIS comment from gatewaywesteis.com
Date: Friday, June 28, 2013 12:54:34 PM

A final EIS comment from gatewaywesteis.com.

Name:
Rayma Cates

Organization:
Power County Task Force

Mailing Address:
2948 Little Creek Road

Mailing Address 2:

City:
American Falls

State:
ID

Zip:
83211

Daytime Phone:
208-226-2614

E-mail:
raymacates@gmail.com

Confidential:
False

EIS Chapter:

Section Number:

Page Number:

Comment:
Concerning the Gateway West Final EIS, Segments 5 and 7

I am a member of the Power County Task Force.

I am very disappointed that the BLM did not do any work on discussing the feasibility of incorporating underground lines into the Gateway West project EIS. I attended a presentation on underground lines and was impressed with the underground technology that is now available and in use in other areas. The BLM should be open to examining new technology. Underground lines would likely eliminate the controversy involved with placing Gateway West on privately owned land. The BLM must be open to new ideas. Underground placement of power lines must be studied.

The Deep Creek Mountains are a great resource for Power County. Above ground placement, whether on private or public land, will greatly diminish this resource. This is another reason underground placement must be carefully considered.
The final EIS places almost the entire Gateway West project in Power County on private ground. Our County Task Force does not agree with placing public transmission lines on private land against the desires of landowners. It appears to me that the BLM has tried to avoid the unpleasant topics of sage grouse and visual effects on view sheds by pushing the line onto public ground. Much of the transmission line in Power County, as proposed in the final EIS, would travel just off of public ground on private land. Thus as proposed, the line would have the same effects on sage grouse and view sheds as if it was placed on private ground. The only differences are these negative effects can apparently be ignored by the BLM if the line runs across private ground. Making the EIS process easier for BLM is not an excuse for placing a transmission ground on private ground. In Idaho, counties have the authority to site public transmission lines. Thus, the path Power County selected for Gateway West should have been honored.

I would like to note that the maps utilized for sage grouse habitat siting have not seemed to be consistent among agencies and that Fish and Game officials have confessed to me that sage grouse leks are often present, but not marked on private land. I know that numerous leks were recently documented in the Arbon Valley area. This documentation was done at the request of landowners who wanted to enroll land in the SAFE, Conservation Reserve Program, and needed to have documentation of a lek within a certain distance to qualify. I feel that the maps being used for Gateway West are not entirely accurate with conditions in the field. I also think further research is needed to determine the effect transmission lines actually have on sage grouse survival.

On a personal note, I have lived along the foothills of the Deep Creek Mountains for over twenty years. I walk in these foothills almost daily and greatly enjoy the view. I have worked for the federal government in several different positions and so I understand that to the BLM this transmission line is likely just another project, with deadlines, that must be seen to completion. However, to the people of Power County, this is our homes nestled in the foothills of a beautiful place and in many cases, it is our livelihood. The placement of this transmission line will create a new electric transmission corridor and if placed overhead, will affect the scenery and the quality of life for our grandchildren, great grandchildren and great-great grandchildren. This is why studying underground placement and working with Power County for final placement of Gateway West is so important.
Sincerely,
Rayma Cates

Comments of the Snake River Alliance
On the Final Environmental Impact Statement
Gateway West Transmission Line Project

Submitted by
Ken Miller, Clean Energy Program Director, Snake River Alliance

June 28, 2013

Gateway West Transmission Line Project Final Environmental Impact Statement
Bureau of Land Management
P.O. Box 20879
Cheyenne, Wyoming 82003

The Snake River Alliance ("Alliance") appreciates the opportunity to comment on the Bureau of Land Management's Final Environmental Impact Statement (FEIS) for the Gateway West Transmission Line Project. We acknowledge that the FEIS was prepared primarily by BLM, as well as by and through the input of other federal agencies.

The Snake River Alliance is an Idaho-based non-profit organization, established in 1979 to address Idahoans' concerns about nuclear safety issues. In 2007, the Alliance expanded the scope of its mission by launching its Clean Energy Program. The Alliance's energy initiative includes advocacy for renewable energy resources in Idaho; expanded conservation and demand-side management programs offered by Idaho's regulated utilities and the Bonneville Power Administration; and development of local, state, regional, and national initiatives to advance sustainable supply-side and transmission policies. The Alliance pursues these programs on behalf of its members, many of whom are customers of Gateway West proponents Idaho Power and Rocky Mountain Power and who are interested in advancing progressive energy policies. Other commenters are addressing the far-reaching environmental, social, cultural, and other impacts presented by the Gateway West proposal. Our comments concentrate on the narrower topic of whether the proponents have sufficiently addressed the issue of the project's stated purpose and whether this project is needed to meet future energy demands in the proponents' respective service areas. The Alliance submitted extensive comments in response to the DEIS for this project, as well as during the scoping process in which BLM sought to identify central issues needing to be addressed in the course of its environmental review.

Purpose and Need

We appreciate that the FEIS attempts to address the many comments and responses to the DEIS regarding the need for this project, but we do not believe the FEIS adequately addresses those concerns in its revised Chapter 1 (Purpose and Need).

BLM responded to our comments to the DEIS on this issue at length. While we appreciate the responses to our comments, we continue to believe the proponents have not satisfactorily

addressed this most important component of the proposed project, and that the responses that were provided to our comments and those of many others continue to lack needed specificity.

In response to our concern that Proponents' Purpose and Need (DEIS 1.3) fails to sufficiently justify this project, BLM responds that:

> "Additional information on purpose and need has been added to Chapter 1."

And in response to our lengthy comments addressing such specifics as whether proponent utilities' IRPs and other plans presented a need for the project, BLM again referred to the additions in Chapter 1. Clearly, the Agency believes it has adequately addressed the concerns raised by the Alliance and myriad other commenters regarding the need for this project. Unfortunately, the revised Chapter 1 fails to adequately address these and related concerns.

We agree with BLM that the Proponent Utilities are bound by FERC and other regulators that the utilities are bound to:

> "Plan, design, construct, operate, and maintain an adequate electric transmission system that meets not only the customers' energy demands … but also meet the customer's peak load demands. Both are important in determining the need for the project." [1-1]

We further take notice of BLM's position that:

> "The proposed transmission line is needed to supplement existing transmission lines in order to relieve operating limitations, increase capacity, and improve reliability in the existing electric transmission grid, allowing for the delivery of up to 1,500 megawatts of additional energy for the proponents' larger service areas and to the other interconnected systems. The project is principally necessary to serve the proponents' customers, though other markets may also be served." [1-1]

We also take notice of Idaho Power's stated objectives for the project (1-14):

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Page 1-14 of the FEIS then takes notice of Idaho Power's 2011 Integrated Resource Plan and its 20-year planning horizon:

> "The first 10-year period is analyzed first (2011-2020), followed by the second 10-year period (2021-2030). Idaho Power customer needs are largely met in the first 10-year period with the construction of the Boardman to Hemingway transmission line project (B2H). For the second 10-year period, ten resource portfolios were analyzed in the IRP and some of these portfolios required Gateway West transmission capacity to deliver energy to major load centers in southern Idaho while others did not. The need for Gateway West capacity in each of these portfolios was driven by the assumed locations of the resources in each portfolio."

Much has changed since the above scenario was outlined for purposes of the FEIS.

The Agency should know that Idaho Power's 2011 IRP preferred alternative does not contemplate development of Gateway West, at least not within the time frame projected in the IRP. More important, in the Company's 2013 IRP, *none of the portfolios that have been analyzed or modeled by Idaho Power includes Gateway West,* and it is highly unlikely that any new supply side resources proposed by Idaho Power will be resources that would require development of Gateway West for delivery to Idaho Power's primary load centers in southwest and southern Idaho. All of those portfolios anticipate meeting the Company's peak demand requirements with other supply side and demand side resources. Idaho Power's primary needs during the time frames covered by the 2011 and 2013 IRPs are for added capacity rather than energy. It is impractical to believe that peak demand issues can be addressed by new remote supply side resources regardless of their dispatchability. That being the case, one of the primary needs offered to justify this project cannot be addressed by this project, but must be addressed through more modern, distributed generation and other methods to readily dispatchable address peak load. We understand this is a transmission line FEIS and not a power planning document, but we also believe that decisions in a project as encompassing as this one cannot be made in a regulatory vacuum by excluding the diverse factors that support or detract from a project such as this.

It is clear from the just-concluded development of the 2013 IRP that Idaho Power is not counting on Gateway West to satisfy its energy or capacity needs – at least over the course of the next two decades. The Purpose and Need section of the FEIS also says that:

> "Idaho Power has reported in the most recent POD (December 2012, Appendix B of this FEIS) that without adequate transmission capacity across southern Idaho, its ability to site future generation resources will be limited. The long lead time required to permit design and construct high voltage transmission lines simply will not allow new transmission capacity to be built in conjunction with the construction schedule of such primary new generation resources. Therefore, Idaho Power believes it is prudent to continue to pursue additional transmission capacity across southern Idaho through Gateway West."

This, according to the FEIS, is Idaho Power's primary Purpose and Need for Gateway West. It closely tracks that of PacifiCorp (Rocky Mountain Power), which has identified similar needs, although given the size of its service territory needs those needs are described as being much greater.

The Alliance proposes that BLM withhold its Record of Decision (ROD) in this case until such time as the IRPs that are or will soon be considered by Idaho Power's and PacifiCorp's regulators in their respective states are reviewed by the public and either accepted or acknowledged, depending on the regulatory jurisdiction. PacifiCorp's 2013 IRP has been filed in all of its jurisdictions; Idaho Power's was to be filed June 28, and along with it a an application for a Certificate of Public Convenience and Necessity (CPCN), which will attempt to justify the need for significant coal plant investments to thermal plants that are central to some of the purported needs for Gateway West. Given the repeated delays encountered over the course of development of this EIS, it is not unreasonable to allow the additional time needed to adequately address all issues identified in the Purpose and Need section of this proposal.

As mentioned above, much has changed since the IRPs (and IRP updates) filed by the Proponent Utilities, and as a result much of the language in the Purpose and Need Chapter in the FEIS is outdated and even subject to contrary proposals by the utilities. Those who have followed development of these IRPs know, for instance, that in the case of Idaho Power, the company's preferred alternative in its 2013 IRP *contains no new supply side resource development over the 20 years covered by the plan,* but rather will rely on expanded demand response measures in addition to the Boardman-Hemingway transmission project. Idaho Power is referenced on 1-15 of the FEIS as expecting that in the second decade covered by its IRP:

> "Some of these portfolios required Gateway West transmission capacity to deliver energy to major load centers in southern Idaho while others did not. The need for Gateway West capacity in each of these portfolios was driven by the assumed locations of the resources in each portfolio."

If Idaho Power's 2013 IRP preferred alternative does not propose building new resources, it is difficult to understand how it and its partner, PacifiCorp, have justified the need for this project – at least at the present time and regardless of the long lead times required in developing a transmission project of this magnitude. In the case of Idaho Power, the utility's enthusiasm for moving forward with this project appears to wane with each IRP. Gateway West is not identified as a committed asset over the next 20 years – longer, actually, judging from the documents provided to the Company's IRP Advisory Council. It is also likely that the existing load on the east-west path that would presumably be expanded by Gateway West will diminish given the uncertain future of the coal assets owned or co-owned by Idaho Power and PacifiCorp.

As planning for this project has advanced over the years, it has become clear that it is a project based on speculation of uncertain future requirements by both utilities. At a cost to utility

customers of somewhere between $1.5 billion and $2.8 billion and climbing, BLM must evaluate the impacts to customers of both utilities should it propose advancing this project in light of the lack of demonstrated need. If the Agencies are factoring into their consideration the unproven need for the project, they should also be mindful of the enormous and long-lasting costs the project would place on utility customers.

On 1-24 at 1.3.6 [Purpose of the Gateway West Proposed Action], the FEIS notes that:

> "The proponents state that from Windstar to Populus, Gateway West will deliver up to 1,500 MW of primarily wind energy for transmission to markets south and west of Populus, including the Wasatch Front."

What the FEIS fails to acknowledge is that Idaho Power has identified no new wind additions to its system beyond that required by the 1978 Public Utility Regulatory Policies Act [PURPA]. The Company has made it clear that, aside from the wind it is statutorily required to accommodate on its system through PURPA, it has no interest in adding more during the 20-year time frame and beyond.

All of this is to say that, as with the DEIS, the FEIS fails to present a Purpose and Need that is required to justify the significant environmental and related impacts –including the economic ones that would accompany this project in Wyoming and Idaho and burden customers of these utilities and presumably those served by other utilities that might purchase capacity on these lines for their own needs, which is addressed in Appendix B of the FEIS [Transmission Line and Substation Components, B-1] and which attempts to further demonstrate the need for this project:

> "The proposed transmission line is intended to supplement existing transmission lines in order to relieve operating limitations, increase capacity, and improve reliability in the existing electric transmission grid, allowing for the delivery of up to 1,500 megawatts of additional energy for the Company's larger service areas and to other interconnected systems."

Even though this language is contained in an appendix and therefore lacks the background to support it, it is nonetheless a problematic "everything but the kitchen sink" defense of this proposal. We agree absolutely in the need for a stable and reliable transmission system and in the region-wide resource adequacy, which has been and continues to be sufficient. But the Utility Proponents have fallen short in justifying the need for 1,500MW of new east-west capacity in an era in which certain thermal units owned or co-owned by the proponents might be retired even before this line would be built. It remains unclear where this 1,500MW would come from and how it would be generated inasmuch as coastal markets will not accept additional energy from carbon-heavy thermal resources given their respective state clean energy requirements. And the potential for interconnecting this line to other systems, presumably serving southwestern markets, has not been clearly explained.

This point is driven home as well by the Utility Proponents [Letter Number 100343] in their discussion of Chapter 4 – Cumulative Impact – 4.422 – 95 – Entire Section:

> "The analysis of electrical effects determined that the Gateway West project would have no effects o health or safety; therefor, there would be no cumulative effects to other past, present, or reasonably foreseeable future projects. This is the case across all alternatives. Cumulative impacts of noise due to corona effects are treated in Section 4.4.24 – it is unclear why the cumulative impacts analysis for electrical environments centers on health and safety, which is covered in the next section. This section should discuss the cumulative impacts of all the reasonable foreseeable future actions and this project on electrical capacity, reliability, public needs, peak usage, etc. The Draft EIS should be revised to incorporate these suggestions."

That BLM has struggled with this balancing act is reflected in its response to Idaho Power and Rocky Mountain Power:

> "The impact of this project on capacity, reliability, public needs, and peak usage is appropriately addressed in the Proponent's Integrated Resource Plans (IRPs) that are reviewed and acknowledged by each state's public utility commission. That analysis is beyond the scope of this EIS."

The FEIS expands on that at ES-27 in the Executive Summary:

> "In other cases, although the effects of Gateway West would be minor, when taken together with effects of other past, present, and proposed future actions, many of which collectively already present a substantial cumulative effect, the cumulative impact may be considerable. Finally, there are some effects of Gateway West that would by themselves be large and, when considered with other effects alto be cumulatively substantial."

Generation Resources

For both Utility Proponents, wind generation is identified as a "purpose" for Gateway West. It is not a resource sought by Idaho Power, which has a 2013 IRP preferred portfolio that does not include significant additions of wind other than the statutorily required PURPA additions referenced above. And also as mentioned, Idaho Power's projected needs between now and 2032 are mostly capacity needs and not energy needs, and it is unlikely those needs will be met with a portion of a 1,500MW east-side transmission addition or significant new supply side resources. Yet the Purpose and Need identified in this FEIS points to wind as the primary driver for the need of this project. Idaho Power has said repeatedly that wind has almost no capacity value, so any attempts to try to portray this proposed transmission project as a way to move wind energy to Idaho Power's load centers should be carefully scrutinized if it is to be offered as one of the purposes for Gateway West.

At 1-25 of the FEIS, the Agency notes that:

> "Gateway West is independent of, and would be built regardless of, any particular new generation project."

We disagree, and we don't believe that existing regulations require the Agencies to consider the proposal "regardless of any particular new generation project," since these projects, cumulative or not, are precisely why Gateway West has been proposed. While the need for this project is based not on one particular supply side resource (wind, as mentioned above, or coal, which is unlikely), it is clear from the FEIS that the proponent utilities believe their respective (though not yet identified) projects demand a new high-voltage transmission line. If it is true that the loss of one project here or one there would not alter the nature of the utilities' request, it is also clear that without most of the projects individually, there would be no need for Gateway West.

In response to the Snake River Alliance's DEIS comments proposing that the FEIS more fully examine the issue of regional adequacy and in particular the analysis contained in the [Northwest Power and Conservation Council's' 6th Power Plan, BLM reiterates its position that such a consideration of the Pacific Northwest's regional electricity adequacy is beyond he scope of its review:

> "Analyzing regional needs for power is beyond the scope of this analysis. See the Purpose and Need discussion in Section 1.2 of Chapter 1."

Referencing Table 2.7.1 [Rating and Capacity of Paths With and Without the Gateway West Project, 2-7], we note that the five transmission paths identified appear to have no existing available transmission capacity.

Yet at 1-39 in the Purpose and Need section under Generation, we find this seemingly contradictory statement regarding the need for this line:

> "Independent producers are building new wind farms and have proposed many more. Some of these projects would be constructed, sending power into the grid before the Gateway Project is permitted. Therefore, their wind farms are not driving the Project and are not 'connected actions' under the 'part of a larger action' criterion."

This seems to indicate that some of these new projects might advance with or without Gateway West, yet at the same time it is being argued that the relevant transmission paths lack capacity to accommodate those projects.

Similarly, the FEIS states that the project is not dependent on one particular transmission route segment. Yet it is clear that in the case of the Bonneville Power Administration, Gateway West has little utility unless the Boardman-Hemingway line is completed. While we agree that this project, if built, would be built one segment at a time, we disagree that individual segments

without regard to the value of another segment can analyze this project. In the case of Bonneville, for example, its new need to access southeast Idaho customers would depend not only on some sections of Gateway West, but also of Boardman-Hemingway.

Finally, at 1-39, the FEIS notes that:

> "Because the pubic utilities commissions of Idaho and Wyoming must allow the utilities to pass on the capital costs of system improvement, including but not limited to Gateway West, those commissions prohibit "speculative" construction and only permit capital improvement that show a clear demand ahead of construction." While this does include predictive models that estimate future growth, they are subject to review and approval by the commissions. Therefore, a project like Gateway West is in response to, rather than in anticipation of, load growth."

While that may be true, it raises a question about why the FEIS includes at 1-14 and 1-15, in the Purpose and Need section, detailed references to *anticipated load growth by both of the utility proponents.* If the purpose of the FEIS is to *respond* to load growth, then references to a*nticipated* load growth seem inappropriate given the current wording at 1-39.

We would also point out that the FEIS in Chapter 45 – Cumulative Effects at 4-40, in Table 4.2.14 [Proposed Natural Gas-Fired Power Plants in Idaho], there is reference to the Mountain View Power Inc. Gateway project at 180MW, yet there are no indications that project will be built. Similarly, the Langley Gulch natural gas plant has been in operation for about one year. The proposed geothermal facilities section at 4-41 references five proposed geothermal projects in Idaho, yet those projects are unlikely to be developed for various reasons.

Coal

The federal agencies indicate that they are indifferent to the kinds of energy that would be moved on Gateway West and its related lines, if built. But it is difficult if not irresponsible to view this project in such a way that the agencies are indifferent to the commodity that would be shipped across their lands, and the environmental and other impacts associated with such a development. On a megawatt basis, it is reasonable to assume that energy from the Dave Johnston and Bridger coal plants in Wyoming are one of the primary commodities that would be shipped via an expanded transmission line. Without those resources, the need for Gateway West would evaporate, to the extent is even exists today.

The FEIS concludes at 1.7.3.1 {1-39] that:

> "Given the [Council on Environmental Quality] definition, electrical generating sources that might use the Gateway West Project to transmit their power are not connected actions. Therefore, electrical generating sources are not analyzed in the direct and indirect effects analysis, but are included in the consideration of cumulative impacts. The requests for generation interconnection, whether they be fossil or renewable, to

> which the proponents must respond under FERC regulations, are made to multiple carriers, including other utilities if they are unable to respond to an interconnection request due to a denial of a ROW grant from BLM, other carriers may respond. Therefore, the new generation requests do not qualify as connected actions under the 'automatically trigger' criterion.
> The Gateway West Project can proceed without any one generation project. Multiple generators have made interconnection requests. The overall demand, rather than any one project, provides part of the impetus for the Project. Therefore, no particular project is necessarily tied to Gateway West."

In response to a Snake River Alliance comment to the DEIS [Letter Number 100333] in which the Alliance noted that:

> "As of June 2011, all of the generators requesting transportation on Gateway West were wind energy…"

BLM responded:

> "The commenter is correct, as of June 2011, only wind energy producers have requested transportation. Wind energy is an important energy source and the amount of wind energy used in the country is expected to grow. One study by the U.S. Department of Energy indicates that wind may provide 20 percent of the country's energy by 2030."

We hope that DOE is correct, but even if wind provides 20 percent of the country's energy by 2030, that has no bearing on this application, particularly in light of the Alliance's comments above regarding Proponent Utility resource acquisition plans. Besides, also as noted above, this FEIS does not consider specific energy projects or types of energy generation, yet it repeatedly refers to them.

Given the proven and growing impacts that coal extraction, transportation, and combustion are having nationwide and particularly in the West, and despite BLM's insistence that the nature of the resource that would be transmitted on Gateway West is immaterial, the Alliance cannot support new transmission projects that facilitate an expanded reliance on coal for energy projection. We are mindful of the need to maintain and in some cases build new transmission projects for purposes of grid reliability and to accommodate expanded load, but contrary to BLM's assertions, reviews of such projects cannot be made in a vacuum and without regard to their environmental and climate impacts. In addition, the Alliance would not support expanded wind power development simply for the stake of building new wind farms: Any new energy resource must be considered for its overall environmental impacts regardless of its carbon emissions.

Proposed Routes and, Land Ownership:

It is difficult to escape the fact that a disproportionate amount of land that would be crossed by the proposed Gateway West project is private land. According to Table 1.7-2 [I38], about 45.2 percent of the land impacted by construction would be private lands. About 44.7 percent of the land impacted by operations would be private land. Yet private lands account for less than 30 percent of the ownership in Idaho.

We respect and are sensitive to concerns raised by affected local communities and their residents and the perception that the use of private lands for a project such as this may be preferred by certain proponents as a matter of expediency for the sake of environmental review. Those concerns are being made effectively by other commenters with greater familiarity of these issues than we have.

Conclusion:

The Snake River Alliance appreciates the earnest efforts by the Proponent Utilities, the BLM, and state and federal participants and preparers of the FEIS to address the many questions, suggestions, concerns, and observations posed by the hundreds of individuals and entities that commented on the DEIS. We believe this document is stronger for those efforts.

The revised Chapter 1 language in the FEIS, however, continues to be unpersuasive with regard to the Purpose and Need for this project. We are confronted with a scattershot of reasons why the Utility Proponents believe this project is necessary, but many of those arguments, like the FEIS itself, are based on information that is clearly outdated and that must be freshened if it is to be included at all in this FEIS. We understand the time required to date in preparation of this document, but much has changed since the DEIS and as a result much of the case made in Chapter 1 is readily refutable.

We encourage the BLM to consider the comments it is receiving in response to this document and to reconsider whether it is prepared to defend a Record of Decision in support of the proposed Gateway West proposal.

Respectfully submitted,

Ken Miller
Clean Energy Program Director
Snake River Alliance
P.O. Box 1731
Boise, ID 83701
(208) 344-9161 (o)
(208) 841-6982 (c)
kmiller@snakeriveralliance.org
www.snakeriveralliance.org

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duplicate

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addressed this most important component of the proposed project, and that the responses that were provided to our comments and those of many others continue to lack needed specificity.

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It is clear from the just-concluded development of the 2013 IRP that Idaho Power is not counting on Gateway West to satisfy its energy or capacity needs – at least over the course of the next two decades. The Purpose and Need section of the FEIS also says that:

> "Idaho Power has reported in the most recent POD (December 2012, Appendix B of this FEIS) that without adequate transmission capacity across southern Idaho, its ability to site future generation resources will be limited. The long lead time required to permit design and construct high voltage transmission lines simply will not allow new transmission capacity to be built in conjunction with the construction schedule of such primary new generation resources. Therefore, Idaho Power believes it is prudent to continue to pursue additional transmission capacity across southern Idaho through Gateway West."

This, according to the FEIS, is Idaho Power's primary Purpose and Need for Gateway West. It closely tracks that of PacifiCorp (Rocky Mountain Power), which has identified similar needs, although given the size of its service territory needs those needs are described as being much greater.

The Alliance proposes that BLM withhold its Record of Decision (ROD) in this case until such time as the IRPs that are or will soon be considered by Idaho Power's and PacifiCorp's regulators in their respective states are reviewed by the public and either accepted or acknowledged, depending on the regulatory jurisdiction. PacifiCorp's 2013 IRP has been filed in all of its jurisdictions; Idaho Power's was to be filed June 28, and along with it a an application for a Certificate of Public Convenience and Necessity (CPCN), which will attempt to justify the need for significant coal plant investments to thermal plants that are central to some of the purported needs for Gateway West. Given the repeated delays encountered over the course of development of this EIS, it is not unreasonable to allow the additional time needed to adequately address all issues identified in the Purpose and Need section of this proposal.

As mentioned above, much has changed since the IRPs (and IRP updates) filed by the Proponent Utilities, and as a result much of the language in the Purpose and Need Chapter in the FEIS is outdated and even subject to contrary proposals by the utilities. Those who have followed development of these IRPs know, for instance, that in the case of Idaho Power, the company's preferred alternative in its 2013 IRP *contains no new supply side resource development over the 20 years covered by the plan,* but rather will rely on expanded demand response measures in addition to the Boardman-Hemingway transmission project. Idaho Power is referenced on 1-15 of the FEIS as expecting that in the second decade covered by its IRP:

> "Some of these portfolios required Gateway West transmission capacity to deliver energy to major load centers in southern Idaho while others did not. The need for Gateway West capacity in each of these portfolios was driven by the assumed locations of the resources in each portfolio."

If Idaho Power's 2013 IRP preferred alternative does not propose building new resources, it is difficult to understand how it and its partner, PacifiCorp, have justified the need for this project – at least at the present time and regardless of the long lead times required in developing a transmission project of this magnitude. In the case of Idaho Power, the utility's enthusiasm for moving forward with this project appears to wane with each IRP. Gateway West is not identified as a committed asset over the next 20 years – longer, actually, judging from the documents provided to the Company's IRP Advisory Council. It is also likely that the existing load on the east-west path that would presumably be expanded by Gateway West will diminish given the uncertain future of the coal assets owned or co-owned by Idaho Power and PacifiCorp.

As planning for this project has advanced over the years, it has become clear that it is a project based on speculation of uncertain future requirements by both utilities. At a cost to utility

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customers of somewhere between $1.5 billion and $2.8 billion and climbing, BLM must evaluate the impacts to customers of both utilities should it propose advancing this project in light of the lack of demonstrated need. If the Agencies are factoring into their consideration the unproven need for the project, they should also be mindful of the enormous and long-lasting costs the project would place on utility customers.

On 1-24 at 1.3.6 [Purpose of the Gateway West Proposed Action], the FEIS notes that:

> "The proponents state that from Windstar to Populus, Gateway West will deliver up to 1,500 MW of primarily wind energy for transmission to markets south and west of Populus, including the Wasatch Front."

What the FEIS fails to acknowledge is that Idaho Power has identified no new wind additions to its system beyond that required by the 1978 Public Utility Regulatory Policies Act [PURPA]. The Company has made it clear that, aside from the wind it is statutorily required to accommodate on its system through PURPA, it has no interest in adding more during the 20-year time frame and beyond.

All of this is to say that, as with the DEIS, the FEIS fails to present a Purpose and Need that is required to justify the significant environmental and related impacts –including the economic ones that would accompany this project in Wyoming and Idaho and burden customers of these utilities and presumably those served by other utilities that might purchase capacity on these lines for their own needs, which is addressed in Appendix B of the FEIS [Transmission Line and Substation Components, B-1] and which attempts to further demonstrate the need for this project:

> "The proposed transmission line is intended to supplement existing transmission lines in order to relieve operating limitations, increase capacity, and improve reliability in the existing electric transmission grid, allowing for the delivery of up to 1,500 megawatts of additional energy for the Company's larger service areas and to other interconnected systems."

Even though this language is contained in an appendix and therefore lacks the background to support it, it is nonetheless a problematic "everything but the kitchen sink" defense of this proposal. We agree absolutely in the need for a stable and reliable transmission system and in the region-wide resource adequacy, which has been and continues to be sufficient. But the Utility Proponents have fallen short in justifying the need for 1,500MW of new east-west capacity in an era in which certain thermal units owned or co-owned by the proponents might be retired even before this line would be built. It remains unclear where this 1,500MW would come from and how it would be generated inasmuch as coastal markets will not accept additional energy from carbon-heavy thermal resources given their respective state clean energy requirements. And the potential for interconnecting this line to other systems, presumably serving southwestern markets, has not been clearly explained.

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This point is driven home as well by the Utility Proponents [Letter Number 100343] in their discussion of Chapter 4 – Cumulative Impact – 4.422 – 95 – Entire Section:

> "The analysis of electrical effects determined that the Gateway West project would have no effects o health or safety; therefor, there would be no cumulative effects to other past, present, or reasonably foreseeable future projects. This is the case across all alternatives. Cumulative impacts of noise due to corona effects are treated in Section 4.4.24 – it is unclear why the cumulative impacts analysis for electrical environments centers on health and safety, which is covered in the next section. This section should discuss the cumulative impacts of all the reasonable foreseeable future actions and this project on electrical capacity, reliability, public needs, peak usage, etc. The Draft EIS should be revised to incorporate these suggestions."

That BLM has struggled with this balancing act is reflected in its response to Idaho Power and Rocky Mountain Power:

> "The impact of this project on capacity, reliability, public needs, and peak usage is appropriately addressed in the Proponent's Integrated Resource Plans (IRPs) that are reviewed and acknowledged by each state's public utility commission. That analysis is beyond the scope of this EIS."

The FEIS expands on that at ES-27 in the Executive Summary:

> "In other cases, although the effects of Gateway West would be minor, when taken together with effects of other past, present, and proposed future actions, many of which collectively already present a substantial cumulative effect, the cumulative impact may be considerable. Finally, there are some effects of Gateway West that would by themselves be large and, when considered with other effects alto be cumulatively substantial."

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Generation Resources

For both Utility Proponents, wind generation is identified as a "purpose" for Gateway West. It is not a resource sought by Idaho Power, which has a 2013 IRP preferred portfolio that does not include significant additions of wind other than the statutorily required PURPA additions referenced above. And also as mentioned, Idaho Power's projected needs between now and 2032 are mostly capacity needs and not energy needs, and it is unlikely those needs will be met with a portion of a 1,500MW east-side transmission addition or significant new supply side resources. Yet the Purpose and Need identified in this FEIS points to wind as the primary driver for the need of this project. Idaho Power has said repeatedly that wind has almost no capacity value, so any attempts to try to portray this proposed transmission project as a way to move wind energy to Idaho Power's load centers should be carefully scrutinized if it is to be offered as one of the purposes for Gateway West.

At 1-25 of the FEIS, the Agency notes that:

> "Gateway West is independent of, and would be built regardless of, any particular new generation project."

We disagree, and we don't believe that existing regulations require the Agencies to consider the proposal "regardless of any particular new generation project," since these projects, cumulative or not, are precisely why Gateway West has been proposed. While the need for this project is based not on one particular supply side resource (wind, as mentioned above, or coal, which is unlikely), it is clear from the FEIS that the proponent utilities believe their respective (though not yet identified) projects demand a new high-voltage transmission line. If it is true that the loss of one project here or one there would not alter the nature of the utilities' request, it is also clear that without most of the projects individually, there would be no need for Gateway West.

In response to the Snake River Alliance's DEIS comments proposing that the FEIS more fully examine the issue of regional adequacy and in particular the analysis contained in the [Northwest Power and Conservation Council's' 6th Power Plan, BLM reiterates its position that such a consideration of the Pacific Northwest's regional electricity adequacy is beyond he scope of its review:

> "Analyzing regional needs for power is beyond the scope of this analysis. See the Purpose and Need discussion in Section 1.2 of Chapter 1."

Referencing Table 2.7.1 [Rating and Capacity of Paths With and Without the Gateway West Project, 2-7], we note that the five transmission paths identified appear to have no existing available transmission capacity.

Yet at 1-39 in the Purpose and Need section under Generation, we find this seemingly contradictory statement regarding the need for this line:

> "Independent producers are building new wind farms and have proposed many more. Some of these projects would be constructed, sending power into the grid before the Gateway Project is permitted. Therefore, their wind farms are not driving the Project and are not 'connected actions' under the 'part of a larger action' criterion."

This seems to indicate that some of these new projects might advance with or without Gateway West, yet at the same time it is being argued that the relevant transmission paths lack capacity to accommodate those projects.

Similarly, the FEIS states that the project is not dependent on one particular transmission route segment. Yet it is clear that in the case of the Bonneville Power Administration, Gateway West has little utility unless the Boardman-Hemingway line is completed. While we agree that this project, if built, would be built one segment at a time, we disagree that individual segments

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without regard to the value of another segment can analyze this project. In the case of Bonneville, for example, its new need to access southeast Idaho customers would depend not only on some sections of Gateway West, but also of Boardman-Hemingway.

Finally, at 1-39, the FEIS notes that:

> "Because the pubic utilities commissions of Idaho and Wyoming must allow the utilities to pass on the capital costs of system improvement, including but not limited to Gateway West, those commissions prohibit "speculative" construction and only permit capital improvement that show a clear demand ahead of construction." While this does include predictive models that estimate future growth, they are subject to review and approval by the commissions. Therefore, a project like Gateway West is in response to, rather than in anticipation of, load growth."

While that may be true, it raises a question about why the FEIS includes at 1-14 and 1-15, in the Purpose and Need section, detailed references to *anticipated load growth by both of the utility proponents.* If the purpose of the FEIS is to *respond* to load growth, then references to a*nticipated* load growth seem inappropriate given the current wording at 1-39.

We would also point out that the FEIS in Chapter 45 – Cumulative Effects at 4-40, in Table 4.2.14 [Proposed Natural Gas-Fired Power Plants in Idaho], there is reference to the Mountain View Power Inc. Gateway project at 180MW, yet there are no indications that project will be built. Similarly, the Langley Gulch natural gas plant has been in operation for about one year. The proposed geothermal facilities section at 4-41 references five proposed geothermal projects in Idaho, yet those projects are unlikely to be developed for various reasons.

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Coal

The federal agencies indicate that they are indifferent to the kinds of energy that would be moved on Gateway West and its related lines, if built. But it is difficult if not irresponsible to view this project in such a way that the agencies are indifferent to the commodity that would be shipped across their lands, and the environmental and other impacts associated with such a development. On a megawatt basis, it is reasonable to assume that energy from the Dave Johnston and Bridger coal plants in Wyoming are one of the primary commodities that would be shipped via an expanded transmission line. Without those resources, the need for Gateway West would evaporate, to the extent is even exists today.

The FEIS concludes at 1.7.3.1 {1-39] that:

> "Given the [Council on Environmental Quality] definition, electrical generating sources that might use the Gateway West Project to transmit their power are not connected actions. Therefore, electrical generating sources are not analyzed in the direct and indirect effects analysis, but are included in the consideration of cumulative impacts. The requests for generation interconnection, whether they be fossil or renewable, to

> which the proponents must respond under FERC regulations, are made to multiple carriers, including other utilities if they are unable to respond to an interconnection request due to a denial of a ROW grant from BLM, other carriers may respond. Therefore, the new generation requests do not qualify as connected actions under the 'automatically trigger' criterion.
> The Gateway West Project can proceed without any one generation project. Multiple generators have made interconnection requests. The overall demand, rather than any one project, provides part of the impetus for the Project. Therefore, no particular project is necessarily tied to Gateway West."

In response to a Snake River Alliance comment to the DEIS [Letter Number 100333] in which the Alliance noted that:

> "As of June 2011, all of the generators requesting transportation on Gateway West were wind energy…"

BLM responded:

> "The commenter is correct, as of June 2011, only wind energy producers have requested transportation. Wind energy is an important energy source and the amount of wind energy used in the country is expected to grow. One study by the U.S. Department of Energy indicates that wind may provide 20 percent of the country's energy by 2030."

We hope that DOE is correct, but even if wind provides 20 percent of the country's energy by 2030, that has no bearing on this application, particularly in light of the Alliance's comments above regarding Proponent Utility resource acquisition plans. Besides, also as noted above, this FEIS does not consider specific energy projects or types of energy generation, yet it repeatedly refers to them.

Given the proven and growing impacts that coal extraction, transportation, and combustion are having nationwide and particularly in the West, and despite BLM's insistence that the nature of the resource that would be transmitted on Gateway West is immaterial, the Alliance cannot support new transmission projects that facilitate an expanded reliance on coal for energy projection. We are mindful of the need to maintain and in some cases build new transmission projects for purposes of grid reliability and to accommodate expanded load, but contrary to BLM's assertions, reviews of such projects cannot be made in a vacuum and without regard to their environmental and climate impacts. In addition, the Alliance would not support expanded wind power development simply for the stake of building new wind farms: Any new energy resource must be considered for its overall environmental impacts regardless of its carbon emissions.

Proposed Routes and, Land Ownership:

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It is difficult to escape the fact that a disproportionate amount of land that would be crossed by the proposed Gateway West project is private land. According to Table 1.7-2 [I38], about 45.2 percent of the land impacted by construction would be private lands. About 44.7 percent of the land impacted by operations would be private land. Yet private lands account for less than 30 percent of the ownership in Idaho.

We respect and are sensitive to concerns raised by affected local communities and their residents and the perception that the use of private lands for a project such as this may be preferred by certain proponents as a matter of expediency for the sake of environmental review. Those concerns are being made effectively by other commenters with greater familiarity of these issues than we have.

Conclusion:

The Snake River Alliance appreciates the earnest efforts by the Proponent Utilities, the BLM, and state and federal participants and preparers of the FEIS to address the many questions, suggestions, concerns, and observations posed by the hundreds of individuals and entities that commented on the DEIS. We believe this document is stronger for those efforts.

The revised Chapter 1 language in the FEIS, however, continues to be unpersuasive with regard to the Purpose and Need for this project. We are confronted with a scattershot of reasons why the Utility Proponents believe this project is necessary, but many of those arguments, like the FEIS itself, are based on information that is clearly outdated and that must be freshened if it is to be included at all in this FEIS. We understand the time required to date in preparation of this document, but much has changed since the DEIS and as a result much of the case made in Chapter 1 is readily refutable.

We encourage the BLM to consider the comments it is receiving in response to this document and to reconsider whether it is prepared to defend a Record of Decision in support of the proposed Gateway West proposal.

Respectfully submitted,

Ken Miller
Clean Energy Program Director
Snake River Alliance
P.O. Box 1731
Boise, ID 83701
(208) 344-9161 (o)
(208) 841-6982 (c)
kmiller@snakeriveralliance.org
www.snakeriveralliance.org

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From: jmclain@blm.gov on behalf of Gateway_West_Trans_Line, BLM_WY
To: blm@gwcomment.com
Subject: Fwd: Gateway_FEIS_comments.docx (Gateway_west_WYMail@blm.gov)
Date: Monday, July 01, 2013 10:22:17 AM
Attachments: Gateway_FEIS_comments.docx.html

---------- Forwarded message ----------
From: **Bob Orr (Google Drive)** <robert.alexander.orr.3@gmail.com>
Date: Fri, Jun 28, 2013 at 1:30 PM
Subject: Gateway_FEIS_comments.docx (Gateway_west_WYMail@blm.gov)
To: Gateway_west_WYMail@blm.gov
Cc: whitlock368@clearwire.net, clairwhitlock@cableone.net, toolalang@aol.com, AnkaraRysaling@gmail.com, jhdoremus@cableone.net

Attached: Gateway_FEIS_comments.docx

Hello BLM:

The Snake River Raptors Volunteers have reviewed the proposed routes for the Gateway Transmission Line Project and request that the BLM develop a route which is outside of the SRBOPNCA.

Attached please find a more detailed letter supporting our decision with supporting citations from the EIS.

Sincerely

Robert Orr, President, Snake River Raptor Volunteers
James Whitlock, Vice President, Snake River Raptor Volunteers
Leslee Doner, Secretary, Snake River Raptor Volunteers
Randall Kaufman, Treasurer, Snake River Raptor Volunteers
John Doremus, Board Member, Snake River Raptor Volunteers

P.O. Box 7773
Boise, ID 83707

Gateway_FEIS_comments.docx

Google Drive: create, share, and keep all your stuff in one place.

June 28, 2013

Via electronic mail to Gateway_west_WYMail@blm.gov

Bureau of Land Management
Gateway West Project
P.O. Box 20879
Cheyenne, WY 82003

Snake River Raptor Volunteers, the friends group for the Morley Nelson Snake River Birds of Prey National Conservation Area (SRBOPNCA), appreciates this opportunity to comment on the final EIS for the Gateway West Transmission Line Project. The impacts the proposed transmission lines will have on raptors, if routed through the Morley Nelson Snake River Birds of Prey National Conservation Area are of concern to our group.

We have concerns with the proposed alternatives, routes 8B and 9E, which avoids many impacts on the SRBOPNCA but not all impacts. The National Landscape Conservation System was established "in order to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations." National Landscape Conservation System Act, 16 U.S.C. § 7202(a) (2009).

Secretarial Order 3308 speaks to the management of the Conservation Lands, stating that "BLM shall ensure that the components of the NLCS are managed to protect the values for which they were designated, including, where appropriate, prohibiting uses that are in conflict with those values." The 15-Year Strategy for the Conservation Lands reinforces this by stating the "conservation, protection, and restoration of the NLCS values is the highest priority in NLCS planning and management, consistent with the designating legislation or presidential proclamation." Conservation Lands Strategy at 8.

As conservation of natural and cultural resources is the principal mandate for BLM management of the Conservation Lands, the agency must diligently protect these areas from damage from new infrastructure projects, including transmission lines. Recent BLM policy guidance specifically addresses the management of BLM-managed national monuments and NCAs and creates a presumption that BLM will not approve new rights-of-ways (ROW) in these areas. Specifically the manual provides:

5. To the greatest extent possible, subject to applicable law, the BLM should through land use planning and project-level processes and decisions, avoid designating or authorizing use of transportation or utility corridors within NLCS units.

To that end, and consistent with applicable law, when developing or revising land use plans addressing NLCS units, the BLM will consider:

1. designating the NLCS unit as an exclusion or avoidance area;

2. not designating any new transportation or utility corridors within the NLCS unit if the BLM determines that the corridor would be incompatible with the designating authority or the purposes for which the NLCS unit was designated; and

c. relocating any existing designated transportation and utility corridors outside the NLCS unit.

BLM Manual 6100, § 1.6J(5).

The law establishing the Snake River Birds of Prey NCA includes specific provisions addressing allowable uses of the NCA "that will be compatible with the protection, maintenance, and enhancement of raptor populations and habitats and the other purposes for which the conservation area is established." 16 U.S.C. § 460iii-3(b)(7). These "other purposes" include "the natural and environmental resources and values associated therewith, and of the scientific, cultural, and educational resources and values of the public lands in the conservation area." 16 U.S.C. § 460iii-2(a)(2). Thus, only those proposed actions that would "protect, maintain, and enhance" the purposes of the NCA are permissible.

Transmission line development causes serious impacts, including direct damage to wildlands, wildlife habitat and cultural resources; interference with scenic vistas; habitat fragmentation; and others. Consequently, transmission lines are generally incompatible with management of the Conservation Lands absent a specific showing of how such a project would "protect, maintain, and enhance" the raptors, raptor habitat and the other purposes for which the NCA was designated. The BLM has not provided analyses that demonstrate this standard has been met for the Gateway West line. Unless BLM can demonstrate how these

transmissions lines would be good for the raptors we cannot support the lines going through the SRBOPNCA.

We request that a route, which avoids the SRBOPNCA, be developed by the BLM.

Sincerely,
Robert Orr, President, Snake River Raptor Volunteers
James Whitlock, Vice President, Snake River Raptor Volunteers
Leslee Doner, Secretary, Snake River Raptor Volunteers
Randall Kaufman, Treasurer, Snake River Raptor Volunteers
John Doremus, Board Member, Snake River Raptor Volunteers
P.O. Box 7773
Boise, ID 83707

The Nature Conservancy
Protecting nature. Preserving life.™

Southwest Office
950 W. Bannock St.
Suite 210
Boise, ID 83702

Tel (208) 343-8826
Fax (208) 343-8892

nature.org

June 28, 2013

Via electronic mail

Walt George
Gateway West Transmission Line Project Manager
Bureau of Land Management
P.O. Box 20879
Cheyenne, Wyoming 82003
Gateway_West_WYMail@blm.gov

Re: Comments on Gateway West Transmission Line Final Environmental Impact Statement

Dear Mr. George:

Thank you for the opportunity to comment on the Final Environmental Impact Statement for the proposed Gateway West Transmission Line Project. The Nature Conservancy's response is attached. Our comments represent contributions from staff the Idaho and Wyoming chapters of The Nature Conservancy

If you have questions regarding these comments, please contact Will Whelan, Director of Government Relations for The Nature Conservancy in Idaho, at 208-350-2202 or wwhelan@tnc.org.

Sincerely,

Toni Hardesty
State Director
Idaho Chapter

Andrea Erickson
State Director
Wyoming Chapter

100% post-consumer materials

Comments of The Nature Conservancy Regarding the Final Environmental Impact Statement for the Gateway West Transmission Line Project

June 28, 2013

INTRODUCTION

The Nature Conservancy (the Conservancy) is an international nonprofit whose mission is to conserve the lands and waters on which all life depends. The Conservancy's on-the-ground conservation work is carried out in all 50 states and in 30 countries with the support of approximately one million members. Throughout the United States, the Conservancy works closely with federal, state and local governments, businesses, the conservation community and private individuals to protect biodiversity in a science-based, collaborative manner.

The Conservancy is committed to cooperative, pragmatic approaches to resolving environmental issues associated with the nation's energy infrastructure. The Conservancy uses landscape-scale assessments in collaborative planning processes to balance the needs of energy infrastructure development with the conservation of natural resources and wildlife. Our experience has reinforced our belief that energy and biodiversity are not mutually exclusive. In our view, the question is not whether to proceed with energy development and associated infrastructure, e.g., transmission; the question is *where* to locate development to avoid or minimize impacts, or how to mitigate impacts to species and habitats if impacts cannot be avoided.

Our approach to environmental review is guided by the "mitigation hierarchy," which provides that the guiding principles for conserving natural resources are to avoid, minimize, mitigate and compensate for environmental impacts, in that order. The BLM and the project proponents have generally done a good job of avoiding and minimizing impacts.

Although these comments raise serious concerns about the adequacy of the compensatory mitigation proposed in the Gateway West Final Environmental Impact Statement (FEIS), we remain convinced that there is still time for the BLM, the project proponents, and key stakeholders to reach an appropriate balance between protecting the environment and building an electrical grid that meets the country's energy needs.

SUMMARY OF COMMENTS

1. BLM should take the time needed to fix major problems with its approach to compensatory mitigation for sage grouse impacts. *page 2*

2. The FEIS fails to mitigate for significant impacts to sage grouse and their habitats. *page 3*
3. The compensatory mitigation plan should include indirect impacts. *page 6*
4. Scientific research documents quantifiable indirect impacts and serves as a basis for incorporating these impacts into the compensatory mitigation plan. *Page 8*

   Recommendation: Compensatory mitigation of indirect impacts should be based on the loss of habitat services within .6 kilometers each side of the centerline of the Gateway West Transmission Line. We calculate that this measure would include 15,903 acres in preliminary priority habitat and 32,999 acres in general habitat. *page 9*

5. The record of decision should address mitigation planning and oversight. *page 10*
6. Key elements of the Habitat Equivalency Analysis are unsupported and should be revised. *page 10*
7. The FEIS lacks the findings needed to comply with legal standards for the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA). *page 14*
8. Enhancement measures offer an important opportunity to improve the condition of the NCA. *page 15*
9. The final route for Segment 4 in Wyoming should avoid pending conservation easements and address a local proposal to protect important wildlife habitat. *Page 16*

COMMENTS

I. BLM Should Take the Time Needed to Fix Major Problems with Its Approach to Compensatory Mitigation for Sage Grouse Impacts.

These comments point out serious flaws in the FEIS' approach to compensatory mitigation of the sage grouse impacts of the Gateway West Project. We respectfully request that BLM establish an inclusive process to fix these problems that draws on policy and scientific experts from the project proponents, key wildlife and resources agencies, and stakeholders experienced in mitigation science and practice. We are convinced that these concerns can be resolved through a purposeful and constructive engagement with the goal of producing a biologically effective and economically feasible compensatory mitigation plan.

The stakes are high. The Gateway West Project will set crucial precedents regarding BLM's approach to infrastructure mitigation at a time when the federal and state governments are working to establish "adequate regulatory mechanisms" that can avoid the need to list sage grouse under the Endangered Species Act.

Progress on other fronts is promising. The BLM has just issued draft Manual[1] provisions that represent a major step forward in off-site compensatory mitigation planning and implementation.

[1] Draft MS-1974 – Regional Mitigation Manual Section (P), attached to Instruction Memorandum No. 2013-142 (6/14/13).

The State of Idaho has advanced a state sage grouse conservation alternative that adopts the Idaho Mitigation Framework to offset infrastructure impacts. In Idaho, where large swaths of sage grouse habitat are being lost nearly every year to fire and invasive plants, it is critical that we develop policies and funding sources that can replace some of that habitat being lost. Utility companies, conservationists, ranchers, and everyone linked to our rangelands have a stake in developing effective compensatory mitigation programs.

The FEIS undermines this progress at a critical time. The major categories of sage grouse impacts – long recognized by the BLM as well as state and federal wildlife agencies – are simply excluded from the compensatory mitigation plan. The costs and benefits of mitigation actions are stipulated with little analysis and few procedures to ensure that those actions will actually accomplish the expected benefits. Some proposed mitigation actions, such as fence marking, are inappropriate to offset the type of impacts associated with Gateway West.

The result of the FEIS would be that hundreds of miles of transmission lines will be placed in sage grouse habitat with compensatory mitigation that is incomplete and insufficient. No one's long-term interest is served by this outcome.

The BLM has the time to remedy this situation. With the time that remains between the FEIS and the issuance of Notices to Proceed, we ask the BLM to: (1) reach out to the project proponents to request their support for a more open process on compensatory mitigation; (2) re-open certain elements of the Habitat Equivalency Analysis (HEA); (3) integrate indirect impacts into the compensatory mitigation analysis and (4) align the mitigation for this project with the planning approaches described in the BLM's draft Manual provisions and Idaho's Mitigation Framework.

II. The FEIS Fails to Mitigate for Significant Impacts to Sage Grouse and Their Habitats.

The compensatory mitigation package for the Gateway West is based on a Habitat Equivalency Analysis (HEA) set forth in Appendix J-2 of the FEIS. The document describes the HEA as a "standardized method to determine a one-to-one ratio [of] habitat services lost to habitat services mitigated."[2] The project proponents, acting at the direction of BLM, used the HEA-generated sum of habitat services lost to develop a package of compensatory mitigation projects. As explained below, the compensatory mitigation recommendations that emerged from the HEA process do not even come close to providing one-to-one mitigation for habitat services lost because the most significant project effects on sage grouse were excluded from the HEA analysis.

The project impacts that were incorporated into the HEA included the permanent and interim loss of sage grouse habitat services as a result of vegetation loss, noise and human presence

[2] FEIS at Appendix J-1, page 3.

anticipated with project construction and operation as well as the physical footprint of project structures.

The central flaw in the HEA is that it encompasses only a small portion of the sage grouse impacts that the U.S. Fish and Wildlife Services (USFWS) has linked to transmission lines.

> The USFWS's *12-Month Findings for Petitions to List the Greater Sage-Grouse as Threatened or Endangered* (2010e) listed the following as potential impacts to the sage-grouse resulting from powerlines: 1) collisions/electrocutions, 2) consolidation of predatory birds along powerlines, 3) lower recruitment rates near lines, 4) habitat fragmentation, 5) degradation of habitat due to spread of invasive plant species, 6) impacts resulting from the line's electromagnetic fields, and 7) direct loss of habitat. Additional impacts related to construction and operations of the line, as well as associated infrastructure, could include short-term disturbances due to construction and long-term disturbances during operations, increased road access allowing poaching/hunting in previously inaccessible locations, and changes to habitat structure resulting from altered fire regimes.[3]

None of the first six factors listed by USFWS are considered in the HEA and are therefore excluded from the mitigation package developed by the project proponents. This means that the HEA model fails to account for the synergistic and cumulative impacts of this transmission line, especially the indirect impacts of placing permanent and tall infrastructure in previously unaltered high quality habitat. For ease of reference, these excluded effects are referred to here as "indirect impacts."

Even though indirect impacts are not integrated into the HEA, the FEIS acknowledges they exist. For example, the FEIS quotes repeatedly from Connelly et. al. (2000) that "analysis of sage-grouse populations that attend leks within 18 kilometers (11 miles) of the Project is a critical component of an impacts analysis for the species *because these sage-grouse may be <u>indirectly affected</u> by the loss of habitat functionality during other seasons of the year (Connelly et.al. 2000)."* (emphasis added) The FEIS also recognizes indirect effects, stating that "Long-term beneficial effects (of decommissioning) would include the removal of tall structures (towers) from grouse habitats, and the decommissioning of Project facilities and access roads, both of which could increase the connectivity and size of wildlife habitat."[4]

The FEIS' recognition of the existence of indirect effects has ample scientific support. U.S. Geological Survey's recently issued Baseline Environmental Report (BER; Manier et al. 2013)[5] provides a recent summary of research showing that the effects of transmission lines far exceeds their direct "footprint" and construction effects. While the evidence is not extensive, the report

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[3] FEIS at 3.11-61 – 3.11-62.
[4] FEIS at 3.11-135.
[5] USGS, Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocercus urophasianus*) at 50. (Manier et al. 2013)

provides a clear rationale for including indirect and cumulative effects in the compensatory mitigation plan. The relevant selection from the BER report is set forth below:

> Transmission- and distribution-line construction (power lines) may result in substantial indirect habitat loss (that is, avoidance) due to sage-grouse avoidance of vertical structures, potentially because of changes in raptor concentrations and raptor species' composition relative to perches on flat landscapes. Additionally, the tendency of sage-grouse to fly relatively low, and in low light or when harried, may put them at a particularly high risk of collision with lines…. The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years (Ellis, 1985). This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons (Ellis, 1985). Negative effects of power lines on lek persistence were documented in northeastern Wyoming; the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 4 mi (6.4 km) window around leks (Walker and others, 2007a). Braun (1998b) reported that use of areas near transmission lines by sage-grouse increased as distance from transmission lines increased up to 1970 ft (600 m). Sage-grouse avoided brood-rearing habitats within 2.9 mi (4.7 km) of transmission lines in south-central Wyoming (LeBeau, 2012). Power line collisions accounted for 33 percent of juvenile (1st winter) mortality in low-elevation areas in Idaho (Beck and others, 2006). In general, it appears sage-grouse may avoid habitats within 0.4–2.9 mi (0.6–4.7 km) of a transmission line, and erection of a transmission line close to a lek will negatively influence sage-grouse lek attendance and breeding-season behavior. Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse (Steenhof and others, 1993; Connelly and others, 2004). Foraging distances of avian, sage-grouse predators have been estimated at 4.3 mi (6.9 km; Knick and Connelly, 2011a), suggesting that transmission and power lines may influence sage-grouse at large spatial scales (Connelly and others, 2004; Cresswell and others, 2010). *Based on these data, the direct footprint within any given MZ is relatively small (1.1–5.0 percent; table 8), but the area of relative influence is more extensive (25.2–62.8 percent PGH; table 8).* (emphasis added)

This conclusion is backed by a significant body of scientific research, including both peer reviewed publications and significant additional evidence, discussing the effects of transmission lines and tall structures on sage grouse habitat. These effects include habitat fragmentation and habitat loss caused by behavioral avoidance of transmission corridors. In particular, the U. S. Fish and Wildlife Service issued a briefing paper titled "Prairie Grouse Leks and Wind Turbines: U.S. Fish and Wildlife Service Justification for a 5-Mile Buffer from Leks" (2004) which places sage grouse and prairie grouse in the same "prairie grouse" category, and concludes that the avoidance impacts from vertical structures to both species are the same. This guidance goes on to say that "the Service feels it is important to clarify that avoidance of vertical structures by grassland and sage steppe-obligate wildlife is not a new issue."

As we explained in our comments on the DEIS, peer-reviewed studies conducted on other North American grouse species with similar life history traits to the sage grouse (i.e., the lesser and greater prairie-chickens) have shown that the birds' use of quality habitat is reduced when tall structures are located nearby, because prairie grouse instinctively avoid tall structures (Manes et al. 2002).

Three additional peer-reviewed studies found additional relevant evidence. In Utah, golden eagle predation of sage grouse increased from 26% to 73% (of total predation) after a transmission line was constructed within 200 yards of an occupied lek. The lek was extirpated and the author concluded that the presence of the transmission line resulted in both changes in sage grouse dispersal patterns and fragmentation of the habitat (Ellis 1985). In Kansas, the average displacement of prairie-chicken use areas was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines (Hagen et al. 2004). In Oklahoma, the displacement of lesser prairie-chickens from a power line was at least 500 meters (Pruett et al. 2009).

Other studies not published corroborate this evidence. In California, power lines resulted in sage grouse lek abandonment and reduced lek attendance up to 3 miles away from the lines (Rodgers 2003). In Colorado, pellet transects illustrated declining habitat use by sage grouse up to 600 meters from power lines (Braun 1998). In Washington, 19 of 20 leks (95%) documented within 7.5 km of 500 kV power lines were abandoned by the birds. In contrast, the vacancy rate for leks further than 7.5 km is 59% (22 of 37 leks) (Schroeder 2010).

Based on this body of scientific research, we conclude that any attempt to limit the compensatory mitigation package to direct and construction/operation impacts explicitly ignores the main influences of a transmission line on sage grouse habitat.

III. The Compensatory Mitigation Plan Should Include Indirect Impacts.

The FEIS' rationale for narrowing the HEA to just direct, construction, and operation impacts is that indirect impacts, such as predation, fragmentation, invasive species, etc., are difficult to

quantify within the HEA model. Importantly, the FEIS never contends that these effects are non-existent or insignificant.[6] Instead, they are excluded because they are difficult to tally within the specific model the agency selected for scaling project mitigation. Rather than weigh these effects in the mitigation analysis, the agency states that "indirect impacts to sage-grouse and their habitats are qualitatively assessed" outside the scope of the HEA process. Thus, the FEIS effectively concedes that the HEA does not capture the full range of impacts of the project.

We understand that indirect impacts can be difficult to quantify precisely but disagree that this is an adequate basis for entirely failing to mitigate for them. It is insufficient for the FEIS to state that, because the indirect effects of hundreds of miles of transmission line cannot be "accounted" for in the HEA, no mitigation of any sort for those impacts is necessary. Although there may be a range of uncertainty regarding the extent of indirect impacts, that range does not include a "zero effect."

This situation calls for BLM to exercise its judgment and determine how to account for indirect effects in the mitigation package – either within the HEA or, preferably, as an additional component of the mitigation analysis. The BLM's Framework for Analyzing Sage Grouse Impacts, prepared prior to the draft EIS, states that it is reasonable to make predictions about indirect impacts:

> Qualitative and quantitative measures of habitat change must be considered in describing the potential impacts of the project. In the context of managing a species that requires such a large landscape of habitats to meet their lifecycle needs, and the nature of the proposed disturbance, *it is reasonable to make some assumptive predictions about the relative impacts within 18km.*[7]

The FEIS itself at one point appears to contemplate a quantitative approach to assessing indirect impacts:

> The general Analysis Area used for wildlife habitat mapping (see Section 3.11.1.4) consisted of a 1,000-foot-wide area centered on the Proposed Route and Route Alternatives (500-foot-wide on either side of the centerline of each route)…. While most of this Analysis Area would not be directly impacted by the Project, information gathered for this larger area allows for an understanding of

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[6] In fact, the draft EIS states that the project's direct and indirect impacts plus the absence of an agreed-upon compensatory mitigation plan is "likely to contribute to a trend toward federal listing or loss of viability for the greater sage-grouse." DEIS at 3-11-72 – 3-11-73 (emphasis added, referencing Region 4 language. It is hard to imagine how the minor amount of mitigation required via the HEA-based approach would serve as a sufficient basis for altering this finding.

[7] FEIS at Appendix J-1, pg. 2.

> the context in which the impacts would occur and *allows an assessment of indirect effects*.[8]

Our concern is that neither this nor any other approach for assessing indirect effects (other than construction noise) was ever incorporated into the compensatory mitigation analysis.

We request that BLM work with the project proponents, federal and state experts, and stakeholders to develop a defensible approach to compensating for indirect effects prior to issuing notices to proceed for the project.

IV. Scientific Research Documents Quantifiable Indirect Impacts and Serves as a Basis for Incorporating These Impacts into the Compensatory Mitigation Plan.

The following table summarizes studies of indirect effects of transmission lines on sage grouse, including reproductive behavior, predation, and vital rates. Although these studies discuss impacts at different distances from transmission lines, they all come to the same conclusion that these impacts are real and detrimental. Taken together, these studies provide a reasonable starting point for quantifying how indirect impacts can be integrated into the compensatory mitigation package.

A Literature Review of Transmission Line Effect Distances

Effect Distance Value	Source	Comments
No effect detected at 5 and 18km of a lek.	(Johnson et al. 2011)	Authors examined trends in lek counts and anthropogenic features (1997-2007). No general pattern/association was found across the entire study area with transmission at tested 5km and 18km of lek.
200 m	(Ellis 1985)	The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years. This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons.
360 m +/- 60, 630 m +/- 40	(Robel et al. 2004)	Data are from a 6 year study of energy development on lesser prairie-chickens in Kansas. Distances are mean (+/- SE) distance to electric power lines avoided by 90% of 187 nesting prairie checking and mean distance to power lines across which 95% of 18,866 telemetry locations of prairie chickens were absent, respectively.
450-650 m	(Hagen et al. 2004)	In Kansas, the average displacement of prairie-chicken use

[8] FEIS at 3.11-2 – 3.11-3 (emphasis added).

		sites was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines.
400m	(Pitman et al. 2005)	Data are from a study on lesser prairie-chickens in Kansas and found that nest proximity was "seldom less than 400 meters from a transmission line" (Table 3)
500m	(Hanser et al. 2011)	Wyoming Basins Ecoregional Assessment: Study of responses of sage-grouse to anthropogenic effects. Authors tested effects at .5 km and 1km and found the most significant effect of transmission lines on sage-grouse abundance at .5 km.
500m	(Pruett et al. 2009)	Oklahoma prairie-chicken study found that displacement of prairie-chickens was at least 500m from a power line.
600 m	(Braun 1998)	In Colorado, pellet transects illustrated declining habitat use by sage-grouse up to 600 meters from power lines.
600 m	(Gillan et al. 2013)	Using a spatial statistical approach with telemetry data from Idaho, this study found that sage-grouse avoided power transmission lines by 600 m.
0-4.7 km	(LeBeau 2012)	A wind turbine effects and infrastructure study that examined infrastructure related to wind development within the two study areas in SE Wyoming and found that the estimated odds of sage-grouse selecting brood-rearing habitat within the Seven Mile Hill study area increased as distance from nearest overhead transmission line increased up to 4.7 km (90% CI: 2.2–18.5 km), then declined. However, LeBeau also found that sage-grouse selected *for* nesting habitat closer to transmission lines within Simpson Ridge study area.
4.8 km	(Rodgers 2003)	In California, power lines resulted in sage-grouse lek abandonment and reduced lek attendance up to 3 miles away.
6.4 km	(Steenhof et al. 1993, Connelly et al. 2004)	Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse.

Recommendation: Based on this information, The Nature Conservancy recommends that compensatory mitigation be based on loss of habitat services within .6 kilometers either side of the centerline of the Gateway West Transmission Line route. We note that the literature supports the conclusion that indirect impacts, such as predation, occur at much larger distances. Therefore, a 600 meter "band" on either side of the transmission line represents a moderate approach to quantifying habitat services losses that should be subject to compensatory mitigation based on available information for the habitat types affected.

We calculate that this approach would include 19,084 acres in preliminary priority habitat and 39,599 acres in preliminary general habitat.

V. The Record of Decision Should Address Mitigation Planning and Oversight.

Replacing sage grouse habitat that has been lost due to infrastructure project development is difficult yet essential. Success depends on investing compensatory mitigation funds at sites where sage grouse actually benefit from improved conditions, where vegetation status and trends are well enough understood to calculate mitigation project benefits or "uplift," and where land management practices are consistent with maintaining the durability of mitigation benefits.

The project proponents recognize these challenges in their compensatory mitigation proposal at Appendix C-3 and propose a collaborative "oversight committee" to help them select appropriate projects and locations. We think that this approach has merit and encourage BLM to include it in the Record of Decision (ROD).

The ROD should elaborate on the committee's composition and responsibilities and give it broad authority to align the implementation of compensatory mitigation measures with the BLM's draft Manual provisions on mitigation and the Idaho Mitigation Framework.

Specifically, we request that the oversight committee be given broad latitude to address:

1. The selection of mitigation sites based on a landscape analysis that considers locations that provide greatest benefit to sage grouse populations, ensure compatible land management policies and practices, and maintain the persistence of mitigation benefits;

2. The mix of conservation projects included in the compensatory mitigation package;

3. Estimates of conservation project cost and mitigation benefit (uplift); and;

4. Stewardship and monitoring plans.

The oversight committee should have discretion to direct mitigation funds to off-site projects in accordance with the guidance discussed in the draft BLM Manual – 1794.

VI. Key Elements of the HEA Are Unsupported and Should Be Revised.

As a general matter, the application of the HEA model used for the Gateway West Project is not fully supported in the administrative record. The BLM should re-open the HEA to address shortcomings and should consider other analytical approaches for this and future projects.

A. The HEA's Approach to Habitat Characterization Is Vulnerable to Inaccuracy and Undervalues High Quality Habitat.

We believe that the HEA model is overly simplistic in ways that compromise its results. The HEA description states that "The Habitat Equivalency Analysis, described [below], provides a standardized basis to determine a one-to-one ratio for habitat services lost to habitat services mitigated." [9] The key to the validity of the process is how "service" is defined. HEA relies on categorical measures ("bins") derived from expert opinion that are not weighted to reflect their relationship with sage grouse habitat utilization. This introduces unquantifiable inaccuracy into the HEA model.

We recommend the use of data-driven, likelihood-based models that allow variables to be weighted based on observed habitat use similar to the U.S. Geological Survey's Wyoming Basins Ecological Assessment sage grouse model. Similar models should be developed in Idaho.

In the HEA, scores of each category (i.e., 0,1,2,3) were assigned arbitrarily. In an analytical sense these are ordinal variables – and simply rank one class against the others. Yet, these scores are treated as meaningful in a mathematical sense. The model sums these ordinal variables to generate a single score. In a very real sense, the model adds 5 fairs, 2 excellents, and 4 goods, to come with a value of 19. In order for the model to be truly meaningful, the BLM must provide evidence that there is a *mathematical* relationship between these categories. For example, in the current model a site 51 meters from a county/state highway is twice as good as an identical one 50 meters away, but a site 1 km from the same highway is only 50% better than one 51 meters removed. This relationship holds true for all the variables; there is an exponential decline in value gained with improving quality (rate of improvement declines at a rate of x^{-1}). As a result, the model dramatically *undervalues* quality habitat relative to poor or fair habitat. We believe that most scientists familiar with sage-grouse and sage-steppe systems would argue the exact opposite, that habitat value increases exponentially with improving quality, likely at a rate of x^{10}. If the BLM wants to use this framework as a quantitative model for assessing habitat quality, it must provide the mathematical relationships between these categories, and relate them to the published literature.

Seven of the eleven variables in the model cannot have a score <1. This further undervalues the best quality habitat by arbitrarily increasing scores for the poorest quality sites.

The model completely ignores the regional and landscape context of the impacts. For example sage-grouse priority habitat areas should be highly valued and these values should be reflected in the site scores. Currently, this is not the case.

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[9] FEIS at Appendix J-1, pg. 2.

By design, the model explicitly ignores any interaction among variables that might impact habitat quality. For example, a site that is close to a lek and is in a large patch of intact sagebrush is most likely far more valuable to sage grouse than one that has a similar patch size but is >8 km from an active lek (all other variable held constant). Yet, the model values the former as having only a 7.5% greater value to sage grouse. A cursory examination of the variables reveals many such interactions documented in the literature (e.g., sagebrush cover and bunchgrass cover). These clearly need to be reflected in the model. By ignoring these interactions, the current model is a significant step backward from the Habitat Suitability Index models developed for other prairie grouse species. Finally, by not incorporating interactions among variables, the current model further undervalues the highest quality sage grouse habitat. The importance of the "service" currency is accentuated when it is used to value mitigation lands. The model is explicit that "successful" mitigation occurs when the total service value impacted is replaced by mitigation. As a result, service value gained by mitigating poor quality habitat to moderate quality habitat is the same as that from moderate to high quality. Thus, for example, the loss of an acre of high quality habitat could be mitigated by seeding three acres of post-fire rehabilitation to bring those lands up to marginal quality. We disagree with the notion that this reflects effective, or appropriate, mitigation. TNC's sage-steppe mitigation experience is that it is far easier to create low to moderate quality sage grouse habitat than to (re)create that of high quality. Thus, the current model's structure would foster restoration of poor quality habitat as mitigation for the loss of that of highest quality. Rather, we suggest that the valuation model be used to identify quality classes (e.g. acres with a score >20 = quality class 1) and mitigation must replace all acres of quality class 1 with quality class 1 lands. This ensures that the total habitat quality is not ratcheted downward by constantly replacing high quality lands with those of lower quality.

Finally, the HEA Technical Advisory Team identified five classes of projects suitable to mitigate the impacts of development: fence marking/modification, sagebrush restoration/reclamation, conifer/juniper removal, grass/forb enhancement, and conservation easements. Only two of these activities, sagebrush restoration/reclamation and grass/forb enhancement, are related to the 11 variables in the HEA model, and thus would have any measurable impact on the service value of the mitigated lands. And, as noted above, the known challenges of restoring high quality sage-steppe could, without careful planning and oversight, result in the restoration of poor quality habitat to moderate quality habitat as mitigation for the loss of the highest valued areas.

B. <u>The BLM Should Address Specific Shortcomings in the HEA</u>.

We have the following specific comments about the HEA:

1. *The HEA's treatment of the risk of mitigation project failure is arbitrary.* The habitat conservation projects modeled in the HEA include actions that have a significant risk of project failure – particularly sagebrush steppe restoration and improvement

projects and bunchgrass and forb seeding projects. The Conservancy strongly supports including these actions in the mitigation package. However, given the substantial risk of project failure, it is essential that the cost of these actions must be increased enough to offset the risk that vegetation treatments may not achieve the expected benefits. The HEA states that "conservative growth rates were sufficient to offset the potential for mitigation project failure."[10] This is an overly general approach to an issue that deserves a more precise treatment. A better approach would be to examine actual project histories and existing restoration project databases to determine the likely risk of project failure for the different types of conservation projects. The risk of project failure could then be reflected as a multiplier on the estimated cost of the action. The BLM's recently issued Instruction Memorandum and Draft Manual Section—1794 suggests the use of ratios is an appropriate way to ensure that mitigation benefits will be proportional to impacts in light of uncertainty.[11]

2. *Fence marking should be removed from the list of eligible habitat projects.* Two reasons support this request. First, fence marking does not replace habitat services lost due to direct or indirect habitat effects of the project. At most, fence marking offsets direct mortality due to power line strikes. Second, other funding sources and efforts are targeted on fence marking. These efforts should proceed and the Gateway West mitigation should be focused on projects that replace habitat services through protection, restoration, and enhancement.

3. *The values for habitat services gained and cost per services gained are not adequately disclosed in the record.* With the exception of fence marking, the mix of habitat conservation projects modeled in the HEA is appropriate. However, we are unable to understand how the specific habitat services gained values and costs per services gained, shown in Table 8 of Appendix J-2, were derived. Appendix D of Appendix J is difficult to understand.

4. *Conservation projects will likely require a mix of measures that was not modeled.* The HEA did not attempt to model a mix of different conservation actions, such as combining sagebrush restoration and conservation easements. However, vegetation treatments and other habitat enhancement projects on private lands will require some sort of long-term agreement to ensure that the mitigation site is not disturbed or developed. A conservation easement or other long-term management agreement is

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[10] FESI at Appendix J-2, page 12.
[11] Draft MS-1974 – Regional Mitigation Manual Section (P) at page 12 , attached to Instruction Memorandum No. 2013-142 (6/14/13).

likely required as a component of such projects. This cost should be reflected in the estimates of cost per services gained.

VII. The FEIS Lacks the Findings Needed To Comply with Legal Standards for the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA).

The BLM preferred routes for Segments 8 and 9 would cross portions of the NCA, a unit of the National Landscape Conservation System. In fact, the FEIS contains no alternative that entirely avoids the NCA. Therefore, BLM's decision to issue a right-of-way for the project must comply with the standards established in the 1993 statute establishing the NCA. In addition, the decision should also be consistent with the BLM Manual's standards implementing the National Landscape Conservation System Title of the Omnibus Public Lands Act of 2009. The FEIS lacks the findings needed to comply with these standards. As explained below, these standards require two findings: (1) the proposed project must not be incompatible with the values that NCA was established to protect and (2) the project must "protect, mitigate and enhance" the NCA.

Compatibility Finding: The BLM Manual provides that the agency will not designate utility corridors within NLCS units if it determines the "corridor would be *incompatible* with the designating authority or the purposes for which the NLCS unit was designated." BLM Manual 1.6.J.5 (emphasis added). *See also*, 16 U.S.C. 460iii-3(b)(7) (allowing non-military uses within the NCA that are "compatible" with NCA purposes). The NCA purposes to be considered in making such a finding include: the conservation, protection, and enhancement of raptor populations and habitats and the natural and environmental resources and values associated therewith, and of the scientific, cultural, and educational resources and values of the public lands in the conservation area. 16 U.S.C. §460iii-1(a)(2).

The BLM Manual does not define the terms "compatible" or "incompatible." However, compatibility determinations are a familiar feature of administering the National Wildlife Refuge System and Wild and Scenic Rivers. In the context of Wildlife Refuges, an action is deemed "compatible" if it "will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the refuge." 16 U.S.C. § 668ee(1). BLM's compatibility determinations for livestock grazing and recreational shooting at the Cascade-Siskiyou National Monument may also offer useful guidance on this point.

Enhancement Finding: The NCA legislation requires that non-military uses must be consistent with "protection, maintenance, and enhancement" of raptors and other NCA purposes. *See* 16 U.S.C. 460iii-3(b)(7).

The term "enhancement" requires more than simply minimizing or offsetting impacts. It calls for actions that leave the NCA better off than it would have been without the construction of transmission line. *See also* 16 U.S.C. 460iii-3(a)(2) (allowing activities in the NCA that "further the purposes for which the conservation area was established"). Prior to issuing the right-of-way

for the project, BLM must analyze proposed enhancement measures and determine their effectiveness.

We do not believe that these standards bar the project from NCA lands. However, no project right-of-way should be issued without findings in the administrative record that comply with these standards.

VIII. Enhancement Measures Offer an Important Opportunity to Improve the Condition of the NCA.

The Birds of Prey National Conservation Area has been highly degraded by repeated fire and invasive plants. The area's native sagebrush/bunchgrass/forb assemblages have been lost across large portions of the NCA. The area is in urgent need of restoration and enhancement. A well-designed package of enhancement measures could provide significant benefits to the area.

The enhancement package should focus primarily on the major threat to raptor populations within the NCA: the decline of the raptor's prey base due to the loss of shrub and perennial grass vegetative cover. Most of the NCA has burned in the last 25 years, and native shrub steppe vegetation has been replaced by annual grasslands dominated by cheatgrass and other non-native species. The change in vegetation has reduced the populations of small mammals that form the prey base for raptors. This decline has reduced the productivity of raptors within the NCA. In particular, efforts are needed to restore black-tailed jackrabbit and Paiute ground squirrel populations.

Recommended measures include:

1. Restore native shrubs and perennial grasses. Given the low precipitation levels within the NCA and the extent to which NCA lands have been invaded by annual grasslands, some non-native species that provide the structure needed by prey species may be used as necessary. The guiding principle should be to produce more resilient vegetation that provides better habitat for raptor prey species.

2. Work with ranchers or grazing permittees to improve riparian areas and springs.

3. Protect private inholdings through fee or conservation easement acquisition where lands have special features of high conservation value, such as canyon rims and adjacent areas that offer important nesting, perching, and foraging habitat. The goal for any acquisitions should not simply be NCA expansion. There is little value in BLM acquiring more annual grasslands or degraded range. Acquisition should be focused on specific natural, scenic or recreational features that add significant value to the NCA.

The existing NCA Resource Management Plan provides important guidance on the best places and techniques for this work.

In addition, to these measures, we think there is a great opportunity to include measures to communicate with recreational users regarding seasonal or area closures or other best practices to reduce impacts and fire risks associated with off-highway vehicles, shooting, and other recreational activities. Interpretive signage, kiosks and other out-reach could help reverse the pace of fire and degradation in the NCA.

As noted above, the goal for the enhancement package should go beyond one-to-one replacement of impacts. The BLM's recently issued draft Manual makes it clear that designations such as National Conservation Areas are appropriately considered in determining the value of the affected resource.[12] We believe that a well-designed enhancement package could provide significant net benefits to the NCA.

IX. The Final Route for Segment 4 in Wyoming Should Avoid Pending Conservation Easements and Address a Local Proposal to Protect Important Wildlife Habitat.

With respect to the proposed and alternative routes of the Gateway West transmission line in Lincoln County, Wyoming, identified on Figure A-5, Segment 4-WY in Appendix A of the FEIS, the Conservancy expresses the following concerns and recommendations:

- The BLM Preferred Alternative and Proposed Route would diagonally bisect property that the Conservancy is in the process of establishing a conservation easement on, in cooperation with the property owners. This conservation easement will be purchased using both private and public dollars as well as a substantial donation from the landowners. As a result, we are concerned with the proposed construction of a transmission line that would impact the wildlife habitat, open spaces and agricultural operation that the landowners, the state of Wyoming, the federal government, private funders and the Conservancy feel warrant protection. We recommend a route that would avoid these impacts.

- With respect to Feasible Alternative 4F, identified on Figure A-5, Segment 4-WY in Appendix A of the FEIS, we are concerned with the route's identified intersections with multiple properties that are in the process of establishing conservation easements. We recommend that alternative transmission line routes avoid impacting wildlife habitat, open spaces and culturally significant properties by avoiding properties with conservation easements in place or near completion.

- The Conservancy is aware of the efforts of local stakeholders (landowners, community members and Lincoln County leaders) who have worked with representatives from Gateway

[12] Draft MS-1794 – Regional Mitigation Manual Section (P) Section 1.6.D.11.c.i. at page 1-10.

West throughout the development of this project. From conversations with these stakeholders we understand they have recommended a route that would follow the existing transmission line corridor, and therefore minimize impacts on wildlife habitat and the community. Our understanding is that local stakeholders assumed the BLM Preferred Alternative route would be constructed slightly to the south of the existing line but still within the existing corridor, rather than to the north as in the current Preferred Alternative. From our understanding of these recommendations, we support this local stakeholder-recommended route that would follow an existing transmission line to the south and reduce impacts to properties that will be placed under conservation easement.

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Wildlife Society Bulletin 37(2):301–310; 2013; DOI: 10.1002/wsb.272

Original Article

Using Spatial Statistics and Point-Pattern Simulations to Assess the Spatial Dependency Between Greater Sage-Grouse and Anthropogenic Features

JEFFREY K. GILLAN,[1,2] *Department of Forest, Rangeland and Fire Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

EVA K. STRAND, *Department of Forest, Rangeland and Fire Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

JASON W. KARL, *New Mexico State University Las Cruces, NM 88003-8003, USA*

KERRY P. REESE, *Department of Fish and Wildlife Resources, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

TAMARA LANINGA, *Department of Conservation Social Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

ABSTRACT The greater sage-grouse (*Centrocercus urophasianus;* hereafter, sage-grouse), a candidate species for listing under the Endangered Species Act, has experienced population declines across its range in the sagebrush (*Artemisia* spp.) steppe ecosystems of western North America. One factor contributing to the loss of habitat is the expanding human population with associated development and infrastructure. Our objective was to use a spatial-statistical approach to assess the effect of roads, power transmission lines, and rural buildings on sage-grouse habitat use. We used the pair correlation function (PCF) spatial statistic to compare sage-grouse radiotelemetry locations in west-central Idaho, USA, to the locations of anthropogenic features to determine whether sage-grouse avoided these features, thus reducing available habitat. To determine significance, we compared empirical PCFs with Monte Carlo simulations that replicated the spatial autocorrelation of the sampled sage-grouse locations. We demonstrate the implications of selecting an appropriate null model for the spatial statistical analysis by comparing results using a spatially random and a clustered null model. Results indicated that sage-grouse avoided buildings by 150 m and power transmission lines by 600 m, because their PCFs were outside the bounds of a 95% significance envelope constructed from 1,000 iterations of a null model. Sage-grouse exhibited no detectable avoidance of major and minor roads. The methods used here are broadly applicable in conservation biology and wildlife management to evaluate spatial relationships between species occurrence and landscape features. Our results can directly inform planning of infrastructure and other development projects in or near sage-grouse habitat. © 2013 The Wildlife Society.

KEY WORDS *Centrocercus urophasianus*, Monte Carlo, pair correlation function, point pattern, Ripley's K, sage-grouse, spatial statistics.

The greater sage-grouse (*Centrocercus urophasianus;* hereafter, sage-grouse), a candidate species for listing under the Endangered Species Act of 1973 (ESA; U.S. Department of the Interior 2010), has experienced population declines across its range in the sagebrush (*Artemisia* spp.) steppe ecosystems of western North America (Connelly and Braun 1997, Connelly et al. 2004). Sage-grouse now occupy only 56% of their pre-settlement range, though they still occur in 11 western states and 2 Canadian provinces (Schroeder et al. 2004). The conservation status of this wide-ranging species could have a significant influence on public land policy regarding land use, energy and mineral development, transportation and communication corridors, and livestock grazing (Wambolt et al. 2002; US Bureau of Land Management 2004, 2011; Stiver et al. 2006, 2010), because two-thirds of remaining sagebrush lands (329,881 km^2) are publicly managed (Knick 2011). The remaining one-third of sagebrush lands (150,186 km^2) that are privately owned (Knick 2011) could be impacted if sage-grouse are listed under the ESA.

Causes for the species' decline have been attributed primarily to the removal and degradation of sagebrush-dominated lands essential for cover, nesting, and food (Connelly and Braun 1997, Braun 1998, Leonard et al. 2000, Connelly et al. 2004). Historically, conversion of sagebrush habitats to crop fields and livestock pastures was the primary driver of habitat reduction (Swenson et al. 1987, Beck and

Received: 4 June 2012; Accepted: 14 November 2012
Published: 14 May 2013

[1]*E-mail: jgillan@nmsu.edu*
[2]*New Mexico State University Las Cruces, NM 88003-8003, USA*

Mitchell 2000), but more recently wildfire, invasion of annual grasses, and infrastructure development have been responsible for habitat alteration in the sagebrush steppe biome (Knick et al. 2003, 2011; Connelly et al. 2004; Miller et al. 2011).

One factor contributing to current sage-grouse habitat threats is the continually expanding human population and footprint. From 1960 to 2000, the western United States was the fastest growing region of the country and during the 1990s grew at twice the national rate (Perry and Mackun 2001, Travis 2007). From 2000 to 2010, population growth in the region slowed only slightly and 3 of the 4 fastest growing states (NV, UT, and ID) were those with significant sage-grouse populations (Mackun and Wilson 2011). Development patterns spurred by increasing human populations have been characterized by extensive suburban development around major cities and rapid growth of exurban communities and "ranchettes" far removed from metropolitan centers (Brown et al. 2005, Hansen et al. 2005, Travis 2007). This type of growth consumes more land and fragments landscapes more significantly than concentrated urban development (Sullins et al. 2002, Connelly et al. 2004). Many ranches that were previously used for livestock production have been sold and subdivided into low-density housing (Knick et al. 2011). Associated infrastructure, including roads and power-lines, has also expanded on these landscapes (Leu et al. 2008, Leu and Hanser 2011). In some parts of the sage-grouse range, most notably Wyoming, USA, energy development has expanded (Walker et al. 2007, Naugle et al. 2011). Thousands of new natural gas wells have come on line in recent years and required the construction of roads, power lines, compressor stations, pipelines, and ponds (US Bureau of Land Management 2003).

Anthropogenic features can impact ecological processes and wildlife behavior beyond the immediately affected area. Typically, lower biodiversity and more human-adapted species persist adjacent to ranchettes (Theobald et al. 1997; Maestas et al. 2001, 2003; Odell and Knight 2001). The introduction of non-native plant species is one cause because it can change the ecological composition of surrounding land, effectively degrading habitat (Hansen et al. 2005). Wildlife may also avoid anthropogenic features because of noise and the presence of domestic animals such as dogs and cats (Hansen et al. 2005). This type of avoidance behavior can fragment habitat, shrink total available habitat, and create dispersal barriers (Marzluff and Ewing 2001). By assuming that anthropogenic features have some effect on the surrounding land, a recent study by Knick et al. (2011) concluded that power lines have an ecological influence on 39% of all remaining sagebrush lands in the American West, highways influence 38% of remaining sagebrush lands, and urban development influences 18.6% of sagebrush lands. Also, <5% of the entire sage-grouse range is farther than 2.5 km from a mapped road (Knick et al. 2011).

Although sage-grouse cannot tolerate the outright removal of sagebrush (Braun et al. 1977, Connelly et al. 2000), the extent to which proximity to anthropogenic features can negatively influence sage-grouse or cause avoidance behavior is less understood. Some studies have observed negative associations of infrastructure on sage-grouse lek size and persistence (Braun 1986, Hall and Haney 1997, Harju et al. 2010, Holloran et al. 2010, Johnson et al. 2011) and also nest initiation rates (Lyon and Anderson 2003). Sage-grouse have been documented avoiding habitat adjacent to oil and gas wells and their associated infrastructure (Carpenter et al. 2010, Holloran et al. 2010). Sage-grouse are also thought to occur less often near power lines and major highways (Braun 1998, Hanser et al. 2011).

Most of the studies aimed at understanding sage-grouse habitat associations have not directly considered the clustered nature of sage-grouse populations and the impact of the resulting spatial autocorrelation of sage-grouse observations (only surveyed exception was Yost et al. 2008). Spatial autocorrelation refers to tendency of nearby observations to be more similar (positive autocorrelation) or less similar (negative autocorrelation) than distant observations (i.e., observations are not independent in space; Legendre and Fortin 1989, Legendre 1993). Almost all ecological data will exhibit some degree of autocorrelation as a result of processes (e.g., competition, succession, population genetics, predator–prey interactions), or underlying environmental patterns (e.g., vegetation, soils, topography, anthropogenic features; Legendre and Fortin 1989). Likewise, the species being sampled will often cluster because of habitat features or social structures within the population (Lieske and Bender 2009). Spatial autocorrelation inherent in ecological data by itself is not a problem; in fact, it is very useful for resource usage estimations that use interpolation techniques (Aarts et al. 2008).

Problems can arise when autocorrelated data are used in classical statistical models and significance testing that assumes independent samples (Legendre and Fortin 1989, Legendre et al. 1990, Fortin and Jacquez 2000). Spatial autocorrelation in sample data can reduce the effective sample size and the degrees of freedom for tests of statistical significance (Dale and Fortin 2002). As a consequence, results can be classified as significant when they are actually not (i.e., type I error; Dale and Fortin 2002, Klute et al. 2002, Lieske and Bender 2009). In logistic regression analysis, a popular modeling technique for species-habitat associations, spatially autocorrelated data can overestimate the effects of independent variables on the response (Klute et al. 2002, Dormann et al. 2007, Aarts et al. 2008, Lieske and Bender 2009). Similarly, "Monte Carlo" studies that compare observed data with many different computer-generated random permutations can also result in Type I errors if spatial autocorrelation of the observed data is not included in the null model (Fortin and Payette 2002).

Previous studies on sage-grouse habitat associations should not be disregarded and may be highly accurate if the parameters capture the spatial dependency inherent in the data. But frequently, non-environmental processes that cannot be modeled may be partly responsible for the species' distribution. Accordingly, all ecological studies should consider the potential of spatial autocorrelation in their data and how it might affect results.

Our objectives were to employ a spatial-statistical approach to determine whether sage-grouse in an isolated population in west-central Idaho, USA, were avoiding anthropogenic features (i.e., roads, power transmission lines, and rural buildings) and, if so, how far from the feature was the zone of influence. This study explicitly accounted for the spatial autocorrelation of sage-grouse observations to evaluate their association with anthropogenic features. This research incorporates spatial analysis techniques, including considerations for null model selection, that are broadly applicable for evaluating relationships between species occurrence and landscape features within the species' environment across large areas. The results can inform planning and decision making for rural development including infrastructure routes that minimize negative impacts to sage-grouse and their habitats.

STUDY AREA

This study was conducted in the West Central Sage-grouse planning area in west-central Idaho, which included parts of Washington, Adams, Gem, and Payette counties (centered at 44°26′N, 116°38′W). The 374,700 ha planning area was established to conserve a small and isolated population of sage-grouse that was considered the most likely to be extirpated within the state (Idaho Sage-grouse Advisory Committee 2006). Exact population numbers are unknown but it was estimated that the population was significantly lower than in 1970 due to the abandonment of many leks (Idaho Sage-grouse Advisory Committee 2006, West Central Sage-grouse Local Working Group 2008). Currently, 14 leks are being monitored each year. The major potential threats to sage-grouse in this area were geographic isolation, private property development, wildfire, expansion of annual grasslands, and West Nile Virus (Idaho Sage-grouse Advisory Committee 2006).

The study area consisted primarily of rolling hills of sagebrush steppe and grassland vegetation. The shrub component was mainly xeric big sagebrush (*Artemisia tridentata* sp. *xericensis*), stiff sagebrush (*A. rigida*) and three-tip sagebrush (*A. tripartita*). Native perennial grasses included bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*), and Thurber needlegrass (*Achnatherum thurberianum*). Elevations ranged from 630 m at the Snake River near Brownlee reservoir to >1,220 m at the southern boundary of Payette National Forest. The greatest proportion of the area and of occupied sage-grouse habitat lay between 760 m and 1,070 m in elevation (West Central Sage-grouse Local Working Group 2008). The climate was characterized by cold, wet winters and hot, dry summers. Mean annual precipitation was about 28 cm at lower elevations near the city of Weiser, Idaho, but increased quickly with elevation to >51 cm over much of the planning area. Seventy-five percent of the planning area was considered intact shrub and bunchgrass communities dominated by sagebrush species. Of the 25% that had been altered, 50% was due to invasive annual grasslands thought to have originated from contaminated wheat crops, 49% was in farmland, and only 1% was developed (West Central Sage-grouse Local Working Group 2008).

The study area was rural and had experienced slow human population growth compared with other regions of Idaho. The valley bottoms support irrigated farmland while the uplands were primarily used for livestock grazing. Most settlements, including the small towns of Midvale and Cambridge, occurred along the U.S. 95 highway corridor (Fig. 1). Land speculation and ranchette style housing, however, had become increasingly popular outside of city limits (Adams County, Idaho 2006, West Central Sage-grouse Local Working Group 2008).

METHODS

Sage-grouse Telemetry

We obtained sage-grouse location data from the Idaho Department of Fish and Game, who used radiotelemetry to locate sage-grouse in the study area from April 2005 to December 2007 (Gray 2009). Fourteen females and 44 males captured on 14 different leks were used in this study. To ensure a representative sample of the population, leks were selected to have a range of habitats, a mix of private and public lands, and geographic separation. Sage-grouse were monitored every 2–3 weeks from March through September and once per month from October through February. With this sampling method, bias from serially correlated individual sage-grouse should be small. Location coordinates were recorded using a Garmin (Olathe, Kansas, USA) 76CS Global Positioning System (GPS) where the bird was first seen, but 26 of the locations were obtained through triangulation to prevent flushing. Average accuracy of the GPS was 2–10 m, while the triangulation error could be up to 150 m. Four-hundred ninety-six locations, collected between the months of March and November across all years, were used for the analysis. We excluded the few locations obtained during the winter (Dec–Feb) because sage-grouse habitat use is greatly dependent on snow depth and topography and may not accurately reflect behavior toward anthropogenic features (Connelly et al. 2011). We treated all sage-grouse locations equally with no attempt to depict behavior based on sex, age, or lek of capture. Though it is likely that sage-grouse behavior is partially dependent on seasonal habitat requirements and sex (Patterson 1952; Gill and Glover 1965; Wallestad et al. 1975; Connelly et al. 1981, 1988, 2000, 2011; Gates 1985), we did not examine avoidance behavior distinguished by season or sex because of small sample sizes.

Anthropogenic Features

We compared sage-grouse locations with the mapped locations of major roads, minor roads, power transmission lines, and buildings within the study area (Fig. 1). Major roads were defined as any road receiving average daily traffic counts from the Idaho Transportation Department (2004*a*, *b*). The major roads could be paved or dirt and represented the most frequently used roads. Included in the major roads category was the only 2-lane highway in the study area, U.S.

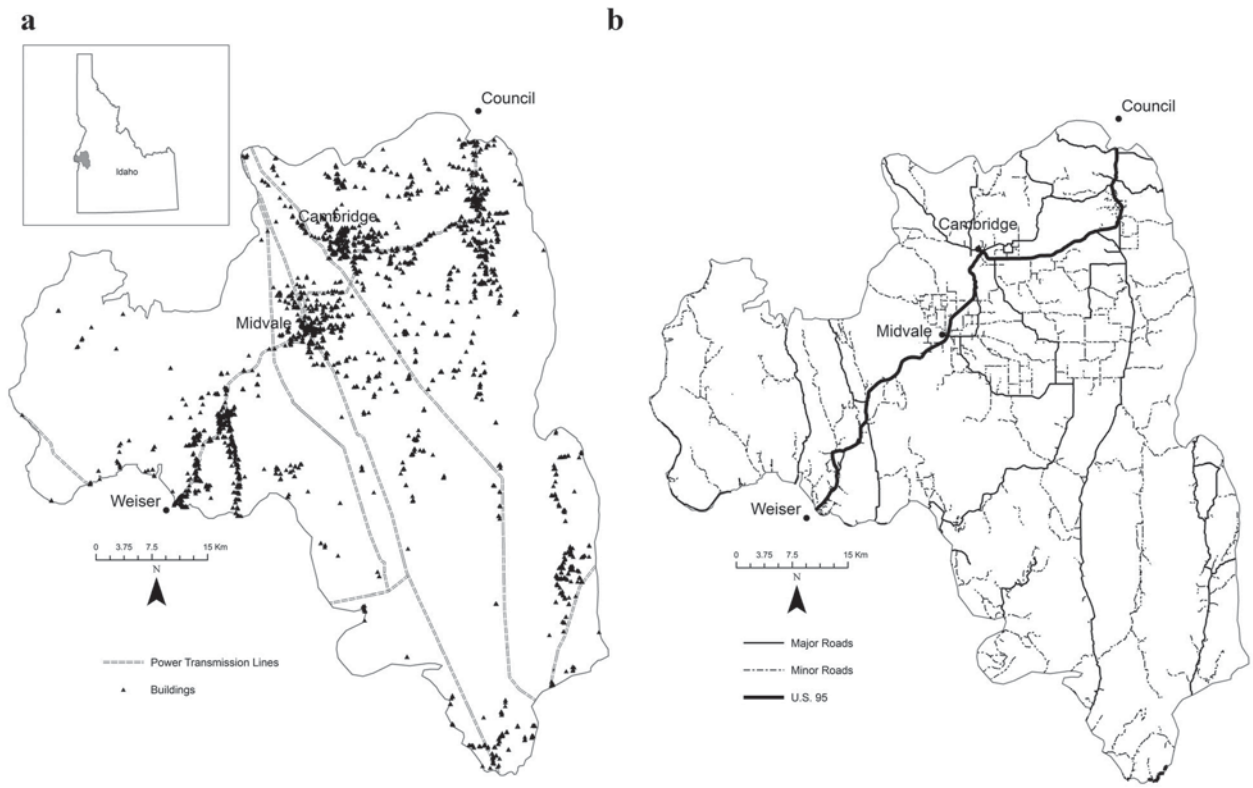

Figure 1. The west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette counties) (a) power transmission lines and buildings, and (b) major and minor roads.

95. Minor roads consisted of all remaining mapped roads excluding 2-tracks. Mapped power lines included only the major transmission lines (>138 kV), and excluded the distribution lines (National Geographic Maps 2004, US Bureau of Land Management 2007). These transmission lines were usually supported by large structures, including the steel lattice (25 m ht) and steel H-frame (17 m ht). The buildings polygon layer included all structures in the study area and was created through digitizing (at a scale of 1:3,000) on aerial imagery from the National Agriculture Image Program (USDA-FSA-APFO 2004). Because the sage-grouse location data were collected 2005–2007, it is possible that some anthropogenic features were omitted or committed in the analysis.

For the analysis, we transformed each anthropogenic feature layer originally modeled as lines and polygons into point features. For linear features, we placed a point every 125 m, which was determined largely by computing limitations. The point frequency should not affect the results comparing the observed point pattern with the null model. For the buildings layer, a centroid point was placed in each polygon.

Analysis

To determine geographic relationships between sage-grouse locations and each of the anthropogenic feature types, we employed a multi-scale measure of spatial dependence for point patterns. We used the pair correlation function (PCF) to compare observed with expected number of anthropogenic feature points within concentric rings surrounding sage-grouse locations.

In the bivariate form, the PCF is defined (Stoyan and Stoyan 1994, Schurr et al. 2004):

$$\hat{g}_{12}(r) = \frac{1}{2\pi r}\frac{A^2}{n_1 n_2}\sum_{i=1}^{n_1}\sum_{j=1}^{n_2} w_{ij}^{-1} k_h(r - |x_i - y_i|)$$

where $\hat{g}_{12}(r)$ is the PCF at a specified radius, A is the total point-pattern area, and n_1 and n_2 are the number of sage-grouse points and anthropogenic feature points, respectively. The x_i are locations of sage-grouse points, y_i are the locations of anthropogenic feature points, and w_{ij} is a weighting function that accounts for edge effect bias created by unobservable anthropogenic feature points outside the study area. We used the "translation" edge correction described by Torquato (2002) and Pommerening and Stoyan (2006), which extrapolates the point-pattern spatial structure within the study area to infinitely outside the study area. This edge correction is also recommended for study areas with complex shapes (Baddeley and Turner 2005). The PCF looks at a neighborhood of points surrounding the specified radius and gives greater weight to points near the radius and less weight to points further away. This type of weighting is known as an Epanečnikov kernel and is specified by k_h, where h is the bandwidth parameter specifying the size of the radius neighborhood that will receive weighting. Points lying

outside the bandwidth will not be considered in the calculation at that radius.

The PCF is a variation of Ripley's K (Ripley 1981), which measures spatial association within cumulative circles rather than rings. For this application, PCF is the preferred method because it is a more responsive analysis at multiple scales and can identify specific distances of avoidance or clustering. In a Ripley's K analysis, the results at larger distances are influenced by the shorter distances, which may obscure the spatial association at any given scale.

We computed the PCF function initially with $r = 150$ m, because this is the estimated largest possible location error associated with GPS and radio triangulation (Garmin 2011, Shepherd et al. 2011). We subsequently computed the PCF function every 150 m to a maximum of $r = 5$ km to assess the spatial relationship at different scales across the study area. We chose a bandwidth of 75 m because it was half the distance between PCF calculations, and because it provided enough smoothing to the PCF graph to aid in interpretation while not over-smoothing the results.

The empirical $\hat{g}_{12}(r)$ considers all the points of type 1 (sage-grouse) and calculates the intensity of points of type 2 (anthropogenic feature) surrounding it in a ring with a specified radius. The empirical value can then be compared with the expected number of points at the same radius, which is derived from a null PCF model constructed from Monte Carlo point simulations. A deviation between the empirical and expected curves suggests dependence between points of type 1 and 2. Empirical values larger than the expected curve at a given distance suggest that the 2-point types are clustering around each other at that scale. Smaller values than expected suggests the point types are exhibiting avoidance at that scale.

To test the significance of the spatial association between sage-grouse locations and anthropogenic features, we compared the empirical plot of $\hat{g}_{12}(r)$ to a null model constructed from 1,000 Monte Carlo simulations. We simulated point patterns designed to mimic the observed spatial pattern of sage-grouse habitat use. The map of sage-grouse telemetry points exhibited strong clustering (Fig. 2a). This strong spatial autocorrelation is a violation of sample independence (see Legendre and Fortin 1989), so a completely spatially random (CSR) null model or parametric statistical test is inappropriate. Therefore, the simulated points used in comparison with the spatially dependent data reflected the same intensity of clustering to prevent false positive findings of significance (Fig. 2b; Fortin and Payette 2002). We also ran the simulations using a CSR model for comparison purposes.

Computation of $\hat{g}_{12}(r)$ and the simulations were carried out using the Spatstat package (Baddeley and Turner 2005) in the statistics program R 2.10.1 (R Development Core Team 2009). Using the "Kppm" command in Spatstat, we fitted a homogenous Poisson cluster point process model to the sage-grouse data using the PCF function with the same parameters described previously. The simulated cluster patterns were realized following the Matern cluster process (see Moller and Waagepetersen 2003), which creates point patterns using 3 parameters: κ is the intensity of parent points generated through a Poisson process; μ is the average number of offspring points surrounding each parent point; and R is the radius of the cluster of offspring points centered

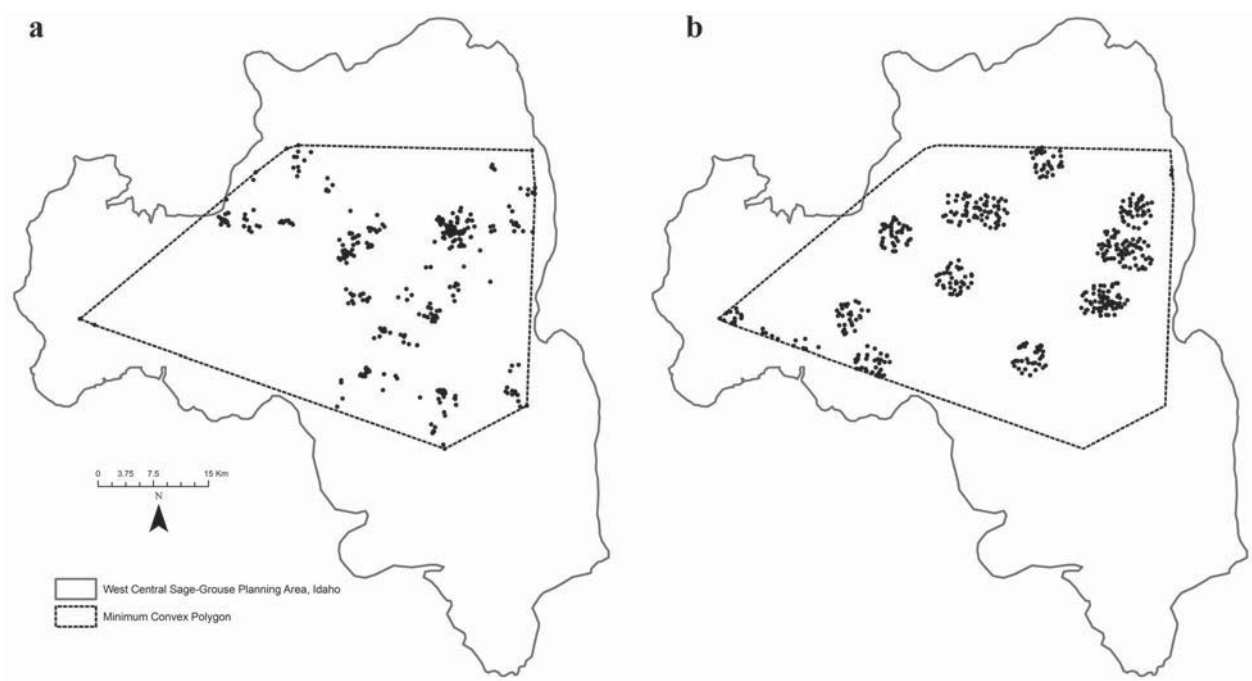

Figure 2. (a) Known sage-grouse locations in the west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette counties) observed April 2005 to December 2007. The locations are bounded by a minimum convex polygon that served as the simulation boundary. (b) Example of a simulated cluster-point pattern created from a homogenous Poisson cluster-point process model. We used 1,000 realizations of the simulated cluster-point patterns as a null model to assess spatial dependency between observed sage-grouse locations and anthropogenic features.

on the parent point. The simulated points were allowed to occur only within available habitat, which we defined as a minimum convex polygon surrounding all of the sage-grouse locations. The Bureau of Land Management, Idaho, considers nearly all of the land within the minimum convex polygon to be sage-grouse habitat (US Bureau of Land Management 2009). Accordingly, simulated points were permitted to occur anywhere within the minimum convex polygon except in water bodies or towns. From the simulations, we created 95% significance envelopes for the clustered and CSR null models to illustrate the difference in statistically significant findings between the 2 simulation methods. For a given radius, values of $\hat{g}_{12}(r)$ outside of the clustered significance envelope were considered to be significantly different from random arrangements of points showing the same spatial dependence as the sage-grouse locations. This would indicate clustering around or avoidance of anthropogenic features by sage-grouse at those distances.

RESULTS

Fitting a homogenous Poisson cluster point process model to the sage-grouse data using the PCF function produced a clustered point pattern with $\kappa = 6.200333\text{e-}09$, $\mu = 47.51922$, and $R = 1{,}748$ m. The significance envelopes exhibited a typical funnel shape where PCF variability was greatest at near distances and shrinks at larger scales (Fig. 3). This was due to the fact that closer concentric rings have less total area and thus a greater opportunity for PCF variability. The funnel-shaped envelopes also tilted upward as scale increased. This is caused by the spatial clustering of the anthropogenic features we are testing. In the study area, there is more open space than there is developed space, so the simulated points were, on average, farther away from anthropogenic features than closer.

Selection of the null model proved to highly influence the statistical inference. The results indicated that observed sage-grouse exhibited avoidance of buildings by 150 m (Fig. 3a) because the PCF value at that distance was less than the clustered 95% significance envelope. The CSR null model produced a much narrower significance envelope, which equates to a much lower standard of statistical significance. The CSR null model indicated that sage-grouse were avoiding buildings by up to 3.45 km. At larger distances, the empirical PCF values were within the simulation significance envelope, which suggested no significant spatial relationship between sage-grouse and building locations.

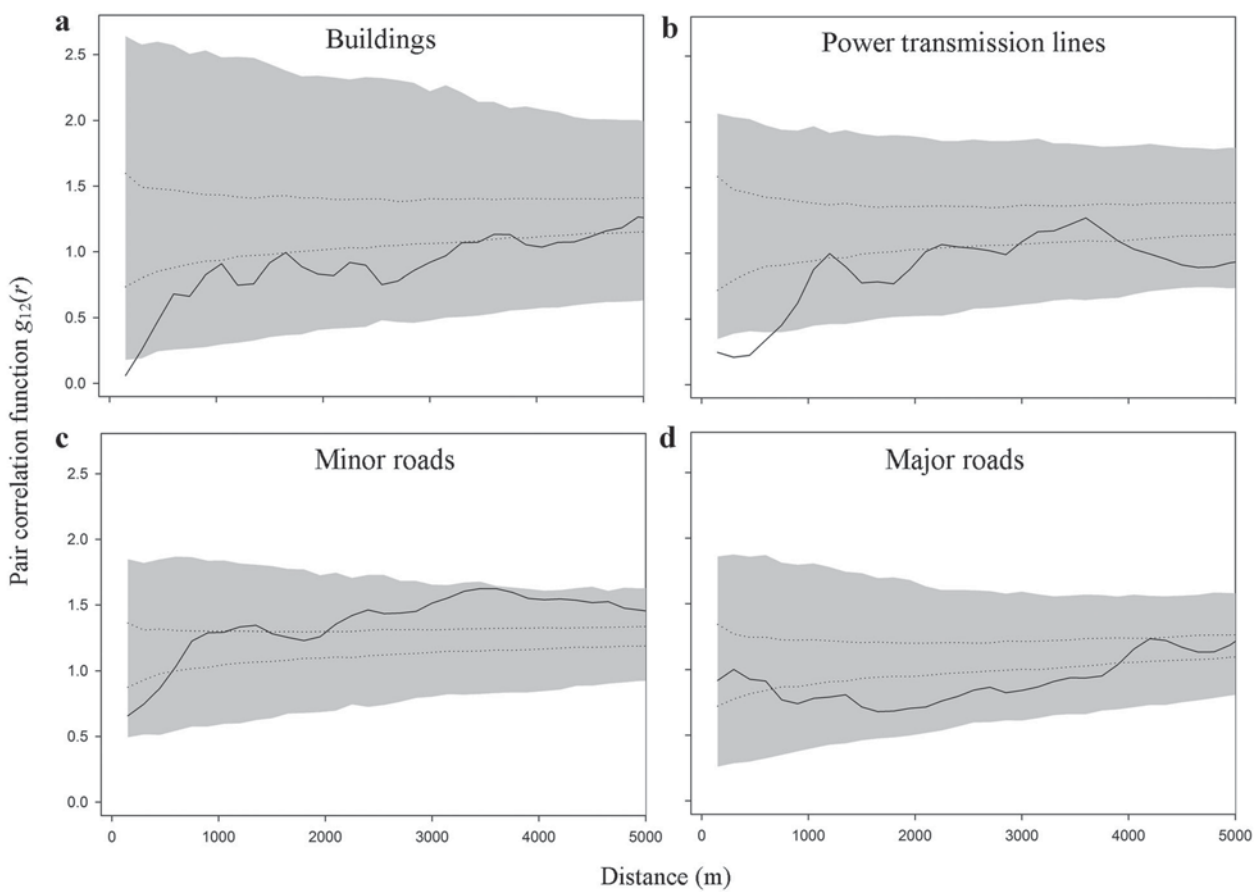

Figure 3. Bivariate pair correlation function, $\hat{g}_{12}(r)$, for greater sage-grouse locations and (a) buildings, (b) power transmission lines, (c) minor roads, and (d) major roads. Sage-grouse locations were collected April 2005 to December 2007. The empirical curve (solid line) is plotted against 2 95% significance envelopes: one determined from 1,000 clustered point-pattern simulations (shaded area); and one determined from 1,000 point patterns that were completely spatially random (dotted lines). This study occurred in the west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette Counties).

Sage-grouse showed avoidance of power transmission lines up to distances of 600 m (Fig. 3b) because the PCF values at 150, 300, 450, and 600 m were less than the clustered significance envelope. At all other scales, the empirical PCF values were within the significance envelope, which suggested no significant spatial relationship. The CSR null model again showed that sage-grouse avoided the features at a greater distance of 1.05 km. At larger scales, the empirical curve dipped in and out of the CSR envelope.

Sage-grouse did not appear to avoid minor roads in the study area because the PCF empirical curve landed within the clustered null model significance envelope at all scales (Fig. 3c). The CSR null model showed that sage-grouse avoided minor roads by 450 m. At larger scales (3–4 km), the empirical curve was far above the CSR envelope and nearly left the bounds of the clustered model envelope. This suggests that, at these distances, there were far more sage-grouse near minor roads than was expected.

Sage-grouse also did not appear to avoid major roads in the study area because the PCF empirical curve landed within the clustered null-model significance envelope at all scales (Fig. 3d). There was agreement in the CSR null model up to 600 m, after which the empirical curve was below the envelope at all scales up to 3.9 km, which suggests avoidance at those distances.

DISCUSSION

This study showed that results from point-pattern simulations could vary greatly between those that incorporate spatial structure and those that employ a CSR method. The CSR null model produced significance envelopes much narrower than the clustered null model, thus setting a much lower standard for significance testing, which may lead to false positive results. This demonstrates the need to explicitly account for spatially dependent data in ecological studies, especially wildlife studies that have presence-only sampling.

Although an improvement over a CSR null model, the homogeneous clustered simulations were not a perfect representation of the observed data. The data appeared to exhibit non-stationary or an inhomogeneous cluster pattern probably caused by differences in seasonal habitat use. Sage-grouse aggregate during the spring lekking season and disperse when breeding has concluded. Analyzing and simulating the data by season and sex may produce improved null models but was not attempted due to small sample size.

Our results support Braun's conjecture (1998; personal communication) that sage-grouse avoid farms and ranch houses. However, he suggested that adult sage-grouse were avoiding occupied farms and ranches by 800 m, while hens with broods might come closer to seek out wet sites. Our study found avoidance up to 150 m, but we did not distinguish between occupied and unoccupied home sites, nor did we consider differences based on sex or season. Sage-grouse may show greater avoidance of occupied houses or farms because of the associated sounds such as human voices or motorized vehicles, or the presence of domestic animals such cats, dogs, horses, or other livestock.

Our findings on sage-grouse and power transmission lines support other studies suggesting avoidance behavior. Braun (1998) concluded that sage-grouse infrequently use areas within 1 km of a power line, and Hanser et al. (2011) found there was less probability of sage-grouse pellet occurrence within 500 m of power lines. Power lines and transmission structures can serve as perches for avian predators in landscapes with few naturally tall structures (Ellis 1987, Connelly et al. 2004). Sage-grouse may also avoid traditional leks if perches or raptors are visible (Hall and Haney 1997). In California, USA, as distance to overhead power lines decreased, peak male lek attendance also decreased (Hall and Haney 1997). Other studies have found power lines to have a benign effect on sage-grouse. In a 10-year range-wide study, Johnson et al. (2011) found no negative effects of power lines on lek counts, but did report that lek trends were reduced when communication towers were nearby.

Though previous research has shown that sage-grouse may avoid major highways (Hanser et al. 2011), have lower lek attendance (Braun 1986, Johnson et al. 2011), and have lower nest initiation rates near roads (Lyon and Anderson 2003), our results show sage-grouse to be minimally affected by minor and major roads in our study area. There was only one 2-lane highway in the study area and most of the minor roads were composed of dirt or gravel and had infrequent traffic. Anecdotally, some sage-grouse actually lek directly on minor roads in the study area (Gray 2009), and perhaps roads provide an open area in the sagebrush where mating displays can be seen (Connelly et al. 1981, Gates 1985). At some scales for minor roads (3–4 km), more sage-grouse were near roads than was expected to almost a significant level. The reason this occurred is unknown. Sage-grouse may be attracted to riparian areas, agricultural fields, or water developments that are often near farms and ranches. In the summer, sage-grouse have been observed using riparian areas and crop fields, which provide a food source (Dunn and Braun 1986, Schroeder et al. 1999). Topography may be important because leks are often on gentle slopes or in valley bottoms (Rogers 1964), and sage-grouse may simply occupy lands that are popular for human settlements, including locations with roads.

Sage-grouse have been observed being influenced by energy infrastructure at greater distances compared with our results. In Alberta, Canada, sage-grouse avoided energy wells by up to 1.9 km during the winter (Carpenter et al. 2010). In Wyoming, yearling males established themselves less often than expected on leks within 3 km of producing wells and more often on leks farther than 3 km from producing wells (Holloran et al. 2010). Fewer yearling females nested within 950 m of infrastructure than was expected (Holloran et al. 2010). Yearling males and females reared within 1.65 km of a producing well pad or haul road had lower annual survival rates (Holloran et al. 2010). At 5 study sites in Wyoming, lek counts were negatively associated with the presence of producing wells within 800 m, 1.2, 1.6, and 4.8 km at each respective site (Harju et al. 2010). Two other study sites showed no reduced lek counts. In the Powder River Basin of Wyoming and Montana, USA, female sage-grouse in the

winter were more likely to occupy habitats with no natural gas wells within 4 km^2 compared with the legal maximum density of 12.3 wells (Doherty et al. 2008).

Sage-grouse have distinct patterns of habitat use during different times of the year, which will likely affect their tolerance of anthropogenic features (Connelly et al. 2000, 2011). Lumping the seasons and sexes together possibly masked or coarsened the precision of some of the results. For example, during the late brood-rearing period (Jul–Sep), the diet of the chicks changes primarily to forbs and they will choose their habitat based on their availability (Patterson 1952). The hen and chicks may use irrigated crop fields, wet meadows, and riparian areas closer to anthropogenic features (Dunn and Braun 1986, Connelly et al. 1988). During the autumn as the forbs desiccate or are killed by frost, sage-grouse switch their diet back to sagebrush (Patterson 1952, Wallestad et al. 1975). A study in Colorado, USA, found that sage-grouse abandoned irrigated hay fields when the irrigation stopped or after the first frost (Gill and Glover 1965). Had the analysis been separated by season, we might have seen different habitat use between summer and autumn in relation to anthropogenic features.

MANAGEMENT IMPLICATIONS

Our results can directly inform land managers who are planning infrastructure and other development projects in or near sage-grouse habitat. We revealed a zone of influence around buildings and power lines that affects the occurrence of sage-grouse within their habitat. Our results indicate that anthropogenic features reduce the total amount of habitat available to the species by a factor larger than just the footprints of the features themselves. Planning and zoning commissions, utility companies, and other government entities can use these results to develop building regulations and plan infrastructure routes that are sensitive to sage-grouse populations and habitat. Specific actions that planning entities can take to protect greater sage-grouse populations and habitats in Idaho are to 1) identify goals for species and habitat protection in the county comprehensive plan, 2) incorporate the spatial data from this study and other studies on species of concern into county land use maps, and 3) develop zoning ordinances that encourage the implementation of 'on-the-ground' conservation actions by private landowners that minimize or mitigate the zone of influence from anthropogenic features (Haines et al. 2012).

ACKNOWLEDGMENTS

We would like to thank the entities responsible for funding *Sage-grouse Habitat in Idaho: A Practical Guide for Land Owners and Managers*: The University of Idaho College of Natural Resources, Idaho Governor's Office of Species Conservation, Idaho Department of Fish and Game, Bureau of Land Management Idaho, US Fish and Wildlife Service, Laura Moore Cunningham Foundation, and Idaho Rangeland Resource Commission. The funding from that publication made this research possible. Special thanks go to J. Hinson and M. Soulen-Hinson for everything they did to support this research. This publication is issued as Contribution no. 1077 of the Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

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Associate Editor: Gervais.

From: jmclain@blm.gov on behalf of Gateway_West_Trans_Line, BLM_WY [blm_wy_gateway_west_trans_line@blm.gov]
Sent: Monday, July 01, 2013 10:21 AM
To: blm@gwcomment.com
Subject: Fwd: The Nature Conservancy Comments on Gateway West Transmission Line FEIS
Attachments: TNC Cover Letter Gateway West FEIS Comments.pdf; TNC Gateway West FEIS Comments.pdf; Gillan et al 2013.pdf

---------- Forwarded message ----------
From: **William S. Whelan** <wwhelan@tnc.org>
Date: Fri, Jun 28, 2013 at 2:27 PM
Subject: The Nature Conservancy Comments on Gateway West Transmission Line FEIS
To: "Gateway_West_WYMail@blm.gov" <Gateway_West_WYMail@blm.gov>
Cc: "Walt George (wgeorge@blm.gov)" <wgeorge@blm.gov>

Thank you for the opportunity to comment on the Gateway West Transmission Line Project Final Environmental Impact Statement.

I have attached a cover letter, comments, and a study that comprise The Nature Conservancy's comments on the FEIS.

Will

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Please consider the environment before printing this email

Will Whelan
Director of Government Relations

wwhelan@tnc.org
(208) 350-2202 (Phone)
(208) 484-9779 (Mobile)
(208) 343-8892 (Fax)

The Nature Conservancy
Idaho Chapter - Boise Office
950 W. Bannock St., Suite 210
Boise, ID 83702

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950 W. Bannock St.
Suite 210
Boise, ID 83702

Tel (208) 343-8826
Fax (208) 343-8892

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June 28, 2013

Via electronic mail

Walt George
Gateway West Transmission Line Project Manager
Bureau of Land Management
P.O. Box 20879
Cheyenne, Wyoming 82003
Gateway_West_WYMail@blm.gov

Re: Comments on Gateway West Transmission Line Final Environmental Impact Statement

Dear Mr. George:

Thank you for the opportunity to comment on the Final Environmental Impact Statement for the proposed Gateway West Transmission Line Project. The Nature Conservancy's response is attached. Our comments represent contributions from staff the Idaho and Wyoming chapters of The Nature Conservancy

If you have questions regarding these comments, please contact Will Whelan, Director of Government Relations for The Nature Conservancy in Idaho, at 208-350-2202 or wwhelan@tnc.org.

Sincerely,

Toni Hardesty
State Director
Idaho Chapter

Andrea Erickson
State Director
Wyoming Chapter

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Comments of The Nature Conservancy Regarding the Final Environmental Impact Statement for the Gateway West Transmission Line Project

June 28, 2013

INTRODUCTION

The Nature Conservancy (the Conservancy) is an international nonprofit whose mission is to conserve the lands and waters on which all life depends. The Conservancy's on-the-ground conservation work is carried out in all 50 states and in 30 countries with the support of approximately one million members. Throughout the United States, the Conservancy works closely with federal, state and local governments, businesses, the conservation community and private individuals to protect biodiversity in a science-based, collaborative manner.

The Conservancy is committed to cooperative, pragmatic approaches to resolving environmental issues associated with the nation's energy infrastructure. The Conservancy uses landscape-scale assessments in collaborative planning processes to balance the needs of energy infrastructure development with the conservation of natural resources and wildlife. Our experience has reinforced our belief that energy and biodiversity are not mutually exclusive. In our view, the question is not whether to proceed with energy development and associated infrastructure, e.g., transmission; the question is *where* to locate development to avoid or minimize impacts, or how to mitigate impacts to species and habitats if impacts cannot be avoided.

Our approach to environmental review is guided by the "mitigation hierarchy," which provides that the guiding principles for conserving natural resources are to avoid, minimize, mitigate and compensate for environmental impacts, in that order. The BLM and the project proponents have generally done a good job of avoiding and minimizing impacts.

Although these comments raise serious concerns about the adequacy of the compensatory mitigation proposed in the Gateway West Final Environmental Impact Statement (FEIS), we remain convinced that there is still time for the BLM, the project proponents, and key stakeholders to reach an appropriate balance between protecting the environment and building an electrical grid that meets the country's energy needs.

SUMMARY OF COMMENTS

1. BLM should take the time needed to fix major problems with its approach to compensatory mitigation for sage grouse impacts. *page 2*

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2. The FEIS fails to mitigate for significant impacts to sage grouse and their habitats. *page 3*
3. The compensatory mitigation plan should include indirect impacts. *page 6*
4. Scientific research documents quantifiable indirect impacts and serves as a basis for incorporating these impacts into the compensatory mitigation plan. *Page 8*

   Recommendation: Compensatory mitigation of indirect impacts should be based on the loss of habitat services within .6 kilometers each side of the centerline of the Gateway West Transmission Line. We calculate that this measure would include 15,903 acres in preliminary priority habitat and 32,999 acres in general habitat. *page 9*

5. The record of decision should address mitigation planning and oversight. *page 10*
6. Key elements of the Habitat Equivalency Analysis are unsupported and should be revised. *page 10*
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COMMENTS

I. BLM Should Take the Time Needed to Fix Major Problems with Its Approach to Compensatory Mitigation for Sage Grouse Impacts.

These comments point out serious flaws in the FEIS' approach to compensatory mitigation of the sage grouse impacts of the Gateway West Project. We respectfully request that BLM establish an inclusive process to fix these problems that draws on policy and scientific experts from the project proponents, key wildlife and resources agencies, and stakeholders experienced in mitigation science and practice. We are convinced that these concerns can be resolved through a purposeful and constructive engagement with the goal of producing a biologically effective and economically feasible compensatory mitigation plan.

The stakes are high. The Gateway West Project will set crucial precedents regarding BLM's approach to infrastructure mitigation at a time when the federal and state governments are working to establish "adequate regulatory mechanisms" that can avoid the need to list sage grouse under the Endangered Species Act.

Progress on other fronts is promising. The BLM has just issued draft Manual[1] provisions that represent a major step forward in off-site compensatory mitigation planning and implementation.

[1] Draft MS-1974 – Regional Mitigation Manual Section (P), attached to Instruction Memorandum No. 2013-142 (6/14/13).

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The State of Idaho has advanced a state sage grouse conservation alternative that adopts the Idaho Mitigation Framework to offset infrastructure impacts. In Idaho, where large swaths of sage grouse habitat are being lost nearly every year to fire and invasive plants, it is critical that we develop policies and funding sources that can replace some of that habitat being lost. Utility companies, conservationists, ranchers, and everyone linked to our rangelands have a stake in developing effective compensatory mitigation programs.

The FEIS undermines this progress at a critical time. The major categories of sage grouse impacts – long recognized by the BLM as well as state and federal wildlife agencies – are simply excluded from the compensatory mitigation plan. The costs and benefits of mitigation actions are stipulated with little analysis and few procedures to ensure that those actions will actually accomplish the expected benefits. Some proposed mitigation actions, such as fence marking, are inappropriate to offset the type of impacts associated with Gateway West.

The result of the FEIS would be that hundreds of miles of transmission lines will be placed in sage grouse habitat with compensatory mitigation that is incomplete and insufficient. No one's long-term interest is served by this outcome.

The BLM has the time to remedy this situation. With the time that remains between the FEIS and the issuance of Notices to Proceed, we ask the BLM to: (1) reach out to the project proponents to request their support for a more open process on compensatory mitigation; (2) re-open certain elements of the Habitat Equivalency Analysis (HEA); (3) integrate indirect impacts into the compensatory mitigation analysis and (4) align the mitigation for this project with the planning approaches described in the BLM's draft Manual provisions and Idaho's Mitigation Framework.

II. The FEIS Fails to Mitigate for Significant Impacts to Sage Grouse and Their Habitats.

The compensatory mitigation package for the Gateway West is based on a Habitat Equivalency Analysis (HEA) set forth in Appendix J-2 of the FEIS. The document describes the HEA as a "standardized method to determine a one-to-one ratio [of] habitat services lost to habitat services mitigated."[2] The project proponents, acting at the direction of BLM, used the HEA-generated sum of habitat services lost to develop a package of compensatory mitigation projects. As explained below, the compensatory mitigation recommendations that emerged from the HEA process do not even come close to providing one-to-one mitigation for habitat services lost because the most significant project effects on sage grouse were excluded from the HEA analysis.

The project impacts that were incorporated into the HEA included the permanent and interim loss of sage grouse habitat services as a result of vegetation loss, noise and human presence

[2] FEIS at Appendix J-1, page 3.

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anticipated with project construction and operation as well as the physical footprint of project structures.

The central flaw in the HEA is that it encompasses only a small portion of the sage grouse impacts that the U.S. Fish and Wildlife Services (USFWS) has linked to transmission lines.

> The USFWS's *12-Month Findings for Petitions to List the Greater Sage-Grouse as Threatened or Endangered* (2010e) listed the following as potential impacts to the sage-grouse resulting from powerlines: 1) collisions/electrocutions, 2) consolidation of predatory birds along powerlines, 3) lower recruitment rates near lines, 4) habitat fragmentation, 5) degradation of habitat due to spread of invasive plant species, 6) impacts resulting from the line's electromagnetic fields, and 7) direct loss of habitat. Additional impacts related to construction and operations of the line, as well as associated infrastructure, could include short-term disturbances due to construction and long-term disturbances during operations, increased road access allowing poaching/hunting in previously inaccessible locations, and changes to habitat structure resulting from altered fire regimes.[3]

None of the first six factors listed by USFWS are considered in the HEA and are therefore excluded from the mitigation package developed by the project proponents. This means that the HEA model fails to account for the synergistic and cumulative impacts of this transmission line, especially the indirect impacts of placing permanent and tall infrastructure in previously unaltered high quality habitat. For ease of reference, these excluded effects are referred to here as "indirect impacts."

Even though indirect impacts are not integrated into the HEA, the FEIS acknowledges they exist. For example, the FEIS quotes repeatedly from Connelly et. al. (2000) that "analysis of sage-grouse populations that attend leks within 18 kilometers (11 miles) of the Project is a critical component of an impacts analysis for the species *because these sage-grouse may be <u>indirectly affected</u> by the loss of habitat functionality during other seasons of the year (Connelly et.al. 2000)."* (emphasis added) The FEIS also recognizes indirect effects, stating that "Long-term beneficial effects (of decommissioning) would include the removal of tall structures (towers) from grouse habitats, and the decommissioning of Project facilities and access roads, both of which could increase the connectivity and size of wildlife habitat."[4]

The FEIS' recognition of the existence of indirect effects has ample scientific support. U.S. Geological Survey's recently issued Baseline Environmental Report (BER; Manier et al. 2013)[5] provides a recent summary of research showing that the effects of transmission lines far exceeds their direct "footprint" and construction effects. While the evidence is not extensive, the report

[3] FEIS at 3.11-61 – 3.11-62.
[4] FEIS at 3.11-135.
[5] USGS, Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocercus urophasianus*) at 50. (Manier et al. 2013)

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provides a clear rationale for including indirect and cumulative effects in the compensatory mitigation plan. The relevant selection from the BER report is set forth below:

> Transmission- and distribution-line construction (power lines) may result in substantial indirect habitat loss (that is, avoidance) due to sage-grouse avoidance of vertical structures, potentially because of changes in raptor concentrations and raptor species' composition relative to perches on flat landscapes. Additionally, the tendency of sage-grouse to fly relatively low, and in low light or when harried, may put them at a particularly high risk of collision with lines…. The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years (Ellis, 1985). This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons (Ellis, 1985). Negative effects of power lines on lek persistence were documented in northeastern Wyoming; the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 4 mi (6.4 km) window around leks (Walker and others, 2007a). Braun (1998b) reported that use of areas near transmission lines by sage-grouse increased as distance from transmission lines increased up to 1970 ft (600 m). Sage-grouse avoided brood-rearing habitats within 2.9 mi (4.7 km) of transmission lines in south-central Wyoming (LeBeau, 2012). Power line collisions accounted for 33 percent of juvenile (1st winter) mortality in low-elevation areas in Idaho (Beck and others, 2006). In general, it appears sage-grouse may avoid habitats within 0.4–2.9 mi (0.6–4.7 km) of a transmission line, and erection of a transmission line close to a lek will negatively influence sage-grouse lek attendance and breeding-season behavior. Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse (Steenhof and others, 1993; Connelly and others, 2004). Foraging distances of avian, sage-grouse predators have been estimated at 4.3 mi (6.9 km; Knick and Connelly, 2011a), suggesting that transmission and power lines may influence sage-grouse at large spatial scales (Connelly and others, 2004; Cresswell and others, 2010). *Based on these data, the direct footprint within any given MZ is relatively small (1.1–5.0 percent; table 8), but the area of relative influence is more extensive (25.2–62.8 percent PGH; table 8).* (emphasis added)

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This conclusion is backed by a significant body of scientific research, including both peer reviewed publications and significant additional evidence, discussing the effects of transmission lines and tall structures on sage grouse habitat. These effects include habitat fragmentation and habitat loss caused by behavioral avoidance of transmission corridors. In particular, the U. S. Fish and Wildlife Service issued a briefing paper titled "Prairie Grouse Leks and Wind Turbines: U.S. Fish and Wildlife Service Justification for a 5-Mile Buffer from Leks" (2004) which places sage grouse and prairie grouse in the same "prairie grouse" category, and concludes that the avoidance impacts from vertical structures to both species are the same. This guidance goes on to say that "the Service feels it is important to clarify that avoidance of vertical structures by grassland and sage steppe-obligate wildlife is not a new issue."

As we explained in our comments on the DEIS, peer-reviewed studies conducted on other North American grouse species with similar life history traits to the sage grouse (i.e., the lesser and greater prairie-chickens) have shown that the birds' use of quality habitat is reduced when tall structures are located nearby, because prairie grouse instinctively avoid tall structures (Manes et al. 2002).

Three additional peer-reviewed studies found additional relevant evidence. In Utah, golden eagle predation of sage grouse increased from 26% to 73% (of total predation) after a transmission line was constructed within 200 yards of an occupied lek. The lek was extirpated and the author concluded that the presence of the transmission line resulted in both changes in sage grouse dispersal patterns and fragmentation of the habitat (Ellis 1985). In Kansas, the average displacement of prairie-chicken use areas was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines (Hagen et al. 2004). In Oklahoma, the displacement of lesser prairie-chickens from a power line was at least 500 meters (Pruett et al. 2009).

Other studies not published corroborate this evidence. In California, power lines resulted in sage grouse lek abandonment and reduced lek attendance up to 3 miles away from the lines (Rodgers 2003). In Colorado, pellet transects illustrated declining habitat use by sage grouse up to 600 meters from power lines (Braun 1998). In Washington, 19 of 20 leks (95%) documented within 7.5 km of 500 kV power lines were abandoned by the birds. In contrast, the vacancy rate for leks further than 7.5 km is 59% (22 of 37 leks) (Schroeder 2010).

Based on this body of scientific research, we conclude that any attempt to limit the compensatory mitigation package to direct and construction/operation impacts explicitly ignores the main influences of a transmission line on sage grouse habitat.

III. The Compensatory Mitigation Plan Should Include Indirect Impacts.

The FEIS' rationale for narrowing the HEA to just direct, construction, and operation impacts is that indirect impacts, such as predation, fragmentation, invasive species, etc., are difficult to

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quantify within the HEA model. Importantly, the FEIS never contends that these effects are non-existent or insignificant.[6] Instead, they are excluded because they are difficult to tally within the specific model the agency selected for scaling project mitigation. Rather than weigh these effects in the mitigation analysis, the agency states that "indirect impacts to sage-grouse and their habitats are qualitatively assessed" outside the scope of the HEA process. Thus, the FEIS effectively concedes that the HEA does not capture the full range of impacts of the project.

We understand that indirect impacts can be difficult to quantify precisely but disagree that this is an adequate basis for entirely failing to mitigate for them. It is insufficient for the FEIS to state that, because the indirect effects of hundreds of miles of transmission line cannot be "accounted" for in the HEA, no mitigation of any sort for those impacts is necessary. Although there may be a range of uncertainty regarding the extent of indirect impacts, that range does not include a "zero effect."

This situation calls for BLM to exercise its judgment and determine how to account for indirect effects in the mitigation package – either within the HEA or, preferably, as an additional component of the mitigation analysis. The BLM's Framework for Analyzing Sage Grouse Impacts, prepared prior to the draft EIS, states that it is reasonable to make predictions about indirect impacts:

> Qualitative and quantitative measures of habitat change must be considered in describing the potential impacts of the project. In the context of managing a species that requires such a large landscape of habitats to meet their lifecycle needs, and the nature of the proposed disturbance, *it is reasonable to make some assumptive predictions about the relative impacts within 18km.*[7]

The FEIS itself at one point appears to contemplate a quantitative approach to assessing indirect impacts:

> The general Analysis Area used for wildlife habitat mapping (see Section 3.11.1.4) consisted of a 1,000-foot-wide area centered on the Proposed Route and Route Alternatives (500-foot-wide on either side of the centerline of each route)…. While most of this Analysis Area would not be directly impacted by the Project, information gathered for this larger area allows for an understanding of

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[6] In fact, the draft EIS states that the project's direct and indirect impacts plus the absence of an agreed-upon compensatory mitigation plan is "likely to contribute to a trend toward federal listing or loss of viability for the greater sage-grouse." DEIS at 3-11-72 – 3-11-73 (emphasis added, referencing Region 4 language. It is hard to imagine how the minor amount of mitigation required via the HEA-based approach would serve as a sufficient basis for altering this finding.

[7] FEIS at Appendix J-1, pg. 2.

> the context in which the impacts would occur and *allows an assessment of indirect effects*.[8]

Our concern is that neither this nor any other approach for assessing indirect effects (other than construction noise) was ever incorporated into the compensatory mitigation analysis.

We request that BLM work with the project proponents, federal and state experts, and stakeholders to develop a defensible approach to compensating for indirect effects prior to issuing notices to proceed for the project.

IV. Scientific Research Documents Quantifiable Indirect Impacts and Serves as a Basis for Incorporating These Impacts into the Compensatory Mitigation Plan.

The following table summarizes studies of indirect effects of transmission lines on sage grouse, including reproductive behavior, predation, and vital rates. Although these studies discuss impacts at different distances from transmission lines, they all come to the same conclusion that these impacts are real and detrimental. Taken together, these studies provide a reasonable starting point for quantifying how indirect impacts can be integrated into the compensatory mitigation package.

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A Literature Review of Transmission Line Effect Distances

Effect Distance Value	Source	Comments
No effect detected at 5 and 18km of a lek.	(Johnson et al. 2011)	Authors examined trends in lek counts and anthropogenic features (1997-2007). No general pattern/association was found across the entire study area with transmission at tested 5km and 18km of lek.
200 m	(Ellis 1985)	The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years. This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons.
360 m +/- 60, 630 m +/- 40	(Robel et al. 2004)	Data are from a 6 year study of energy development on lesser prairie-chickens in Kansas. Distances are mean (+/- SE) distance to electric power lines avoided by 90% of 187 nesting prairie checking and mean distance to power lines across which 95% of 18,866 telemetry locations of prairie chickens were absent, respectively.
450-650 m	(Hagen et al. 2004)	In Kansas, the average displacement of prairie-chicken use

[8] FEIS at 3.11-2 – 3.11-3 (emphasis added).

		sites was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines.
400m	(Pitman et al. 2005)	Data are from a study on lesser prairie-chickens in Kansas and found that nest proximity was "seldom less than 400 meters from a transmission line" (Table 3)
500m	(Hanser et al. 2011)	Wyoming Basins Ecoregional Assessment: Study of responses of sage-grouse to anthropogenic effects. Authors tested effects at .5 km and 1km and found the most significant effect of transmission lines on sage-grouse abundance at .5 km.
500m	(Pruett et al. 2009)	Oklahoma prairie-chicken study found that displacement of prairie-chickens was at least 500m from a power line.
600 m	(Braun 1998)	In Colorado, pellet transects illustrated declining habitat use by sage-grouse up to 600 meters from power lines.
600 m	(Gillan et al. 2013)	Using a spatial statistical approach with telemetry data from Idaho, this study found that sage-grouse avoided power transmission lines by 600 m.
0-4.7 km	(LeBeau 2012)	A wind turbine effects and infrastructure study that examined infrastructure related to wind development within the two study areas in SE Wyoming and found that the estimated odds of sage-grouse selecting brood-rearing habitat within the Seven Mile Hill study area increased as distance from nearest overhead transmission line increased up to 4.7 km (90% CI: 2.2–18.5 km), then declined. However, LeBeau also found that sage-grouse selected *for* nesting habitat closer to transmission lines within Simpson Ridge study area.
4.8 km	(Rodgers 2003)	In California, power lines resulted in sage-grouse lek abandonment and reduced lek attendance up to 3 miles away.
6.4 km	(Steenhof et al. 1993, Connelly et al. 2004)	Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse.

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Recommendation: Based on this information, The Nature Conservancy recommends that compensatory mitigation be based on loss of habitat services within .6 kilometers either side of the centerline of the Gateway West Transmission Line route. We note that the literature supports the conclusion that indirect impacts, such as predation, occur at much larger distances. Therefore, a 600 meter "band" on either side of the transmission line represents a moderate approach to quantifying habitat services losses that should be subject to compensatory mitigation based on available information for the habitat types affected.

We calculate that this approach would include 19,084 acres in preliminary priority habitat and 39,599 acres in preliminary general habitat.

V. The Record of Decision Should Address Mitigation Planning and Oversight.

Replacing sage grouse habitat that has been lost due to infrastructure project development is difficult yet essential. Success depends on investing compensatory mitigation funds at sites where sage grouse actually benefit from improved conditions, where vegetation status and trends are well enough understood to calculate mitigation project benefits or "uplift," and where land management practices are consistent with maintaining the durability of mitigation benefits.

The project proponents recognize these challenges in their compensatory mitigation proposal at Appendix C-3 and propose a collaborative "oversight committee" to help them select appropriate projects and locations. We think that this approach has merit and encourage BLM to include it in the Record of Decision (ROD).

The ROD should elaborate on the committee's composition and responsibilities and give it broad authority to align the implementation of compensatory mitigation measures with the BLM's draft Manual provisions on mitigation and the Idaho Mitigation Framework.

Specifically, we request that the oversight committee be given broad latitude to address:

1. The selection of mitigation sites based on a landscape analysis that considers locations that provide greatest benefit to sage grouse populations, ensure compatible land management policies and practices, and maintain the persistence of mitigation benefits;

2. The mix of conservation projects included in the compensatory mitigation package;

3. Estimates of conservation project cost and mitigation benefit (uplift); and;

4. Stewardship and monitoring plans.

The oversight committee should have discretion to direct mitigation funds to off-site projects in accordance with the guidance discussed in the draft BLM Manual – 1794.

VI. Key Elements of the HEA Are Unsupported and Should Be Revised.

As a general matter, the application of the HEA model used for the Gateway West Project is not fully supported in the administrative record. The BLM should re-open the HEA to address shortcomings and should consider other analytical approaches for this and future projects.

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A. The HEA's Approach to Habitat Characterization Is Vulnerable to Inaccuracy and Undervalues High Quality Habitat.

We believe that the HEA model is overly simplistic in ways that compromise its results. The HEA description states that "The Habitat Equivalency Analysis, described [below], provides a standardized basis to determine a one-to-one ratio for habitat services lost to habitat services mitigated." [9] The key to the validity of the process is how "service" is defined. HEA relies on categorical measures ("bins") derived from expert opinion that are not weighted to reflect their relationship with sage grouse habitat utilization. This introduces unquantifiable inaccuracy into the HEA model.

We recommend the use of data-driven, likelihood-based models that allow variables to be weighted based on observed habitat use similar to the U.S. Geological Survey's Wyoming Basins Ecological Assessment sage grouse model. Similar models should be developed in Idaho.

In the HEA, scores of each category (i.e., 0,1,2,3) were assigned arbitrarily. In an analytical sense these are ordinal variables – and simply rank one class against the others. Yet, these scores are treated as meaningful in a mathematical sense. The model sums these ordinal variables to generate a single score. In a very real sense, the model adds 5 fairs, 2 excellents, and 4 goods, to come with a value of 19. In order for the model to be truly meaningful, the BLM must provide evidence that there is a *mathematical* relationship between these categories. For example, in the current model a site 51 meters from a county/state highway is twice as good as an identical one 50 meters away, but a site 1 km from the same highway is only 50% better than one 51 meters removed. This relationship holds true for all the variables; there is an exponential decline in value gained with improving quality (rate of improvement declines at a rate of x^{-1}). As a result, the model dramatically *undervalues* quality habitat relative to poor or fair habitat. We believe that most scientists familiar with sage-grouse and sage-steppe systems would argue the exact opposite, that habitat value increases exponentially with improving quality, likely at a rate of x^{10}. If the BLM wants to use this framework as a quantitative model for assessing habitat quality, it must provide the mathematical relationships between these categories, and relate them to the published literature.

Seven of the eleven variables in the model cannot have a score <1. This further undervalues the best quality habitat by arbitrarily increasing scores for the poorest quality sites.

The model completely ignores the regional and landscape context of the impacts. For example sage-grouse priority habitat areas should be highly valued and these values should be reflected in the site scores. Currently, this is not the case.

[9] FEIS at Appendix J-1, pg. 2.

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By design, the model explicitly ignores any interaction among variables that might impact habitat quality. For example, a site that is close to a lek and is in a large patch of intact sagebrush is most likely far more valuable to sage grouse than one that has a similar patch size but is >8 km from an active lek (all other variable held constant). Yet, the model values the former as having only a 7.5% greater value to sage grouse. A cursory examination of the variables reveals many such interactions documented in the literature (e.g., sagebrush cover and bunchgrass cover). These clearly need to be reflected in the model. By ignoring these interactions, the current model is a significant step backward from the Habitat Suitability Index models developed for other prairie grouse species. Finally, by not incorporating interactions among variables, the current model further undervalues the highest quality sage grouse habitat. The importance of the "service" currency is accentuated when it is used to value mitigation lands. The model is explicit that "successful" mitigation occurs when the total service value impacted is replaced by mitigation. As a result, service value gained by mitigating poor quality habitat to moderate quality habitat is the same as that from moderate to high quality. Thus, for example, the loss of an acre of high quality habitat could be mitigated by seeding three acres of post-fire rehabilitation to bring those lands up to marginal quality. We disagree with the notion that this reflects effective, or appropriate, mitigation. TNC's sage-steppe mitigation experience is that it is far easier to create low to moderate quality sage grouse habitat than to (re)create that of high quality. Thus, the current model's structure would foster restoration of poor quality habitat as mitigation for the loss of that of highest quality. Rather, we suggest that the valuation model be used to identify quality classes (e.g. acres with a score >20 = quality class 1) and mitigation must replace all acres of quality class 1 with quality class 1 lands. This ensures that the total habitat quality is not ratcheted downward by constantly replacing high quality lands with those of lower quality.

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Finally, the HEA Technical Advisory Team identified five classes of projects suitable to mitigate the impacts of development: fence marking/modification, sagebrush restoration/reclamation, conifer/juniper removal, grass/forb enhancement, and conservation easements. Only two of these activities, sagebrush restoration/reclamation and grass/forb enhancement, are related to the 11 variables in the HEA model, and thus would have any measurable impact on the service value of the mitigated lands. And, as noted above, the known challenges of restoring high quality sage-steppe could, without careful planning and oversight, result in the restoration of poor quality habitat to moderate quality habitat as mitigation for the loss of the highest valued areas.

B. <u>The BLM Should Address Specific Shortcomings in the HEA</u>.

We have the following specific comments about the HEA:

1. *The HEA's treatment of the risk of mitigation project failure is arbitrary.* The habitat conservation projects modeled in the HEA include actions that have a significant risk of project failure – particularly sagebrush steppe restoration and improvement

projects and bunchgrass and forb seeding projects. The Conservancy strongly supports including these actions in the mitigation package. However, given the substantial risk of project failure, it is essential that the cost of these actions must be increased enough to offset the risk that vegetation treatments may not achieve the expected benefits. The HEA states that "conservative growth rates were sufficient to offset the potential for mitigation project failure."[10] This is an overly general approach to an issue that deserves a more precise treatment. A better approach would be to examine actual project histories and existing restoration project databases to determine the likely risk of project failure for the different types of conservation projects. The risk of project failure could then be reflected as a multiplier on the estimated cost of the action. The BLM's recently issued Instruction Memorandum and Draft Manual Section—1794 suggests the use of ratios is an appropriate way to ensure that mitigation benefits will be proportional to impacts in light of uncertainty.[11]

2. *Fence marking should be removed from the list of eligible habitat projects.* Two reasons support this request. First, fence marking does not replace habitat services lost due to direct or indirect habitat effects of the project. At most, fence marking offsets direct mortality due to power line strikes. Second, other funding sources and efforts are targeted on fence marking. These efforts should proceed and the Gateway West mitigation should be focused on projects that replace habitat services through protection, restoration, and enhancement.

3. *The values for habitat services gained and cost per services gained are not adequately disclosed in the record.* With the exception of fence marking, the mix of habitat conservation projects modeled in the HEA is appropriate. However, we are unable to understand how the specific habitat services gained values and costs per services gained, shown in Table 8 of Appendix J-2, were derived. Appendix D of Appendix J is difficult to understand.

4. *Conservation projects will likely require a mix of measures that was not modeled.* The HEA did not attempt to model a mix of different conservation actions, such as combining sagebrush restoration and conservation easements. However, vegetation treatments and other habitat enhancement projects on private lands will require some sort of long-term agreement to ensure that the mitigation site is not disturbed or developed. A conservation easement or other long-term management agreement is

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[10] FESI at Appendix J-2, page 12.
[11] Draft MS-1974 – Regional Mitigation Manual Section (P) at page 12 , attached to Instruction Memorandum No. 2013-142 (6/14/13).

likely required as a component of such projects. This cost should be reflected in the estimates of cost per services gained.

VII. The FEIS Lacks the Findings Needed To Comply with Legal Standards for the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA).

The BLM preferred routes for Segments 8 and 9 would cross portions of the NCA, a unit of the National Landscape Conservation System. In fact, the FEIS contains no alternative that entirely avoids the NCA. Therefore, BLM's decision to issue a right-of-way for the project must comply with the standards established in the 1993 statute establishing the NCA. In addition, the decision should also be consistent with the BLM Manual's standards implementing the National Landscape Conservation System Title of the Omnibus Public Lands Act of 2009. The FEIS lacks the findings needed to comply with these standards. As explained below, these standards require two findings: (1) the proposed project must not be incompatible with the values that NCA was established to protect and (2) the project must "protect, mitigate and enhance" the NCA.

Compatibility Finding: The BLM Manual provides that the agency will not designate utility corridors within NLCS units if it determines the "corridor would be *incompatible* with the designating authority or the purposes for which the NLCS unit was designated." BLM Manual 1.6.J.5 (emphasis added). *See also*, 16 U.S.C. 460iii-3(b)(7) (allowing non-military uses within the NCA that are "compatible" with NCA purposes). The NCA purposes to be considered in making such a finding include: the conservation, protection, and enhancement of raptor populations and habitats and the natural and environmental resources and values associated therewith, and of the scientific, cultural, and educational resources and values of the public lands in the conservation area. 16 U.S.C. §460iii-1(a)(2).

The BLM Manual does not define the terms "compatible" or "incompatible." However, compatibility determinations are a familiar feature of administering the National Wildlife Refuge System and Wild and Scenic Rivers. In the context of Wildlife Refuges, an action is deemed "compatible" if it "will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the refuge." 16 U.S.C. § 668ee(1). BLM's compatibility determinations for livestock grazing and recreational shooting at the Cascade-Siskiyou National Monument may also offer useful guidance on this point.

Enhancement Finding: The NCA legislation requires that non-military uses must be consistent with "protection, maintenance, and enhancement" of raptors and other NCA purposes. *See* 16 U.S.C. 460iii-3(b)(7).

The term "enhancement" requires more than simply minimizing or offsetting impacts. It calls for actions that leave the NCA better off than it would have been without the construction of transmission line. *See also* 16 U.S.C. 460iii-3(a)(2) (allowing activities in the NCA that "further the purposes for which the conservation area was established"). Prior to issuing the right-of-way

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for the project, BLM must analyze proposed enhancement measures and determine their effectiveness.

We do not believe that these standards bar the project from NCA lands. However, no project right-of-way should be issued without findings in the administrative record that comply with these standards.

VIII. Enhancement Measures Offer an Important Opportunity to Improve the Condition of the NCA.

The Birds of Prey National Conservation Area has been highly degraded by repeated fire and invasive plants. The area's native sagebrush/bunchgrass/forb assemblages have been lost across large portions of the NCA. The area is in urgent need of restoration and enhancement. A well-designed package of enhancement measures could provide significant benefits to the area.

The enhancement package should focus primarily on the major threat to raptor populations within the NCA: the decline of the raptor's prey base due to the loss of shrub and perennial grass vegetative cover. Most of the NCA has burned in the last 25 years, and native shrub steppe vegetation has been replaced by annual grasslands dominated by cheatgrass and other non-native species. The change in vegetation has reduced the populations of small mammals that form the prey base for raptors. This decline has reduced the productivity of raptors within the NCA. In particular, efforts are needed to restore black-tailed jackrabbit and Paiute ground squirrel populations.

Recommended measures include:

1. Restore native shrubs and perennial grasses. Given the low precipitation levels within the NCA and the extent to which NCA lands have been invaded by annual grasslands, some non-native species that provide the structure needed by prey species may be used as necessary. The guiding principle should be to produce more resilient vegetation that provides better habitat for raptor prey species.

2. Work with ranchers or grazing permittees to improve riparian areas and springs.

3. Protect private inholdings through fee or conservation easement acquisition where lands have special features of high conservation value, such as canyon rims and adjacent areas that offer important nesting, perching, and foraging habitat. The goal for any acquisitions should not simply be NCA expansion. There is little value in BLM acquiring more annual grasslands or degraded range. Acquisition should be focused on specific natural, scenic or recreational features that add significant value to the NCA.

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The existing NCA Resource Management Plan provides important guidance on the best places and techniques for this work.

In addition, to these measures, we think there is a great opportunity to include measures to communicate with recreational users regarding seasonal or area closures or other best practices to reduce impacts and fire risks associated with off-highway vehicles, shooting, and other recreational activities. Interpretive signage, kiosks and other out-reach could help reverse the pace of fire and degradation in the NCA.

As noted above, the goal for the enhancement package should go beyond one-to-one replacement of impacts. The BLM's recently issued draft Manual makes it clear that designations such as National Conservation Areas are appropriately considered in determining the value of the affected resource.[12] We believe that a well-designed enhancement package could provide significant net benefits to the NCA.

IX. The Final Route for Segment 4 in Wyoming Should Avoid Pending Conservation Easements and Address a Local Proposal to Protect Important Wildlife Habitat.

With respect to the proposed and alternative routes of the Gateway West transmission line in Lincoln County, Wyoming, identified on Figure A-5, Segment 4-WY in Appendix A of the FEIS, the Conservancy expresses the following concerns and recommendations:

- The BLM Preferred Alternative and Proposed Route would diagonally bisect property that the Conservancy is in the process of establishing a conservation easement on, in cooperation with the property owners. This conservation easement will be purchased using both private and public dollars as well as a substantial donation from the landowners. As a result, we are concerned with the proposed construction of a transmission line that would impact the wildlife habitat, open spaces and agricultural operation that the landowners, the state of Wyoming, the federal government, private funders and the Conservancy feel warrant protection. We recommend a route that would avoid these impacts.

- With respect to Feasible Alternative 4F, identified on Figure A-5, Segment 4-WY in Appendix A of the FEIS, we are concerned with the route's identified intersections with multiple properties that are in the process of establishing conservation easements. We recommend that alternative transmission line routes avoid impacting wildlife habitat, open spaces and culturally significant properties by avoiding properties with conservation easements in place or near completion.

- The Conservancy is aware of the efforts of local stakeholders (landowners, community members and Lincoln County leaders) who have worked with representatives from Gateway

[12] Draft MS-1794 – Regional Mitigation Manual Section (P) Section 1.6.D.11.c.i. at page 1-10.

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West throughout the development of this project. From conversations with these stakeholders we understand they have recommended a route that would follow the existing transmission line corridor, and therefore minimize impacts on wildlife habitat and the community. Our understanding is that local stakeholders assumed the BLM Preferred Alternative route would be constructed slightly to the south of the existing line but still within the existing corridor, rather than to the north as in the current Preferred Alternative. From our understanding of these recommendations, we support this local stakeholder-recommended route that would follow an existing transmission line to the south and reduce impacts to properties that will be placed under conservation easement.

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Wildlife Society Bulletin 37(2):301–310; 2013; DOI: 10.1002/wsb.272

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Original Article

Using Spatial Statistics and Point-Pattern Simulations to Assess the Spatial Dependency Between Greater Sage-Grouse and Anthropogenic Features

JEFFREY K. GILLAN,[1,2] *Department of Forest, Rangeland and Fire Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

EVA K. STRAND, *Department of Forest, Rangeland and Fire Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

JASON W. KARL, *New Mexico State University Las Cruces, NM 88003-8003, USA*

KERRY P. REESE, *Department of Fish and Wildlife Resources, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

TAMARA LANINGA, *Department of Conservation Social Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

ABSTRACT The greater sage-grouse (*Centrocercus urophasianus;* hereafter, sage-grouse), a candidate species for listing under the Endangered Species Act, has experienced population declines across its range in the sagebrush (*Artemisia* spp.) steppe ecosystems of western North America. One factor contributing to the loss of habitat is the expanding human population with associated development and infrastructure. Our objective was to use a spatial-statistical approach to assess the effect of roads, power transmission lines, and rural buildings on sage-grouse habitat use. We used the pair correlation function (PCF) spatial statistic to compare sage-grouse radiotelemetry locations in west-central Idaho, USA, to the locations of anthropogenic features to determine whether sage-grouse avoided these features, thus reducing available habitat. To determine significance, we compared empirical PCFs with Monte Carlo simulations that replicated the spatial autocorrelation of the sampled sage-grouse locations. We demonstrate the implications of selecting an appropriate null model for the spatial statistical analysis by comparing results using a spatially random and a clustered null model. Results indicated that sage-grouse avoided buildings by 150 m and power transmission lines by 600 m, because their PCFs were outside the bounds of a 95% significance envelope constructed from 1,000 iterations of a null model. Sage-grouse exhibited no detectable avoidance of major and minor roads. The methods used here are broadly applicable in conservation biology and wildlife management to evaluate spatial relationships between species occurrence and landscape features. Our results can directly inform planning of infrastructure and other development projects in or near sage-grouse habitat. © 2013 The Wildlife Society.

KEY WORDS *Centrocercus urophasianus*, Monte Carlo, pair correlation function, point pattern, Ripley's K, sage-grouse, spatial statistics.

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The greater sage-grouse (*Centrocercus urophasianus;* hereafter, sage-grouse), a candidate species for listing under the Endangered Species Act of 1973 (ESA; U.S. Department of the Interior 2010), has experienced population declines across its range in the sagebrush (*Artemisia* spp.) steppe ecosystems of western North America (Connelly and Braun 1997, Connelly et al. 2004). Sage-grouse now occupy only 56% of their pre-settlement range, though they still occur in 11 western states and 2 Canadian provinces (Schroeder et al. 2004). The conservation status of this wide-ranging species could have a significant influence on public land policy regarding land use, energy and mineral development, transportation and communication corridors, and livestock grazing (Wambolt et al. 2002; US Bureau of Land Management 2004, 2011; Stiver et al. 2006, 2010), because two-thirds of remaining sagebrush lands (329,881 km^2) are publicly managed (Knick 2011). The remaining one-third of sagebrush lands (150,186 km^2) that are privately owned (Knick 2011) could be impacted if sage-grouse are listed under the ESA.

Causes for the species' decline have been attributed primarily to the removal and degradation of sagebrush-dominated lands essential for cover, nesting, and food (Connelly and Braun 1997, Braun 1998, Leonard et al. 2000, Connelly et al. 2004). Historically, conversion of sagebrush habitats to crop fields and livestock pastures was the primary driver of habitat reduction (Swenson et al. 1987, Beck and

Received: 4 June 2012; Accepted: 14 November 2012
Published: 14 May 2013

[1]*E-mail: jgillan@nmsu.edu*
[2]*New Mexico State University Las Cruces, NM 88003-8003, USA*

Mitchell 2000), but more recently wildfire, invasion of annual grasses, and infrastructure development have been responsible for habitat alteration in the sagebrush steppe biome (Knick et al. 2003, 2011; Connelly et al. 2004; Miller et al. 2011).

One factor contributing to current sage-grouse habitat threats is the continually expanding human population and footprint. From 1960 to 2000, the western United States was the fastest growing region of the country and during the 1990s grew at twice the national rate (Perry and Mackun 2001, Travis 2007). From 2000 to 2010, population growth in the region slowed only slightly and 3 of the 4 fastest growing states (NV, UT, and ID) were those with significant sage-grouse populations (Mackun and Wilson 2011). Development patterns spurred by increasing human populations have been characterized by extensive suburban development around major cities and rapid growth of exurban communities and "ranchettes" far removed from metropolitan centers (Brown et al. 2005, Hansen et al. 2005, Travis 2007). This type of growth consumes more land and fragments landscapes more significantly than concentrated urban development (Sullins et al. 2002, Connelly et al. 2004). Many ranches that were previously used for livestock production have been sold and subdivided into low-density housing (Knick et al. 2011). Associated infrastructure, including roads and power-lines, has also expanded on these landscapes (Leu et al. 2008, Leu and Hanser 2011). In some parts of the sage-grouse range, most notably Wyoming, USA, energy development has expanded (Walker et al. 2007, Naugle et al. 2011). Thousands of new natural gas wells have come on line in recent years and required the construction of roads, power lines, compressor stations, pipelines, and ponds (US Bureau of Land Management 2003).

Anthropogenic features can impact ecological processes and wildlife behavior beyond the immediately affected area. Typically, lower biodiversity and more human-adapted species persist adjacent to ranchettes (Theobald et al. 1997; Maestas et al. 2001, 2003; Odell and Knight 2001). The introduction of non-native plant species is one cause because it can change the ecological composition of surrounding land, effectively degrading habitat (Hansen et al. 2005). Wildlife may also avoid anthropogenic features because of noise and the presence of domestic animals such as dogs and cats (Hansen et al. 2005). This type of avoidance behavior can fragment habitat, shrink total available habitat, and create dispersal barriers (Marzluff and Ewing 2001). By assuming that anthropogenic features have some effect on the surrounding land, a recent study by Knick et al. (2011) concluded that power lines have an ecological influence on 39% of all remaining sagebrush lands in the American West, highways influence 38% of remaining sagebrush lands, and urban development influences 18.6% of sagebrush lands. Also, <5% of the entire sage-grouse range is farther than 2.5 km from a mapped road (Knick et al. 2011).

Although sage-grouse cannot tolerate the outright removal of sagebrush (Braun et al. 1977, Connelly et al. 2000), the extent to which proximity to anthropogenic features can negatively influence sage-grouse or cause avoidance behavior is less understood. Some studies have observed negative associations of infrastructure on sage-grouse lek size and persistence (Braun 1986, Hall and Haney 1997, Harju et al. 2010, Holloran et al. 2010, Johnson et al. 2011) and also nest initiation rates (Lyon and Anderson 2003). Sage-grouse have been documented avoiding habitat adjacent to oil and gas wells and their associated infrastructure (Carpenter et al. 2010, Holloran et al. 2010). Sage-grouse are also thought to occur less often near power lines and major highways (Braun 1998, Hanser et al. 2011).

Most of the studies aimed at understanding sage-grouse habitat associations have not directly considered the clustered nature of sage-grouse populations and the impact of the resulting spatial autocorrelation of sage-grouse observations (only surveyed exception was Yost et al. 2008). Spatial autocorrelation refers to tendency of nearby observations to be more similar (positive autocorrelation) or less similar (negative autocorrelation) than distant observations (i.e., observations are not independent in space; Legendre and Fortin 1989, Legendre 1993). Almost all ecological data will exhibit some degree of autocorrelation as a result of processes (e.g., competition, succession, population genetics, predator–prey interactions), or underlying environmental patterns (e.g., vegetation, soils, topography, anthropogenic features; Legendre and Fortin 1989). Likewise, the species being sampled will often cluster because of habitat features or social structures within the population (Lieske and Bender 2009). Spatial autocorrelation inherent in ecological data by itself is not a problem; in fact, it is very useful for resource usage estimations that use interpolation techniques (Aarts et al. 2008).

Problems can arise when autocorrelated data are used in classical statistical models and significance testing that assumes independent samples (Legendre and Fortin 1989, Legendre et al. 1990, Fortin and Jacquez 2000). Spatial autocorrelation in sample data can reduce the effective sample size and the degrees of freedom for tests of statistical significance (Dale and Fortin 2002). As a consequence, results can be classified as significant when they are actually not (i.e., type I error; Dale and Fortin 2002, Klute et al. 2002, Lieske and Bender 2009). In logistic regression analysis, a popular modeling technique for species-habitat associations, spatially autocorrelated data can overestimate the effects of independent variables on the response (Klute et al. 2002, Dormann et al. 2007, Aarts et al. 2008, Lieske and Bender 2009). Similarly, "Monte Carlo" studies that compare observed data with many different computer-generated random permutations can also result in Type I errors if spatial autocorrelation of the observed data is not included in the null model (Fortin and Payette 2002).

Previous studies on sage-grouse habitat associations should not be disregarded and may be highly accurate if the parameters capture the spatial dependency inherent in the data. But frequently, non-environmental processes that cannot be modeled may be partly responsible for the species' distribution. Accordingly, all ecological studies should consider the potential of spatial autocorrelation in their data and how it might affect results.

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Our objectives were to employ a spatial-statistical approach to determine whether sage-grouse in an isolated population in west-central Idaho, USA, were avoiding anthropogenic features (i.e., roads, power transmission lines, and rural buildings) and, if so, how far from the feature was the zone of influence. This study explicitly accounted for the spatial autocorrelation of sage-grouse observations to evaluate their association with anthropogenic features. This research incorporates spatial analysis techniques, including considerations for null model selection, that are broadly applicable for evaluating relationships between species occurrence and landscape features within the species' environment across large areas. The results can inform planning and decision making for rural development including infrastructure routes that minimize negative impacts to sage-grouse and their habitats.

STUDY AREA

This study was conducted in the West Central Sage-grouse planning area in west-central Idaho, which included parts of Washington, Adams, Gem, and Payette counties (centered at 44°26′N, 116°38′W). The 374,700 ha planning area was established to conserve a small and isolated population of sage-grouse that was considered the most likely to be extirpated within the state (Idaho Sage-grouse Advisory Committee 2006). Exact population numbers are unknown but it was estimated that the population was significantly lower than in 1970 due to the abandonment of many leks (Idaho Sage-grouse Advisory Committee 2006, West Central Sage-grouse Local Working Group 2008). Currently, 14 leks are being monitored each year. The major potential threats to sage-grouse in this area were geographic isolation, private property development, wildfire, expansion of annual grasslands, and West Nile Virus (Idaho Sage-grouse Advisory Committee 2006).

The study area consisted primarily of rolling hills of sagebrush steppe and grassland vegetation. The shrub component was mainly xeric big sagebrush (*Artemisia tridentata* sp. *xericensis*), stiff sagebrush (*A. rigida*) and three-tip sagebrush (*A. tripartita*). Native perennial grasses included bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*), and Thurber needlegrass (*Achnatherum thurberianum*). Elevations ranged from 630 m at the Snake River near Brownlee reservoir to >1,220 m at the southern boundary of Payette National Forest. The greatest proportion of the area and of occupied sage-grouse habitat lay between 760 m and 1,070 m in elevation (West Central Sage-grouse Local Working Group 2008). The climate was characterized by cold, wet winters and hot, dry summers. Mean annual precipitation was about 28 cm at lower elevations near the city of Weiser, Idaho, but increased quickly with elevation to >51 cm over much of the planning area. Seventy-five percent of the planning area was considered intact shrub and bunchgrass communities dominated by sagebrush species. Of the 25% that had been altered, 50% was due to invasive annual grasslands thought to have originated from contaminated wheat crops, 49% was in farmland, and only 1% was developed (West Central Sage-grouse Local Working Group 2008).

The study area was rural and had experienced slow human population growth compared with other regions of Idaho. The valley bottoms support irrigated farmland while the uplands were primarily used for livestock grazing. Most settlements, including the small towns of Midvale and Cambridge, occurred along the U.S. 95 highway corridor (Fig. 1). Land speculation and ranchette style housing, however, had become increasingly popular outside of city limits (Adams County, Idaho 2006, West Central Sage-grouse Local Working Group 2008).

METHODS

Sage-grouse Telemetry

We obtained sage-grouse location data from the Idaho Department of Fish and Game, who used radiotelemetry to locate sage-grouse in the study area from April 2005 to December 2007 (Gray 2009). Fourteen females and 44 males captured on 14 different leks were used in this study. To ensure a representative sample of the population, leks were selected to have a range of habitats, a mix of private and public lands, and geographic separation. Sage-grouse were monitored every 2–3 weeks from March through September and once per month from October through February. With this sampling method, bias from serially correlated individual sage-grouse should be small. Location coordinates were recorded using a Garmin (Olathe, Kansas, USA) 76CS Global Positioning System (GPS) where the bird was first seen, but 26 of the locations were obtained through triangulation to prevent flushing. Average accuracy of the GPS was 2–10 m, while the triangulation error could be up to 150 m. Four-hundred ninety-six locations, collected between the months of March and November across all years, were used for the analysis. We excluded the few locations obtained during the winter (Dec–Feb) because sage-grouse habitat use is greatly dependent on snow depth and topography and may not accurately reflect behavior toward anthropogenic features (Connelly et al. 2011). We treated all sage-grouse locations equally with no attempt to depict behavior based on sex, age, or lek of capture. Though it is likely that sage-grouse behavior is partially dependent on seasonal habitat requirements and sex (Patterson 1952; Gill and Glover 1965; Wallestad et al. 1975; Connelly et al. 1981, 1988, 2000, 2011; Gates 1985), we did not examine avoidance behavior distinguished by season or sex because of small sample sizes.

Anthropogenic Features

We compared sage-grouse locations with the mapped locations of major roads, minor roads, power transmission lines, and buildings within the study area (Fig. 1). Major roads were defined as any road receiving average daily traffic counts from the Idaho Transportation Department (2004*a*, *b*). The major roads could be paved or dirt and represented the most frequently used roads. Included in the major roads category was the only 2-lane highway in the study area, U.S.

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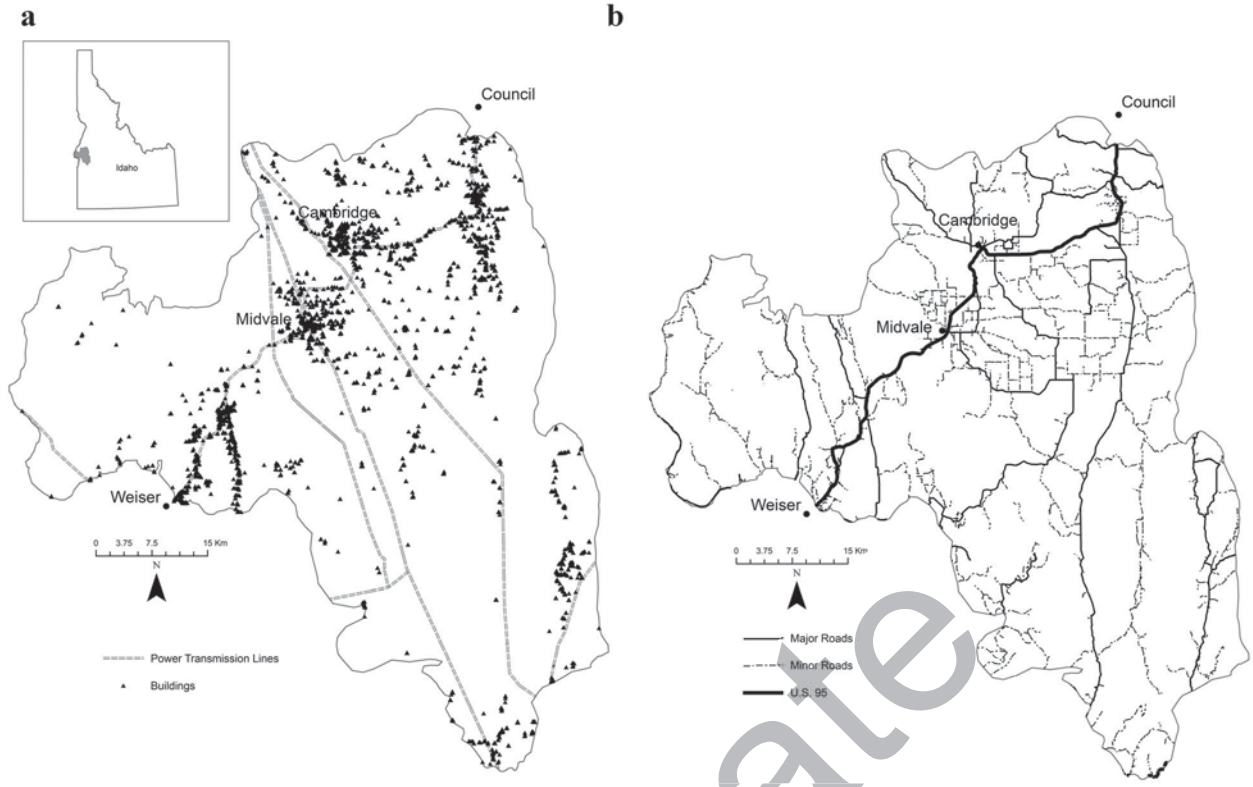

Figure 1. The west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette counties) (a) power transmission lines and buildings, and (b) major and minor roads.

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95. Minor roads consisted of all remaining mapped roads excluding 2-tracks. Mapped power lines included only the major transmission lines (>138 kV), and excluded the distribution lines (National Geographic Maps 2004, US Bureau of Land Management 2007). These transmission lines were usually supported by large structures, including the steel lattice (25 m ht) and steel H-frame (17 m ht). The buildings polygon layer included all structures in the study area and was created through digitizing (at a scale of 1:3,000) on aerial imagery from the National Agriculture Image Program (USDA-FSA-APFO 2004). Because the sage-grouse location data were collected 2005–2007, it is possible that some anthropogenic features were omitted or committed in the analysis.

For the analysis, we transformed each anthropogenic feature layer originally modeled as lines and polygons into point features. For linear features, we placed a point every 125 m, which was determined largely by computing limitations. The point frequency should not affect the results comparing the observed point pattern with the null model. For the buildings layer, a centroid point was placed in each polygon.

Analysis

To determine geographic relationships between sage-grouse locations and each of the anthropogenic feature types, we employed a multi-scale measure of spatial dependence for point patterns. We used the pair correlation function (PCF) to compare observed with expected number of anthropogenic feature points within concentric rings surrounding sage-grouse locations.

In the bivariate form, the PCF is defined (Stoyan and Stoyan 1994, Schurr et al. 2004):

$$\hat{g}_{12}(r) = \frac{1}{2\pi r}\frac{A^2}{n_1 n_2}\sum_{i=1}^{n_1}\sum_{j=1}^{n_2} w_{ij}^{-1} k_h(r - |x_i - y_i|)$$

where $\hat{g}_{12}(r)$ is the PCF at a specified radius, A is the total point-pattern area, and n_1 and n_2 are the number of sage-grouse points and anthropogenic feature points, respectively. The x_i are locations of sage-grouse points, y_i are the locations of anthropogenic feature points, and w_{ij} is a weighting function that accounts for edge effect bias created by unobservable anthropogenic feature points outside the study area. We used the "translation" edge correction described by Torquato (2002) and Pommerening and Stoyan (2006), which extrapolates the point-pattern spatial structure within the study area to infinitely outside the study area. This edge correction is also recommended for study areas with complex shapes (Baddeley and Turner 2005). The PCF looks at a neighborhood of points surrounding the specified radius and gives greater weight to points near the radius and less weight to points further away. This type of weighting is known as an Epanečnikov kernel and is specified by k_h, where h is the bandwidth parameter specifying the size of the radius neighborhood that will receive weighting. Points lying

outside the bandwidth will not be considered in the calculation at that radius.

The PCF is a variation of Ripley's K (Ripley 1981), which measures spatial association within cumulative circles rather than rings. For this application, PCF is the preferred method because it is a more responsive analysis at multiple scales and can identify specific distances of avoidance or clustering. In a Ripley's K analysis, the results at larger distances are influenced by the shorter distances, which may obscure the spatial association at any given scale.

We computed the PCF function initially with $r = 150$ m, because this is the estimated largest possible location error associated with GPS and radio triangulation (Garmin 2011, Shepherd et al. 2011). We subsequently computed the PCF function every 150 m to a maximum of $r = 5$ km to assess the spatial relationship at different scales across the study area. We chose a bandwidth of 75 m because it was half the distance between PCF calculations, and because it provided enough smoothing to the PCF graph to aid in interpretation while not over-smoothing the results.

The empirical $\hat{g}_{12}(r)$ considers all the points of type 1 (sage-grouse) and calculates the intensity of points of type 2 (anthropogenic feature) surrounding it in a ring with a specified radius. The empirical value can then be compared with the expected number of points at the same radius, which is derived from a null PCF model constructed from Monte Carlo point simulations. A deviation between the empirical and expected curves suggests dependence between points of type 1 and 2. Empirical values larger than the expected curve at a given distance suggest that the 2-point types are clustering around each other at that scale. Smaller values than expected suggests the point types are exhibiting avoidance at that scale.

To test the significance of the spatial association between sage-grouse locations and anthropogenic features, we compared the empirical plot of $\hat{g}_{12}(r)$ to a null model constructed from 1,000 Monte Carlo simulations. We simulated point patterns designed to mimic the observed spatial pattern of sage-grouse habitat use. The map of sage-grouse telemetry points exhibited strong clustering (Fig. 2a). This strong spatial autocorrelation is a violation of sample independence (see Legendre and Fortin 1989), so a completely spatially random (CSR) null model or parametric statistical test is inappropriate. Therefore, the simulated points used in comparison with the spatially dependent data reflected the same intensity of clustering to prevent false positive findings of significance (Fig. 2b; Fortin and Payette 2002). We also ran the simulations using a CSR model for comparison purposes.

Computation of $\hat{g}_{12}(r)$ and the simulations were carried out using the Spatstat package (Baddeley and Turner 2005) in the statistics program R 2.10.1 (R Development Core Team 2009). Using the "Kppm" command in Spatstat, we fitted a homogenous Poisson cluster point process model to the sage-grouse data using the PCF function with the same parameters described previously. The simulated cluster patterns were realized following the Matern cluster process (see Moller and Waagepetersen 2003), which creates point patterns using 3 parameters: κ is the intensity of parent points generated through a Poisson process; μ is the average number of offspring points surrounding each parent point; and R is the radius of the cluster of offspring points centered

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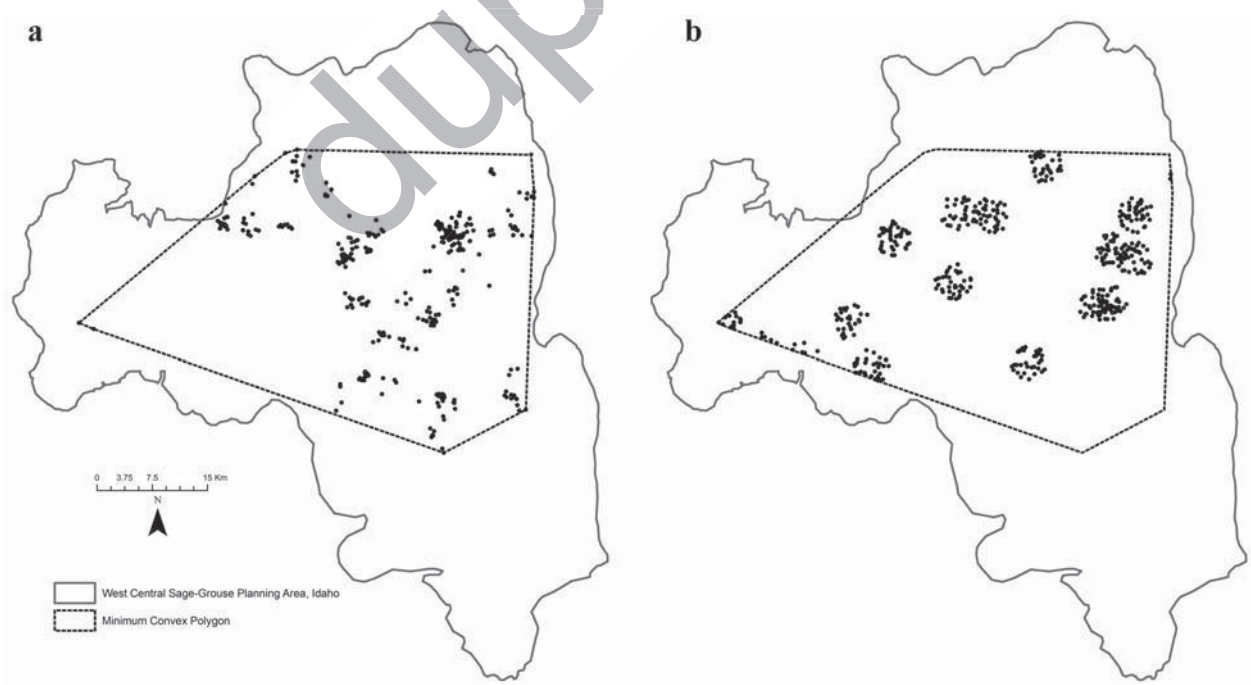

Figure 2. (a) Known sage-grouse locations in the west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette counties) observed April 2005 to December 2007. The locations are bounded by a minimum convex polygon that served as the simulation boundary. (b) Example of a simulated cluster-point pattern created from a homogenous Poisson cluster-point process model. We used 1,000 realizations of the simulated cluster-point patterns as a null model to assess spatial dependency between observed sage-grouse locations and anthropogenic features.

on the parent point. The simulated points were allowed to occur only within available habitat, which we defined as a minimum convex polygon surrounding all of the sage-grouse locations. The Bureau of Land Management, Idaho, considers nearly all of the land within the minimum convex polygon to be sage-grouse habitat (US Bureau of Land Management 2009). Accordingly, simulated points were permitted to occur anywhere within the minimum convex polygon except in water bodies or towns. From the simulations, we created 95% significance envelopes for the clustered and CSR null models to illustrate the difference in statistically significant findings between the 2 simulation methods. For a given radius, values of $\hat{g}_{12}(r)$ outside of the clustered significance envelope were considered to be significantly different from random arrangements of points showing the same spatial dependence as the sage-grouse locations. This would indicate clustering around or avoidance of anthropogenic features by sage-grouse at those distances.

RESULTS

Fitting a homogenous Poisson cluster point process model to the sage-grouse data using the PCF function produced a clustered point pattern with $\kappa = 6.200333\text{e-}09$, $\mu = 47.51922$, and $R = 1{,}748$ m. The significance envelopes exhibited a typical funnel shape where PCF variability was greatest at near distances and shrinks at larger scales (Fig. 3). This was due to the fact that closer concentric rings have less total area and thus a greater opportunity for PCF variability. The funnel-shaped envelopes also tilted upward as scale increased. This is caused by the spatial clustering of the anthropogenic features we are testing. In the study area, there is more open space than there is developed space, so the simulated points were, on average, farther away from anthropogenic features than closer.

Selection of the null model proved to highly influence the statistical inference. The results indicated that observed sage-grouse exhibited avoidance of buildings by 150 m (Fig. 3a) because the PCF value at that distance was less than the clustered 95% significance envelope. The CSR null model produced a much narrower significance envelope, which equates to a much lower standard of statistical significance. The CSR null model indicated that sage-grouse were avoiding buildings by up to 3.45 km. At larger distances, the empirical PCF values were within the simulation significance envelope, which suggested no significant spatial relationship between sage-grouse and building locations.

duplicate

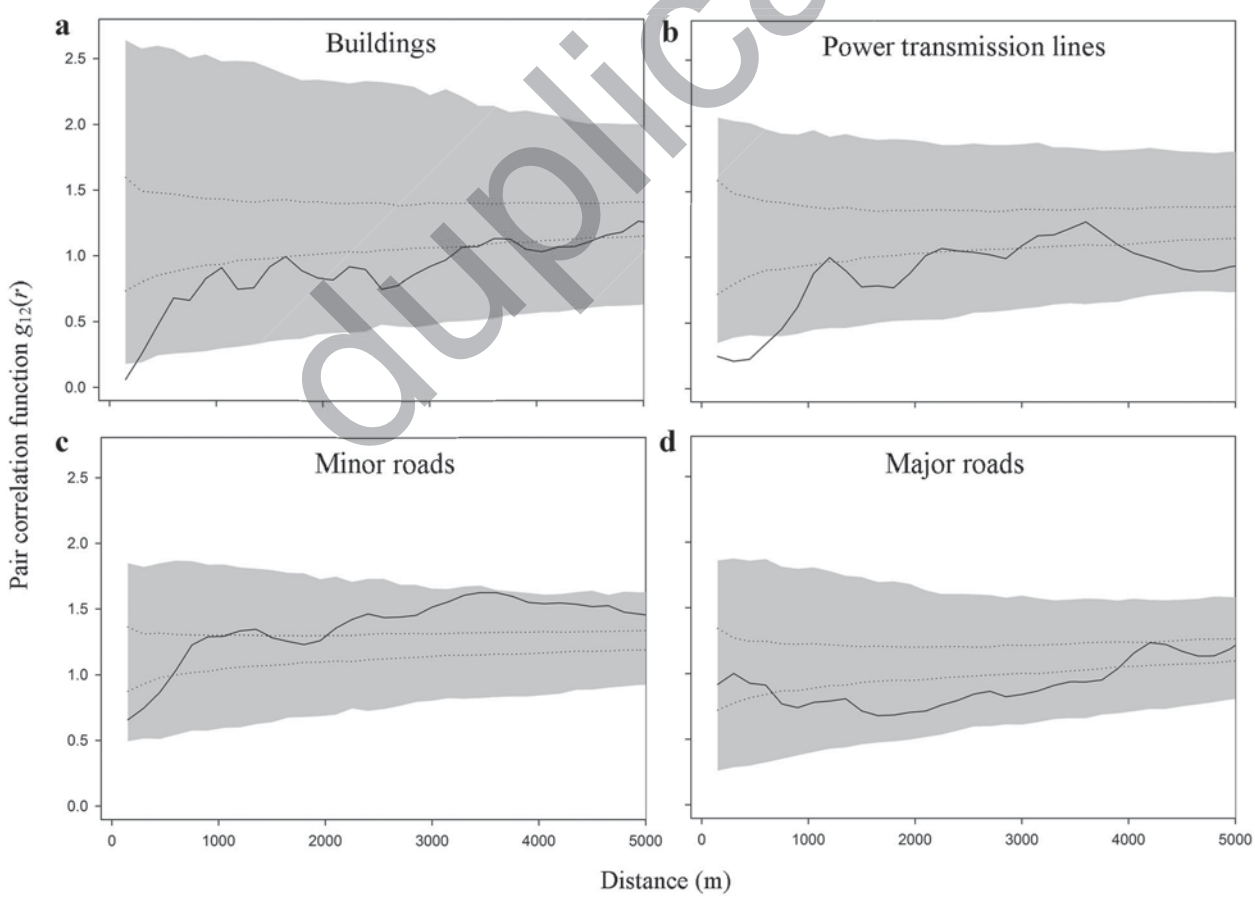

Figure 3. Bivariate pair correlation function, $\hat{g}_{12}(r)$, for greater sage-grouse locations and (a) buildings, (b) power transmission lines, (c) minor roads, and (d) major roads. Sage-grouse locations were collected April 2005 to December 2007. The empirical curve (solid line) is plotted against 2 95% significance envelopes: one determined from 1,000 clustered point-pattern simulations (shaded area); and one determined from 1,000 point patterns that were completely spatially random (dotted lines). This study occurred in the west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette Counties).

Sage-grouse showed avoidance of power transmission lines up to distances of 600 m (Fig. 3b) because the PCF values at 150, 300, 450, and 600 m were less than the clustered significance envelope. At all other scales, the empirical PCF values were within the significance envelope, which suggested no significant spatial relationship. The CSR null model again showed that sage-grouse avoided the features at a greater distance of 1.05 km. At larger scales, the empirical curve dipped in and out of the CSR envelope.

Sage-grouse did not appear to avoid minor roads in the study area because the PCF empirical curve landed within the clustered null model significance envelope at all scales (Fig. 3c). The CSR null model showed that sage-grouse avoided minor roads by 450 m. At larger scales (3–4 km), the empirical curve was far above the CSR envelope and nearly left the bounds of the clustered model envelope. This suggests that, at these distances, there were far more sage-grouse near minor roads than was expected.

Sage-grouse also did not appear to avoid major roads in the study area because the PCF empirical curve landed within the clustered null-model significance envelope at all scales (Fig. 3d). There was agreement in the CSR null model up to 600 m, after which the empirical curve was below the envelope at all scales up to 3.9 km, which suggests avoidance at those distances.

DISCUSSION

This study showed that results from point-pattern simulations could vary greatly between those that incorporate spatial structure and those that employ a CSR method. The CSR null model produced significance envelopes much narrower than the clustered null model, thus setting a much lower standard for significance testing, which may lead to false positive results. This demonstrates the need to explicitly account for spatially dependent data in ecological studies, especially wildlife studies that have presence-only sampling.

Although an improvement over a CSR null model, the homogeneous clustered simulations were not a perfect representation of the observed data. The data appeared to exhibit non-stationary or an inhomogeneous cluster pattern probably caused by differences in seasonal habitat use. Sage-grouse aggregate during the spring lekking season and disperse when breeding has concluded. Analyzing and simulating the data by season and sex may produce improved null models but was not attempted due to small sample size.

Our results support Braun's conjecture (1998; personal communication) that sage-grouse avoid farms and ranch houses. However, he suggested that adult sage-grouse were avoiding occupied farms and ranches by 800 m, while hens with broods might come closer to seek out wet sites. Our study found avoidance up to 150 m, but we did not distinguish between occupied and unoccupied home sites, nor did we consider differences based on sex or season. Sage-grouse may show greater avoidance of occupied houses or farms because of the associated sounds such as human voices or motorized vehicles, or the presence of domestic animals such cats, dogs, horses, or other livestock.

Our findings on sage-grouse and power transmission lines support other studies suggesting avoidance behavior. Braun (1998) concluded that sage-grouse infrequently use areas within 1 km of a power line, and Hanser et al. (2011) found there was less probability of sage-grouse pellet occurrence within 500 m of power lines. Power lines and transmission structures can serve as perches for avian predators in landscapes with few naturally tall structures (Ellis 1987, Connelly et al. 2004). Sage-grouse may also avoid traditional leks if perches or raptors are visible (Hall and Haney 1997). In California, USA, as distance to overhead power lines decreased, peak male lek attendance also decreased (Hall and Haney 1997). Other studies have found power lines to have a benign effect on sage-grouse. In a 10-year range-wide study, Johnson et al. (2011) found no negative effects of power lines on lek counts, but did report that lek trends were reduced when communication towers were nearby.

Though previous research has shown that sage-grouse may avoid major highways (Hanser et al. 2011), have lower lek attendance (Braun 1986, Johnson et al. 2011), and have lower nest initiation rates near roads (Lyon and Anderson 2003), our results show sage-grouse to be minimally affected by minor and major roads in our study area. There was only one 2-lane highway in the study area and most of the minor roads were composed of dirt or gravel and had infrequent traffic. Anecdotally, some sage-grouse actually lek directly on minor roads in the study area (Gray 2009), and perhaps roads provide an open area in the sagebrush where mating displays can be seen (Connelly et al. 1981, Gates 1985). At some scales for minor roads (3–4 km), more sage-grouse were near roads than was expected to almost a significant level. The reason this occurred is unknown. Sage-grouse may be attracted to riparian areas, agricultural fields, or water developments that are often near farms and ranches. In the summer, sage-grouse have been observed using riparian areas and crop fields, which provide a food source (Dunn and Braun 1986, Schroeder et al. 1999). Topography may be important because leks are often on gentle slopes or in valley bottoms (Rogers 1964), and sage-grouse may simply occupy lands that are popular for human settlements, including locations with roads.

Sage-grouse have been observed being influenced by energy infrastructure at greater distances compared with our results. In Alberta, Canada, sage-grouse avoided energy wells by up to 1.9 km during the winter (Carpenter et al. 2010). In Wyoming, yearling males established themselves less often than expected on leks within 3 km of producing wells and more often on leks farther than 3 km from producing wells (Holloran et al. 2010). Fewer yearling females nested within 950 m of infrastructure than was expected (Holloran et al. 2010). Yearling males and females reared within 1.65 km of a producing well pad or haul road had lower annual survival rates (Holloran et al. 2010). At 5 study sites in Wyoming, lek counts were negatively associated with the presence of producing wells within 800 m, 1.2, 1.6, and 4.8 km at each respective site (Harju et al. 2010). Two other study sites showed no reduced lek counts. In the Powder River Basin of Wyoming and Montana, USA, female sage-grouse in the

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winter were more likely to occupy habitats with no natural gas wells within 4 km^2 compared with the legal maximum density of 12.3 wells (Doherty et al. 2008).

Sage-grouse have distinct patterns of habitat use during different times of the year, which will likely affect their tolerance of anthropogenic features (Connelly et al. 2000, 2011). Lumping the seasons and sexes together possibly masked or coarsened the precision of some of the results. For example, during the late brood-rearing period (Jul–Sep), the diet of the chicks changes primarily to forbs and they will choose their habitat based on their availability (Patterson 1952). The hen and chicks may use irrigated crop fields, wet meadows, and riparian areas closer to anthropogenic features (Dunn and Braun 1986, Connelly et al. 1988). During the autumn as the forbs desiccate or are killed by frost, sage-grouse switch their diet back to sagebrush (Patterson 1952, Wallestad et al. 1975). A study in Colorado, USA, found that sage-grouse abandoned irrigated hay fields when the irrigation stopped or after the first frost (Gill and Glover 1965). Had the analysis been separated by season, we might have seen different habitat use between summer and autumn in relation to anthropogenic features.

MANAGEMENT IMPLICATIONS

Our results can directly inform land managers who are planning infrastructure and other development projects in or near sage-grouse habitat. We revealed a zone of influence around buildings and power lines that affects the occurrence of sage-grouse within their habitat. Our results indicate that anthropogenic features reduce the total amount of habitat available to the species by a factor larger than just the footprints of the features themselves. Planning and zoning commissions, utility companies, and other government entities can use these results to develop building regulations and plan infrastructure routes that are sensitive to sage-grouse populations and habitat. Specific actions that planning entities can take to protect greater sage-grouse populations and habitats in Idaho are to 1) identify goals for species and habitat protection in the county comprehensive plan, 2) incorporate the spatial data from this study and other studies on species of concern into county land use maps, and 3) develop zoning ordinances that encourage the implementation of 'on-the-ground' conservation actions by private landowners that minimize or mitigate the zone of influence from anthropogenic features (Haines et al. 2012).

ACKNOWLEDGMENTS

We would like to thank the entities responsible for funding *Sage-grouse Habitat in Idaho: A Practical Guide for Land Owners and Managers*: The University of Idaho College of Natural Resources, Idaho Governor's Office of Species Conservation, Idaho Department of Fish and Game, Bureau of Land Management Idaho, US Fish and Wildlife Service, Laura Moore Cunningham Foundation, and Idaho Rangeland Resource Commission. The funding from that publication made this research possible. Special thanks go to J. Hinson and M. Soulen-Hinson for everything they did to support this research. This publication is issued as Contribution no. 1077 of the Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

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Associate Editor: Gervais.

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The Nature Conservancy
Protecting nature. Preserving life.™

Southwest Office
950 W. Bannock St.
Suite 210
Boise, ID 83702

Tel (208) 343-8826
Fax (208) 343-8892

nature.org

June 28, 2013

Via electronic mail

Walt George
Gateway West Transmission Line Project Manager
Bureau of Land Management
P.O. Box 20879
Cheyenne, Wyoming 82003
Gateway_West_WYMail@blm.gov

Re: Comments on Gateway West Transmission Line Final Environmental Impact Statement

Dear Mr. George:

Thank you for the opportunity to comment on the Final Environmental Impact Statement for the proposed Gateway West Transmission Line Project. The Nature Conservancy's response is attached. Our comments represent contributions from staff the Idaho and Wyoming chapters of The Nature Conservancy

If you have questions regarding these comments, please contact Will Whelan, Director of Government Relations for The Nature Conservancy in Idaho, at 208-350-2202 or wwhelan@tnc.org.

Sincerely,

Toni Hardesty
State Director
Idaho Chapter

Andrea Erickson
State Director
Wyoming Chapter

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Comments of The Nature Conservancy Regarding the Final Environmental Impact Statement for the Gateway West Transmission Line Project

June 28, 2013

INTRODUCTION

The Nature Conservancy (the Conservancy) is an international nonprofit whose mission is to conserve the lands and waters on which all life depends. The Conservancy's on-the-ground conservation work is carried out in all 50 states and in 30 countries with the support of approximately one million members. Throughout the United States, the Conservancy works closely with federal, state and local governments, businesses, the conservation community and private individuals to protect biodiversity in a science-based, collaborative manner.

The Conservancy is committed to cooperative, pragmatic approaches to resolving environmental issues associated with the nation's energy infrastructure. The Conservancy uses landscape-scale assessments in collaborative planning processes to balance the needs of energy infrastructure development with the conservation of natural resources and wildlife. Our experience has reinforced our belief that energy and biodiversity are not mutually exclusive. In our view, the question is not whether to proceed with energy development and associated infrastructure, e.g., transmission; the question is *where* to locate development to avoid or minimize impacts, or how to mitigate impacts to species and habitats if impacts cannot be avoided.

Our approach to environmental review is guided by the "mitigation hierarchy," which provides that the guiding principles for conserving natural resources are to avoid, minimize, mitigate and compensate for environmental impacts, in that order. The BLM and the project proponents have generally done a good job of avoiding and minimizing impacts.

Although these comments raise serious concerns about the adequacy of the compensatory mitigation proposed in the Gateway West Final Environmental Impact Statement (FEIS), we remain convinced that there is still time for the BLM, the project proponents, and key stakeholders to reach an appropriate balance between protecting the environment and building an electrical grid that meets the country's energy needs.

SUMMARY OF COMMENTS

1. BLM should take the time needed to fix major problems with its approach to compensatory mitigation for sage grouse impacts. *page 2*

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2. The FEIS fails to mitigate for significant impacts to sage grouse and their habitats. *page 3*
3. The compensatory mitigation plan should include indirect impacts. *page 6*
4. Scientific research documents quantifiable indirect impacts and serves as a basis for incorporating these impacts into the compensatory mitigation plan. *Page 8*

   Recommendation: Compensatory mitigation of indirect impacts should be based on the loss of habitat services within .6 kilometers each side of the centerline of the Gateway West Transmission Line. We calculate that this measure would include 15,903 acres in preliminary priority habitat and 32,999 acres in general habitat. *page 9*

5. The record of decision should address mitigation planning and oversight. *page 10*
6. Key elements of the Habitat Equivalency Analysis are unsupported and should be revised. *page 10*
7. The FEIS lacks the findings needed to comply with legal standards for the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA). *page 14*
8. Enhancement measures offer an important opportunity to improve the condition of the NCA. *page 15*
9. The final route for Segment 4 in Wyoming should avoid pending conservation easements and address a local proposal to protect important wildlife habitat. *Page 16*

COMMENTS

I. BLM Should Take the Time Needed to Fix Major Problems with Its Approach to Compensatory Mitigation for Sage Grouse Impacts.

These comments point out serious flaws in the FEIS' approach to compensatory mitigation of the sage grouse impacts of the Gateway West Project. We respectfully request that BLM establish an inclusive process to fix these problems that draws on policy and scientific experts from the project proponents, key wildlife and resources agencies, and stakeholders experienced in mitigation science and practice. We are convinced that these concerns can be resolved through a purposeful and constructive engagement with the goal of producing a biologically effective and economically feasible compensatory mitigation plan.

The stakes are high. The Gateway West Project will set crucial precedents regarding BLM's approach to infrastructure mitigation at a time when the federal and state governments are working to establish "adequate regulatory mechanisms" that can avoid the need to list sage grouse under the Endangered Species Act.

Progress on other fronts is promising. The BLM has just issued draft Manual[1] provisions that represent a major step forward in off-site compensatory mitigation planning and implementation.

[1] Draft MS-1974 – Regional Mitigation Manual Section (P), attached to Instruction Memorandum No. 2013-142 (6/14/13).

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The State of Idaho has advanced a state sage grouse conservation alternative that adopts the Idaho Mitigation Framework to offset infrastructure impacts. In Idaho, where large swaths of sage grouse habitat are being lost nearly every year to fire and invasive plants, it is critical that we develop policies and funding sources that can replace some of that habitat being lost. Utility companies, conservationists, ranchers, and everyone linked to our rangelands have a stake in developing effective compensatory mitigation programs.

The FEIS undermines this progress at a critical time. The major categories of sage grouse impacts – long recognized by the BLM as well as state and federal wildlife agencies – are simply excluded from the compensatory mitigation plan. The costs and benefits of mitigation actions are stipulated with little analysis and few procedures to ensure that those actions will actually accomplish the expected benefits. Some proposed mitigation actions, such as fence marking, are inappropriate to offset the type of impacts associated with Gateway West.

The result of the FEIS would be that hundreds of miles of transmission lines will be placed in sage grouse habitat with compensatory mitigation that is incomplete and insufficient. No one's long-term interest is served by this outcome.

The BLM has the time to remedy this situation. With the time that remains between the FEIS and the issuance of Notices to Proceed, we ask the BLM to: (1) reach out to the project proponents to request their support for a more open process on compensatory mitigation; (2) re-open certain elements of the Habitat Equivalency Analysis (HEA); (3) integrate indirect impacts into the compensatory mitigation analysis and (4) align the mitigation for this project with the planning approaches described in the BLM's draft Manual provisions and Idaho's Mitigation Framework.

II. The FEIS Fails to Mitigate for Significant Impacts to Sage Grouse and Their Habitats.

The compensatory mitigation package for the Gateway West is based on a Habitat Equivalency Analysis (HEA) set forth in Appendix J-2 of the FEIS. The document describes the HEA as a "standardized method to determine a one-to-one ratio [of] habitat services lost to habitat services mitigated."[2] The project proponents, acting at the direction of BLM, used the HEA-generated sum of habitat services lost to develop a package of compensatory mitigation projects. As explained below, the compensatory mitigation recommendations that emerged from the HEA process do not even come close to providing one-to-one mitigation for habitat services lost because the most significant project effects on sage grouse were excluded from the HEA analysis.

The project impacts that were incorporated into the HEA included the permanent and interim loss of sage grouse habitat services as a result of vegetation loss, noise and human presence

[2] FEIS at Appendix J-1, page 3.

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anticipated with project construction and operation as well as the physical footprint of project structures.

The central flaw in the HEA is that it encompasses only a small portion of the sage grouse impacts that the U.S. Fish and Wildlife Services (USFWS) has linked to transmission lines.

> The USFWS's *12-Month Findings for Petitions to List the Greater Sage-Grouse as Threatened or Endangered* (2010e) listed the following as potential impacts to the sage-grouse resulting from powerlines: 1) collisions/electrocutions, 2) consolidation of predatory birds along powerlines, 3) lower recruitment rates near lines, 4) habitat fragmentation, 5) degradation of habitat due to spread of invasive plant species, 6) impacts resulting from the line's electromagnetic fields, and 7) direct loss of habitat. Additional impacts related to construction and operations of the line, as well as associated infrastructure, could include short-term disturbances due to construction and long-term disturbances during operations, increased road access allowing poaching/hunting in previously inaccessible locations, and changes to habitat structure resulting from altered fire regimes.[3]

None of the first six factors listed by USFWS are considered in the HEA and are therefore excluded from the mitigation package developed by the project proponents. This means that the HEA model fails to account for the synergistic and cumulative impacts of this transmission line, especially the indirect impacts of placing permanent and tall infrastructure in previously unaltered high quality habitat. For ease of reference, these excluded effects are referred to here as "indirect impacts."

Even though indirect impacts are not integrated into the HEA, the FEIS acknowledges they exist. For example, the FEIS quotes repeatedly from Connelly et. al. (2000) that "analysis of sage-grouse populations that attend leks within 18 kilometers (11 miles) of the Project is a critical component of an impacts analysis for the species *because these sage-grouse may be <u>indirectly affected</u> by the loss of habitat functionality during other seasons of the year (Connelly et.al. 2000)."* (emphasis added) The FEIS also recognizes indirect effects, stating that "Long-term beneficial effects (of decommissioning) would include the removal of tall structures (towers) from grouse habitats, and the decommissioning of Project facilities and access roads, both of which could increase the connectivity and size of wildlife habitat."[4]

The FEIS' recognition of the existence of indirect effects has ample scientific support. U.S. Geological Survey's recently issued Baseline Environmental Report (BER; Manier et al. 2013)[5] provides a recent summary of research showing that the effects of transmission lines far exceeds their direct "footprint" and construction effects. While the evidence is not extensive, the report

[3] FEIS at 3.11-61 – 3.11-62.
[4] FEIS at 3.11-135.
[5] USGS, Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-Grouse (*Centrocercus urophasianus*) at 50. (Manier et al. 2013)

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provides a clear rationale for including indirect and cumulative effects in the compensatory mitigation plan. The relevant selection from the BER report is set forth below:

> Transmission- and distribution-line construction (power lines) may result in substantial indirect habitat loss (that is, avoidance) due to sage-grouse avoidance of vertical structures, potentially because of changes in raptor concentrations and raptor species' composition relative to perches on flat landscapes. Additionally, the tendency of sage-grouse to fly relatively low, and in low light or when harried, may put them at a particularly high risk of collision with lines…. The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years (Ellis, 1985). This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons (Ellis, 1985). Negative effects of power lines on lek persistence were documented in northeastern Wyoming; the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 4 mi (6.4 km) window around leks (Walker and others, 2007a). Braun (1998b) reported that use of areas near transmission lines by sage-grouse increased as distance from transmission lines increased up to 1970 ft (600 m). Sage-grouse avoided brood-rearing habitats within 2.9 mi (4.7 km) of transmission lines in south-central Wyoming (LeBeau, 2012). Power line collisions accounted for 33 percent of juvenile (1st winter) mortality in low-elevation areas in Idaho (Beck and others, 2006). In general, it appears sage-grouse may avoid habitats within 0.4–2.9 mi (0.6–4.7 km) of a transmission line, and erection of a transmission line close to a lek will negatively influence sage-grouse lek attendance and breeding-season behavior. Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse (Steenhof and others, 1993; Connelly and others, 2004). Foraging distances of avian, sage-grouse predators have been estimated at 4.3 mi (6.9 km; Knick and Connelly, 2011a), suggesting that transmission and power lines may influence sage-grouse at large spatial scales (Connelly and others, 2004; Cresswell and others, 2010). *Based on these data, the direct footprint within any given MZ is relatively small (1.1–5.0 percent; table 8), but the area of relative influence is more extensive (25.2–62.8 percent PGH; table 8).* (emphasis added)

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This conclusion is backed by a significant body of scientific research, including both peer reviewed publications and significant additional evidence, discussing the effects of transmission lines and tall structures on sage grouse habitat. These effects include habitat fragmentation and habitat loss caused by behavioral avoidance of transmission corridors. In particular, the U. S. Fish and Wildlife Service issued a briefing paper titled "Prairie Grouse Leks and Wind Turbines: U.S. Fish and Wildlife Service Justification for a 5-Mile Buffer from Leks" (2004) which places sage grouse and prairie grouse in the same "prairie grouse" category, and concludes that the avoidance impacts from vertical structures to both species are the same. This guidance goes on to say that "the Service feels it is important to clarify that avoidance of vertical structures by grassland and sage steppe-obligate wildlife is not a new issue."

As we explained in our comments on the DEIS, peer-reviewed studies conducted on other North American grouse species with similar life history traits to the sage grouse (i.e., the lesser and greater prairie-chickens) have shown that the birds' use of quality habitat is reduced when tall structures are located nearby, because prairie grouse instinctively avoid tall structures (Manes et al. 2002).

Three additional peer-reviewed studies found additional relevant evidence. In Utah, golden eagle predation of sage grouse increased from 26% to 73% (of total predation) after a transmission line was constructed within 200 yards of an occupied lek. The lek was extirpated and the author concluded that the presence of the transmission line resulted in both changes in sage grouse dispersal patterns and fragmentation of the habitat (Ellis 1985). In Kansas, the average displacement of prairie-chicken use areas was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines (Hagen et al. 2004). In Oklahoma, the displacement of lesser prairie-chickens from a power line was at least 500 meters (Pruett et al. 2009).

Other studies not published corroborate this evidence. In California, power lines resulted in sage grouse lek abandonment and reduced lek attendance up to 3 miles away from the lines (Rodgers 2003). In Colorado, pellet transects illustrated declining habitat use by sage grouse up to 600 meters from power lines (Braun 1998). In Washington, 19 of 20 leks (95%) documented within 7.5 km of 500 kV power lines were abandoned by the birds. In contrast, the vacancy rate for leks further than 7.5 km is 59% (22 of 37 leks) (Schroeder 2010).

Based on this body of scientific research, we conclude that any attempt to limit the compensatory mitigation package to direct and construction/operation impacts explicitly ignores the main influences of a transmission line on sage grouse habitat.

III. The Compensatory Mitigation Plan Should Include Indirect Impacts.

The FEIS' rationale for narrowing the HEA to just direct, construction, and operation impacts is that indirect impacts, such as predation, fragmentation, invasive species, etc., are difficult to

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quantify within the HEA model. Importantly, the FEIS never contends that these effects are non-existent or insignificant.[6] Instead, they are excluded because they are difficult to tally within the specific model the agency selected for scaling project mitigation. Rather than weigh these effects in the mitigation analysis, the agency states that "indirect impacts to sage-grouse and their habitats are qualitatively assessed" outside the scope of the HEA process. Thus, the FEIS effectively concedes that the HEA does not capture the full range of impacts of the project.

We understand that indirect impacts can be difficult to quantify precisely but disagree that this is an adequate basis for entirely failing to mitigate for them. It is insufficient for the FEIS to state that, because the indirect effects of hundreds of miles of transmission line cannot be "accounted" for in the HEA, no mitigation of any sort for those impacts is necessary. Although there may be a range of uncertainty regarding the extent of indirect impacts, that range does not include a "zero effect."

This situation calls for BLM to exercise its judgment and determine how to account for indirect effects in the mitigation package – either within the HEA or, preferably, as an additional component of the mitigation analysis. The BLM's Framework for Analyzing Sage Grouse Impacts, prepared prior to the draft EIS, states that it is reasonable to make predictions about indirect impacts:

> Qualitative and quantitative measures of habitat change must be considered in describing the potential impacts of the project. In the context of managing a species that requires such a large landscape of habitats to meet their lifecycle needs, and the nature of the proposed disturbance, *it is reasonable to make some assumptive predictions about the relative impacts within 18km.*[7]

The FEIS itself at one point appears to contemplate a quantitative approach to assessing indirect impacts:

> The general Analysis Area used for wildlife habitat mapping (see Section 3.11.1.4) consisted of a 1,000-foot-wide area centered on the Proposed Route and Route Alternatives (500-foot-wide on either side of the centerline of each route)…. While most of this Analysis Area would not be directly impacted by the Project, information gathered for this larger area allows for an understanding of

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[6] In fact, the draft EIS states that the project's direct and indirect impacts plus the absence of an agreed-upon compensatory mitigation plan is "likely to contribute to a trend toward federal listing or loss of viability for the greater sage-grouse." DEIS at 3-11-72 – 3-11-73 (emphasis added, referencing Region 4 language. It is hard to imagine how the minor amount of mitigation required via the HEA-based approach would serve as a sufficient basis for altering this finding.

[7] FEIS at Appendix J-1, pg. 2.

> the context in which the impacts would occur and *allows an assessment of indirect effects*.[8]

Our concern is that neither this nor any other approach for assessing indirect effects (other than construction noise) was ever incorporated into the compensatory mitigation analysis.

We request that BLM work with the project proponents, federal and state experts, and stakeholders to develop a defensible approach to compensating for indirect effects prior to issuing notices to proceed for the project.

IV. Scientific Research Documents Quantifiable Indirect Impacts and Serves as a Basis for Incorporating These Impacts into the Compensatory Mitigation Plan.

The following table summarizes studies of indirect effects of transmission lines on sage grouse, including reproductive behavior, predation, and vital rates. Although these studies discuss impacts at different distances from transmission lines, they all come to the same conclusion that these impacts are real and detrimental. Taken together, these studies provide a reasonable starting point for quantifying how indirect impacts can be integrated into the compensatory mitigation package.

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A Literature Review of Transmission Line Effect Distances

Effect Distance Value	Source	Comments
No effect detected at 5 and 18km of a lek.	(Johnson et al. 2011)	Authors examined trends in lek counts and anthropogenic features (1997-2007). No general pattern/association was found across the entire study area with transmission at tested 5km and 18km of lek.
200 m	(Ellis 1985)	The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years. This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons.
360 m +/- 60, 630 m +/- 40	(Robel et al. 2004)	Data are from a 6 year study of energy development on lesser prairie-chickens in Kansas. Distances are mean (+/- SE) distance to electric power lines avoided by 90% of 187 nesting prairie checking and mean distance to power lines across which 95% of 18,866 telemetry locations of prairie chickens were absent, respectively.
450-650 m	(Hagen et al. 2004)	In Kansas, the average displacement of prairie-chicken use

[8] FEIS at 3.11-2 – 3.11-3 (emphasis added).

		sites was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines.
400m	(Pitman et al. 2005)	Data are from a study on lesser prairie-chickens in Kansas and found that nest proximity was "seldom less than 400 meters from a transmission line" (Table 3)
500m	(Hanser et al. 2011)	Wyoming Basins Ecoregional Assessment: Study of responses of sage-grouse to anthropogenic effects. Authors tested effects at .5 km and 1km and found the most significant effect of transmission lines on sage-grouse abundance at .5 km.
500m	(Pruett et al. 2009)	Oklahoma prairie-chicken study found that displacement of prairie-chickens was at least 500m from a power line.
600 m	(Braun 1998)	In Colorado, pellet transects illustrated declining habitat use by sage-grouse up to 600 meters from power lines.
600 m	(Gillan et al. 2013)	Using a spatial statistical approach with telemetry data from Idaho, this study found that sage-grouse avoided power transmission lines by 600 m.
0-4.7 km	(LeBeau 2012)	A wind turbine effects and infrastructure study that examined infrastructure related to wind development within the two study areas in SE Wyoming and found that the estimated odds of sage-grouse selecting brood-rearing habitat within the Seven Mile Hill study area increased as distance from nearest overhead transmission line increased up to 4.7 km (90% CI: 2.2–18.5 km), then declined. However, LeBeau also found that sage-grouse selected *for* nesting habitat closer to transmission lines within Simpson Ridge study area.
4.8 km	(Rodgers 2003)	In California, power lines resulted in sage-grouse lek abandonment and reduced lek attendance up to 3 miles away.
6.4 km	(Steenhof et al. 1993, Connelly et al. 2004)	Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse.

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Recommendation: Based on this information, The Nature Conservancy recommends that compensatory mitigation be based on loss of habitat services within .6 kilometers either side of the centerline of the Gateway West Transmission Line route. We note that the literature supports the conclusion that indirect impacts, such as predation, occur at much larger distances. Therefore, a 600 meter "band" on either side of the transmission line represents a moderate approach to quantifying habitat services losses that should be subject to compensatory mitigation based on available information for the habitat types affected.

We calculate that this approach would include 19,084 acres in preliminary priority habitat and 39,599 acres in preliminary general habitat.

V. The Record of Decision Should Address Mitigation Planning and Oversight.

Replacing sage grouse habitat that has been lost due to infrastructure project development is difficult yet essential. Success depends on investing compensatory mitigation funds at sites where sage grouse actually benefit from improved conditions, where vegetation status and trends are well enough understood to calculate mitigation project benefits or "uplift," and where land management practices are consistent with maintaining the durability of mitigation benefits.

The project proponents recognize these challenges in their compensatory mitigation proposal at Appendix C-3 and propose a collaborative "oversight committee" to help them select appropriate projects and locations. We think that this approach has merit and encourage BLM to include it in the Record of Decision (ROD).

The ROD should elaborate on the committee's composition and responsibilities and give it broad authority to align the implementation of compensatory mitigation measures with the BLM's draft Manual provisions on mitigation and the Idaho Mitigation Framework.

Specifically, we request that the oversight committee be given broad latitude to address:

1. The selection of mitigation sites based on a landscape analysis that considers locations that provide greatest benefit to sage grouse populations, ensure compatible land management policies and practices, and maintain the persistence of mitigation benefits;

2. The mix of conservation projects included in the compensatory mitigation package;

3. Estimates of conservation project cost and mitigation benefit (uplift); and;

4. Stewardship and monitoring plans.

The oversight committee should have discretion to direct mitigation funds to off-site projects in accordance with the guidance discussed in the draft BLM Manual – 1794.

VI. Key Elements of the HEA Are Unsupported and Should Be Revised.

As a general matter, the application of the HEA model used for the Gateway West Project is not fully supported in the administrative record. The BLM should re-open the HEA to address shortcomings and should consider other analytical approaches for this and future projects.

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A. The HEA's Approach to Habitat Characterization Is Vulnerable to Inaccuracy and Undervalues High Quality Habitat.

We believe that the HEA model is overly simplistic in ways that compromise its results. The HEA description states that "The Habitat Equivalency Analysis, described [below], provides a standardized basis to determine a one-to-one ratio for habitat services lost to habitat services mitigated." [9] The key to the validity of the process is how "service" is defined. HEA relies on categorical measures ("bins") derived from expert opinion that are not weighted to reflect their relationship with sage grouse habitat utilization. This introduces unquantifiable inaccuracy into the HEA model.

We recommend the use of data-driven, likelihood-based models that allow variables to be weighted based on observed habitat use similar to the U.S. Geological Survey's Wyoming Basins Ecological Assessment sage grouse model. Similar models should be developed in Idaho.

In the HEA, scores of each category (i.e., 0,1,2,3) were assigned arbitrarily. In an analytical sense these are ordinal variables – and simply rank one class against the others. Yet, these scores are treated as meaningful in a mathematical sense. The model sums these ordinal variables to generate a single score. In a very real sense, the model adds 5 fairs, 2 excellents, and 4 goods, to come with a value of 19. In order for the model to be truly meaningful, the BLM must provide evidence that there is a *mathematical* relationship between these categories. For example, in the current model a site 51 meters from a county/state highway is twice as good as an identical one 50 meters away, but a site 1 km from the same highway is only 50% better than one 51 meters removed. This relationship holds true for all the variables; there is an exponential decline in value gained with improving quality (rate of improvement declines at a rate of x^{-1}). As a result, the model dramatically *undervalues* quality habitat relative to poor or fair habitat. We believe that most scientists familiar with sage-grouse and sage-steppe systems would argue the exact opposite, that habitat value increases exponentially with improving quality, likely at a rate of x^{10}. If the BLM wants to use this framework as a quantitative model for assessing habitat quality, it must provide the mathematical relationships between these categories, and relate them to the published literature.

Seven of the eleven variables in the model cannot have a score <1. This further undervalues the best quality habitat by arbitrarily increasing scores for the poorest quality sites.

The model completely ignores the regional and landscape context of the impacts. For example sage-grouse priority habitat areas should be highly valued and these values should be reflected in the site scores. Currently, this is not the case.

[9] FEIS at Appendix J-1, pg. 2.

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By design, the model explicitly ignores any interaction among variables that might impact habitat quality. For example, a site that is close to a lek and is in a large patch of intact sagebrush is most likely far more valuable to sage grouse than one that has a similar patch size but is >8 km from an active lek (all other variable held constant). Yet, the model values the former as having only a 7.5% greater value to sage grouse. A cursory examination of the variables reveals many such interactions documented in the literature (e.g., sagebrush cover and bunchgrass cover). These clearly need to be reflected in the model. By ignoring these interactions, the current model is a significant step backward from the Habitat Suitability Index models developed for other prairie grouse species. Finally, by not incorporating interactions among variables, the current model further undervalues the highest quality sage grouse habitat. The importance of the "service" currency is accentuated when it is used to value mitigation lands. The model is explicit that "successful" mitigation occurs when the total service value impacted is replaced by mitigation. As a result, service value gained by mitigating poor quality habitat to moderate quality habitat is the same as that from moderate to high quality. Thus, for example, the loss of an acre of high quality habitat could be mitigated by seeding three acres of post-fire rehabilitation to bring those lands up to marginal quality. We disagree with the notion that this reflects effective, or appropriate, mitigation. TNC's sage-steppe mitigation experience is that it is far easier to create low to moderate quality sage grouse habitat than to (re)create that of high quality. Thus, the current model's structure would foster restoration of poor quality habitat as mitigation for the loss of that of highest quality. Rather, we suggest that the valuation model be used to identify quality classes (e.g. acres with a score >20 = quality class 1) and mitigation must replace all acres of quality class 1 with quality class 1 lands. This ensures that the total habitat quality is not ratcheted downward by constantly replacing high quality lands with those of lower quality.

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Finally, the HEA Technical Advisory Team identified five classes of projects suitable to mitigate the impacts of development: fence marking/modification, sagebrush restoration/reclamation, conifer/juniper removal, grass/forb enhancement, and conservation easements. Only two of these activities, sagebrush restoration/reclamation and grass/forb enhancement, are related to the 11 variables in the HEA model, and thus would have any measurable impact on the service value of the mitigated lands. And, as noted above, the known challenges of restoring high quality sage-steppe could, without careful planning and oversight, result in the restoration of poor quality habitat to moderate quality habitat as mitigation for the loss of the highest valued areas.

B. <u>The BLM Should Address Specific Shortcomings in the HEA</u>.

We have the following specific comments about the HEA:

1. *The HEA's treatment of the risk of mitigation project failure is arbitrary.* The habitat conservation projects modeled in the HEA include actions that have a significant risk of project failure – particularly sagebrush steppe restoration and improvement

projects and bunchgrass and forb seeding projects. The Conservancy strongly supports including these actions in the mitigation package. However, given the substantial risk of project failure, it is essential that the cost of these actions must be increased enough to offset the risk that vegetation treatments may not achieve the expected benefits. The HEA states that "conservative growth rates were sufficient to offset the potential for mitigation project failure."[10] This is an overly general approach to an issue that deserves a more precise treatment. A better approach would be to examine actual project histories and existing restoration project databases to determine the likely risk of project failure for the different types of conservation projects. The risk of project failure could then be reflected as a multiplier on the estimated cost of the action. The BLM's recently issued Instruction Memorandum and Draft Manual Section—1794 suggests the use of ratios is an appropriate way to ensure that mitigation benefits will be proportional to impacts in light of uncertainty.[11]

2. *Fence marking should be removed from the list of eligible habitat projects.* Two reasons support this request. First, fence marking does not replace habitat services lost due to direct or indirect habitat effects of the project. At most, fence marking offsets direct mortality due to power line strikes. Second, other funding sources and efforts are targeted on fence marking. These efforts should proceed and the Gateway West mitigation should be focused on projects that replace habitat services through protection, restoration, and enhancement.

3. *The values for habitat services gained and cost per services gained are not adequately disclosed in the record.* With the exception of fence marking, the mix of habitat conservation projects modeled in the HEA is appropriate. However, we are unable to understand how the specific habitat services gained values and costs per services gained, shown in Table 8 of Appendix J-2, were derived. Appendix D of Appendix J is difficult to understand.

4. *Conservation projects will likely require a mix of measures that was not modeled.* The HEA did not attempt to model a mix of different conservation actions, such as combining sagebrush restoration and conservation easements. However, vegetation treatments and other habitat enhancement projects on private lands will require some sort of long-term agreement to ensure that the mitigation site is not disturbed or developed. A conservation easement or other long-term management agreement is

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[10] FESI at Appendix J-2, page 12.
[11] Draft MS-1974 – Regional Mitigation Manual Section (P) at page 12 , attached to Instruction Memorandum No. 2013-142 (6/14/13).

likely required as a component of such projects. This cost should be reflected in the estimates of cost per services gained.

VII. The FEIS Lacks the Findings Needed To Comply with Legal Standards for the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA).

The BLM preferred routes for Segments 8 and 9 would cross portions of the NCA, a unit of the National Landscape Conservation System. In fact, the FEIS contains no alternative that entirely avoids the NCA. Therefore, BLM's decision to issue a right-of-way for the project must comply with the standards established in the 1993 statute establishing the NCA. In addition, the decision should also be consistent with the BLM Manual's standards implementing the National Landscape Conservation System Title of the Omnibus Public Lands Act of 2009. The FEIS lacks the findings needed to comply with these standards. As explained below, these standards require two findings: (1) the proposed project must not be incompatible with the values that NCA was established to protect and (2) the project must "protect, mitigate and enhance" the NCA.

Compatibility Finding: The BLM Manual provides that the agency will not designate utility corridors within NLCS units if it determines the "corridor would be *incompatible* with the designating authority or the purposes for which the NLCS unit was designated." BLM Manual 1.6.J.5 (emphasis added). *See also*, 16 U.S.C. 460iii-3(b)(7) (allowing non-military uses within the NCA that are "compatible" with NCA purposes). The NCA purposes to be considered in making such a finding include: the conservation, protection, and enhancement of raptor populations and habitats and the natural and environmental resources and values associated therewith, and of the scientific, cultural, and educational resources and values of the public lands in the conservation area. 16 U.S.C. §460iii-1(a)(2).

The BLM Manual does not define the terms "compatible" or "incompatible." However, compatibility determinations are a familiar feature of administering the National Wildlife Refuge System and Wild and Scenic Rivers. In the context of Wildlife Refuges, an action is deemed "compatible" if it "will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the refuge." 16 U.S.C. § 668ee(1). BLM's compatibility determinations for livestock grazing and recreational shooting at the Cascade-Siskiyou National Monument may also offer useful guidance on this point.

Enhancement Finding: The NCA legislation requires that non-military uses must be consistent with "protection, maintenance, and enhancement" of raptors and other NCA purposes. *See* 16 U.S.C. 460iii-3(b)(7).

The term "enhancement" requires more than simply minimizing or offsetting impacts. It calls for actions that leave the NCA better off than it would have been without the construction of transmission line. *See also* 16 U.S.C. 460iii-3(a)(2) (allowing activities in the NCA that "further the purposes for which the conservation area was established"). Prior to issuing the right-of-way

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for the project, BLM must analyze proposed enhancement measures and determine their effectiveness.

We do not believe that these standards bar the project from NCA lands. However, no project right-of-way should be issued without findings in the administrative record that comply with these standards.

VIII. Enhancement Measures Offer an Important Opportunity to Improve the Condition of the NCA.

The Birds of Prey National Conservation Area has been highly degraded by repeated fire and invasive plants. The area's native sagebrush/bunchgrass/forb assemblages have been lost across large portions of the NCA. The area is in urgent need of restoration and enhancement. A well-designed package of enhancement measures could provide significant benefits to the area.

The enhancement package should focus primarily on the major threat to raptor populations within the NCA: the decline of the raptor's prey base due to the loss of shrub and perennial grass vegetative cover. Most of the NCA has burned in the last 25 years, and native shrub steppe vegetation has been replaced by annual grasslands dominated by cheatgrass and other non-native species. The change in vegetation has reduced the populations of small mammals that form the prey base for raptors. This decline has reduced the productivity of raptors within the NCA. In particular, efforts are needed to restore black-tailed jackrabbit and Paiute ground squirrel populations.

Recommended measures include:

1. Restore native shrubs and perennial grasses. Given the low precipitation levels within the NCA and the extent to which NCA lands have been invaded by annual grasslands, some non-native species that provide the structure needed by prey species may be used as necessary. The guiding principle should be to produce more resilient vegetation that provides better habitat for raptor prey species.

2. Work with ranchers or grazing permittees to improve riparian areas and springs.

3. Protect private inholdings through fee or conservation easement acquisition where lands have special features of high conservation value, such as canyon rims and adjacent areas that offer important nesting, perching, and foraging habitat. The goal for any acquisitions should not simply be NCA expansion. There is little value in BLM acquiring more annual grasslands or degraded range. Acquisition should be focused on specific natural, scenic or recreational features that add significant value to the NCA.

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The existing NCA Resource Management Plan provides important guidance on the best places and techniques for this work.

In addition, to these measures, we think there is a great opportunity to include measures to communicate with recreational users regarding seasonal or area closures or other best practices to reduce impacts and fire risks associated with off-highway vehicles, shooting, and other recreational activities. Interpretive signage, kiosks and other out-reach could help reverse the pace of fire and degradation in the NCA.

As noted above, the goal for the enhancement package should go beyond one-to-one replacement of impacts. The BLM's recently issued draft Manual makes it clear that designations such as National Conservation Areas are appropriately considered in determining the value of the affected resource.[12] We believe that a well-designed enhancement package could provide significant net benefits to the NCA.

IX. The Final Route for Segment 4 in Wyoming Should Avoid Pending Conservation Easements and Address a Local Proposal to Protect Important Wildlife Habitat.

With respect to the proposed and alternative routes of the Gateway West transmission line in Lincoln County, Wyoming, identified on Figure A-5, Segment 4-WY in Appendix A of the FEIS, the Conservancy expresses the following concerns and recommendations:

- The BLM Preferred Alternative and Proposed Route would diagonally bisect property that the Conservancy is in the process of establishing a conservation easement on, in cooperation with the property owners. This conservation easement will be purchased using both private and public dollars as well as a substantial donation from the landowners. As a result, we are concerned with the proposed construction of a transmission line that would impact the wildlife habitat, open spaces and agricultural operation that the landowners, the state of Wyoming, the federal government, private funders and the Conservancy feel warrant protection. We recommend a route that would avoid these impacts.

- With respect to Feasible Alternative 4F, identified on Figure A-5, Segment 4-WY in Appendix A of the FEIS, we are concerned with the route's identified intersections with multiple properties that are in the process of establishing conservation easements. We recommend that alternative transmission line routes avoid impacting wildlife habitat, open spaces and culturally significant properties by avoiding properties with conservation easements in place or near completion.

- The Conservancy is aware of the efforts of local stakeholders (landowners, community members and Lincoln County leaders) who have worked with representatives from Gateway

[12] Draft MS-1794 – Regional Mitigation Manual Section (P) Section 1.6.D.11.c.i. at page 1-10.

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West throughout the development of this project. From conversations with these stakeholders we understand they have recommended a route that would follow the existing transmission line corridor, and therefore minimize impacts on wildlife habitat and the community. Our understanding is that local stakeholders assumed the BLM Preferred Alternative route would be constructed slightly to the south of the existing line but still within the existing corridor, rather than to the north as in the current Preferred Alternative. From our understanding of these recommendations, we support this local stakeholder-recommended route that would follow an existing transmission line to the south and reduce impacts to properties that will be placed under conservation easement.

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Wildlife Society Bulletin 37(2):301–310; 2013; DOI: 10.1002/wsb.272

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Original Article

Using Spatial Statistics and Point-Pattern Simulations to Assess the Spatial Dependency Between Greater Sage-Grouse and Anthropogenic Features

JEFFREY K. GILLAN,[1,2] *Department of Forest, Rangeland and Fire Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

EVA K. STRAND, *Department of Forest, Rangeland and Fire Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

JASON W. KARL, *New Mexico State University Las Cruces, NM 88003-8003, USA*

KERRY P. REESE, *Department of Fish and Wildlife Resources, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

TAMARA LANINGA, *Department of Conservation Social Sciences, University of Idaho, 709 Deakin Avenue, Moscow, ID 83844-9802, USA*

ABSTRACT The greater sage-grouse (*Centrocercus urophasianus;* hereafter, sage-grouse), a candidate species for listing under the Endangered Species Act, has experienced population declines across its range in the sagebrush (*Artemisia* spp.) steppe ecosystems of western North America. One factor contributing to the loss of habitat is the expanding human population with associated development and infrastructure. Our objective was to use a spatial-statistical approach to assess the effect of roads, power transmission lines, and rural buildings on sage-grouse habitat use. We used the pair correlation function (PCF) spatial statistic to compare sage-grouse radiotelemetry locations in west-central Idaho, USA, to the locations of anthropogenic features to determine whether sage-grouse avoided these features, thus reducing available habitat. To determine significance, we compared empirical PCFs with Monte Carlo simulations that replicated the spatial autocorrelation of the sampled sage-grouse locations. We demonstrate the implications of selecting an appropriate null model for the spatial statistical analysis by comparing results using a spatially random and a clustered null model. Results indicated that sage-grouse avoided buildings by 150 m and power transmission lines by 600 m, because their PCFs were outside the bounds of a 95% significance envelope constructed from 1,000 iterations of a null model. Sage-grouse exhibited no detectable avoidance of major and minor roads. The methods used here are broadly applicable in conservation biology and wildlife management to evaluate spatial relationships between species occurrence and landscape features. Our results can directly inform planning of infrastructure and other development projects in or near sage-grouse habitat. © 2013 The Wildlife Society.

KEY WORDS *Centrocercus urophasianus*, Monte Carlo, pair correlation function, point pattern, Ripley's K, sage-grouse, spatial statistics.

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The greater sage-grouse (*Centrocercus urophasianus;* hereafter, sage-grouse), a candidate species for listing under the Endangered Species Act of 1973 (ESA; U.S. Department of the Interior 2010), has experienced population declines across its range in the sagebrush (*Artemisia* spp.) steppe ecosystems of western North America (Connelly and Braun 1997, Connelly et al. 2004). Sage-grouse now occupy only 56% of their pre-settlement range, though they still occur in 11 western states and 2 Canadian provinces (Schroeder et al. 2004). The conservation status of this wide-ranging species could have a significant influence on public land policy regarding land use, energy and mineral development, transportation and communication corridors, and livestock grazing (Wambolt et al. 2002; US Bureau of Land Management 2004, 2011; Stiver et al. 2006, 2010), because two-thirds of remaining sagebrush lands (329,881 km^2) are publicly managed (Knick 2011). The remaining one-third of sagebrush lands (150,186 km^2) that are privately owned (Knick 2011) could be impacted if sage-grouse are listed under the ESA.

Causes for the species' decline have been attributed primarily to the removal and degradation of sagebrush-dominated lands essential for cover, nesting, and food (Connelly and Braun 1997, Braun 1998, Leonard et al. 2000, Connelly et al. 2004). Historically, conversion of sagebrush habitats to crop fields and livestock pastures was the primary driver of habitat reduction (Swenson et al. 1987, Beck and

Received: 4 June 2012; Accepted: 14 November 2012
Published: 14 May 2013

[1]*E-mail: jgillan@nmsu.edu*
[2]*New Mexico State University Las Cruces, NM 88003-8003, USA*

Mitchell 2000), but more recently wildfire, invasion of annual grasses, and infrastructure development have been responsible for habitat alteration in the sagebrush steppe biome (Knick et al. 2003, 2011; Connelly et al. 2004; Miller et al. 2011).

One factor contributing to current sage-grouse habitat threats is the continually expanding human population and footprint. From 1960 to 2000, the western United States was the fastest growing region of the country and during the 1990s grew at twice the national rate (Perry and Mackun 2001, Travis 2007). From 2000 to 2010, population growth in the region slowed only slightly and 3 of the 4 fastest growing states (NV, UT, and ID) were those with significant sage-grouse populations (Mackun and Wilson 2011). Development patterns spurred by increasing human populations have been characterized by extensive suburban development around major cities and rapid growth of exurban communities and "ranchettes" far removed from metropolitan centers (Brown et al. 2005, Hansen et al. 2005, Travis 2007). This type of growth consumes more land and fragments landscapes more significantly than concentrated urban development (Sullins et al. 2002, Connelly et al. 2004). Many ranches that were previously used for livestock production have been sold and subdivided into low-density housing (Knick et al. 2011). Associated infrastructure, including roads and power-lines, has also expanded on these landscapes (Leu et al. 2008, Leu and Hanser 2011). In some parts of the sage-grouse range, most notably Wyoming, USA, energy development has expanded (Walker et al. 2007, Naugle et al. 2011). Thousands of new natural gas wells have come on line in recent years and required the construction of roads, power lines, compressor stations, pipelines, and ponds (US Bureau of Land Management 2003).

Anthropogenic features can impact ecological processes and wildlife behavior beyond the immediately affected area. Typically, lower biodiversity and more human-adapted species persist adjacent to ranchettes (Theobald et al. 1997; Maestas et al. 2001, 2003; Odell and Knight 2001). The introduction of non-native plant species is one cause because it can change the ecological composition of surrounding land, effectively degrading habitat (Hansen et al. 2005). Wildlife may also avoid anthropogenic features because of noise and the presence of domestic animals such as dogs and cats (Hansen et al. 2005). This type of avoidance behavior can fragment habitat, shrink total available habitat, and create dispersal barriers (Marzluff and Ewing 2001). By assuming that anthropogenic features have some effect on the surrounding land, a recent study by Knick et al. (2011) concluded that power lines have an ecological influence on 39% of all remaining sagebrush lands in the American West, highways influence 38% of remaining sagebrush lands, and urban development influences 18.6% of sagebrush lands. Also, <5% of the entire sage-grouse range is farther than 2.5 km from a mapped road (Knick et al. 2011).

Although sage-grouse cannot tolerate the outright removal of sagebrush (Braun et al. 1977, Connelly et al. 2000), the extent to which proximity to anthropogenic features can negatively influence sage-grouse or cause avoidance behavior is less understood. Some studies have observed negative associations of infrastructure on sage-grouse lek size and persistence (Braun 1986, Hall and Haney 1997, Harju et al. 2010, Holloran et al. 2010, Johnson et al. 2011) and also nest initiation rates (Lyon and Anderson 2003). Sage-grouse have been documented avoiding habitat adjacent to oil and gas wells and their associated infrastructure (Carpenter et al. 2010, Holloran et al. 2010). Sage-grouse are also thought to occur less often near power lines and major highways (Braun 1998, Hanser et al. 2011).

Most of the studies aimed at understanding sage-grouse habitat associations have not directly considered the clustered nature of sage-grouse populations and the impact of the resulting spatial autocorrelation of sage-grouse observations (only surveyed exception was Yost et al. 2008). Spatial autocorrelation refers to tendency of nearby observations to be more similar (positive autocorrelation) or less similar (negative autocorrelation) than distant observations (i.e., observations are not independent in space; Legendre and Fortin 1989, Legendre 1993). Almost all ecological data will exhibit some degree of autocorrelation as a result of processes (e.g., competition, succession, population genetics, predator–prey interactions), or underlying environmental patterns (e.g., vegetation, soils, topography, anthropogenic features; Legendre and Fortin 1989). Likewise, the species being sampled will often cluster because of habitat features or social structures within the population (Lieske and Bender 2009). Spatial autocorrelation inherent in ecological data by itself is not a problem; in fact, it is very useful for resource usage estimations that use interpolation techniques (Aarts et al. 2008).

Problems can arise when autocorrelated data are used in classical statistical models and significance testing that assumes independent samples (Legendre and Fortin 1989, Legendre et al. 1990, Fortin and Jacquez 2000). Spatial autocorrelation in sample data can reduce the effective sample size and the degrees of freedom for tests of statistical significance (Dale and Fortin 2002). As a consequence, results can be classified as significant when they are actually not (i.e., type I error; Dale and Fortin 2002, Klute et al. 2002, Lieske and Bender 2009). In logistic regression analysis, a popular modeling technique for species-habitat associations, spatially autocorrelated data can overestimate the effects of independent variables on the response (Klute et al. 2002, Dormann et al. 2007, Aarts et al. 2008, Lieske and Bender 2009). Similarly, "Monte Carlo" studies that compare observed data with many different computer-generated random permutations can also result in Type I errors if spatial autocorrelation of the observed data is not included in the null model (Fortin and Payette 2002).

Previous studies on sage-grouse habitat associations should not be disregarded and may be highly accurate if the parameters capture the spatial dependency inherent in the data. But frequently, non-environmental processes that cannot be modeled may be partly responsible for the species' distribution. Accordingly, all ecological studies should consider the potential of spatial autocorrelation in their data and how it might affect results.

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Our objectives were to employ a spatial-statistical approach to determine whether sage-grouse in an isolated population in west-central Idaho, USA, were avoiding anthropogenic features (i.e., roads, power transmission lines, and rural buildings) and, if so, how far from the feature was the zone of influence. This study explicitly accounted for the spatial autocorrelation of sage-grouse observations to evaluate their association with anthropogenic features. This research incorporates spatial analysis techniques, including considerations for null model selection, that are broadly applicable for evaluating relationships between species occurrence and landscape features within the species' environment across large areas. The results can inform planning and decision making for rural development including infrastructure routes that minimize negative impacts to sage-grouse and their habitats.

STUDY AREA

This study was conducted in the West Central Sage-grouse planning area in west-central Idaho, which included parts of Washington, Adams, Gem, and Payette counties (centered at 44°26′N, 116°38′W). The 374,700 ha planning area was established to conserve a small and isolated population of sage-grouse that was considered the most likely to be extirpated within the state (Idaho Sage-grouse Advisory Committee 2006). Exact population numbers are unknown but it was estimated that the population was significantly lower than in 1970 due to the abandonment of many leks (Idaho Sage-grouse Advisory Committee 2006, West Central Sage-grouse Local Working Group 2008). Currently, 14 leks are being monitored each year. The major potential threats to sage-grouse in this area were geographic isolation, private property development, wildfire, expansion of annual grasslands, and West Nile Virus (Idaho Sage-grouse Advisory Committee 2006).

The study area consisted primarily of rolling hills of sagebrush steppe and grassland vegetation. The shrub component was mainly xeric big sagebrush (*Artemisia tridentata* sp. *xericensis*), stiff sagebrush (*A. rigida*) and three-tip sagebrush (*A. tripartita*). Native perennial grasses included bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*), Sandberg bluegrass (*Poa secunda*), and Thurber needlegrass (*Achnatherum thurberianum*). Elevations ranged from 630 m at the Snake River near Brownlee reservoir to >1,220 m at the southern boundary of Payette National Forest. The greatest proportion of the area and of occupied sage-grouse habitat lay between 760 m and 1,070 m in elevation (West Central Sage-grouse Local Working Group 2008). The climate was characterized by cold, wet winters and hot, dry summers. Mean annual precipitation was about 28 cm at lower elevations near the city of Weiser, Idaho, but increased quickly with elevation to >51 cm over much of the planning area. Seventy-five percent of the planning area was considered intact shrub and bunchgrass communities dominated by sagebrush species. Of the 25% that had been altered, 50% was due to invasive annual grasslands thought to have originated from contaminated wheat crops, 49% was in farmland, and only 1% was developed (West Central Sage-grouse Local Working Group 2008).

The study area was rural and had experienced slow human population growth compared with other regions of Idaho. The valley bottoms support irrigated farmland while the uplands were primarily used for livestock grazing. Most settlements, including the small towns of Midvale and Cambridge, occurred along the U.S. 95 highway corridor (Fig. 1). Land speculation and ranchette style housing, however, had become increasingly popular outside of city limits (Adams County, Idaho 2006, West Central Sage-grouse Local Working Group 2008).

METHODS

Sage-grouse Telemetry

We obtained sage-grouse location data from the Idaho Department of Fish and Game, who used radiotelemetry to locate sage-grouse in the study area from April 2005 to December 2007 (Gray 2009). Fourteen females and 44 males captured on 14 different leks were used in this study. To ensure a representative sample of the population, leks were selected to have a range of habitats, a mix of private and public lands, and geographic separation. Sage-grouse were monitored every 2–3 weeks from March through September and once per month from October through February. With this sampling method, bias from serially correlated individual sage-grouse should be small. Location coordinates were recorded using a Garmin (Olathe, Kansas, USA) 76CS Global Positioning System (GPS) where the bird was first seen, but 26 of the locations were obtained through triangulation to prevent flushing. Average accuracy of the GPS was 2–10 m, while the triangulation error could be up to 150 m. Four-hundred ninety-six locations, collected between the months of March and November across all years, were used for the analysis. We excluded the few locations obtained during the winter (Dec–Feb) because sage-grouse habitat use is greatly dependent on snow depth and topography and may not accurately reflect behavior toward anthropogenic features (Connelly et al. 2011). We treated all sage-grouse locations equally with no attempt to depict behavior based on sex, age, or lek of capture. Though it is likely that sage-grouse behavior is partially dependent on seasonal habitat requirements and sex (Patterson 1952; Gill and Glover 1965; Wallestad et al. 1975; Connelly et al. 1981, 1988, 2000, 2011; Gates 1985), we did not examine avoidance behavior distinguished by season or sex because of small sample sizes.

Anthropogenic Features

We compared sage-grouse locations with the mapped locations of major roads, minor roads, power transmission lines, and buildings within the study area (Fig. 1). Major roads were defined as any road receiving average daily traffic counts from the Idaho Transportation Department (2004*a*, *b*). The major roads could be paved or dirt and represented the most frequently used roads. Included in the major roads category was the only 2-lane highway in the study area, U.S.

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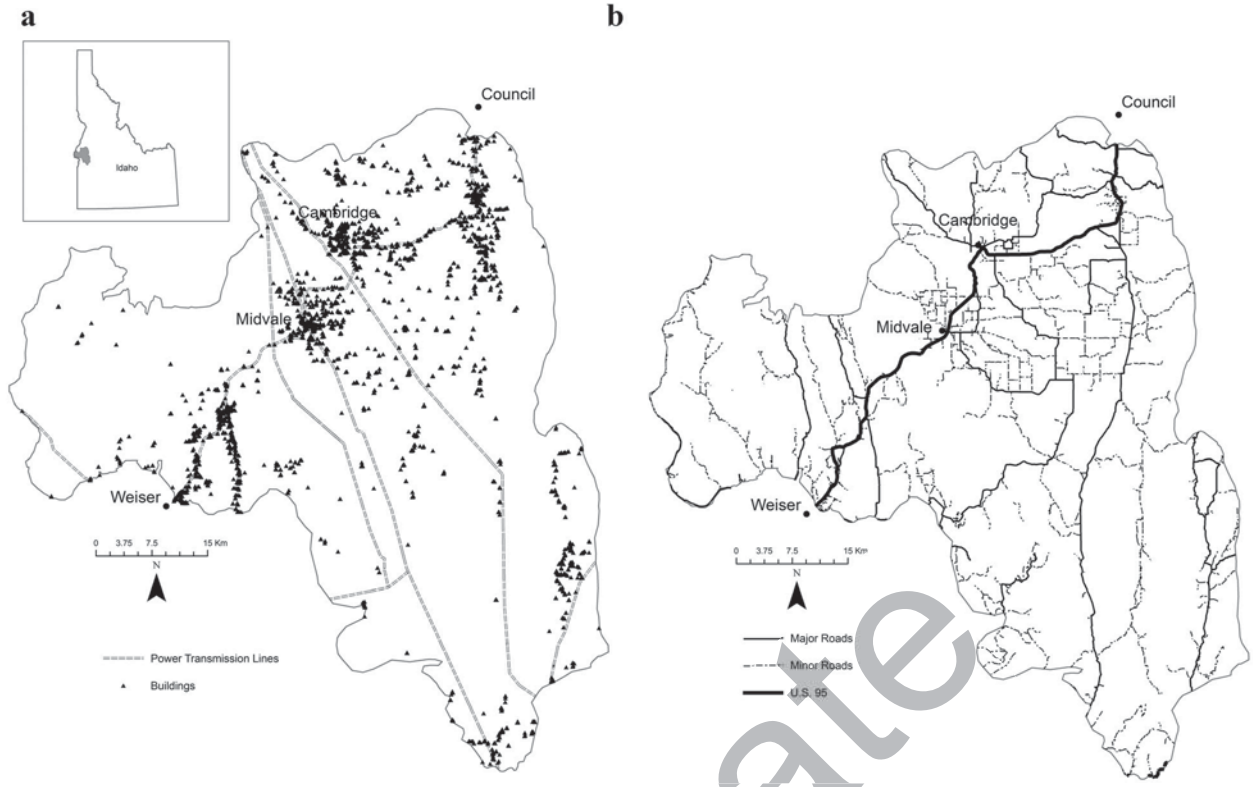

Figure 1. The west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette counties) (a) power transmission lines and buildings, and (b) major and minor roads.

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95. Minor roads consisted of all remaining mapped roads excluding 2-tracks. Mapped power lines included only the major transmission lines (>138 kV), and excluded the distribution lines (National Geographic Maps 2004, US Bureau of Land Management 2007). These transmission lines were usually supported by large structures, including the steel lattice (25 m ht) and steel H-frame (17 m ht). The buildings polygon layer included all structures in the study area and was created through digitizing (at a scale of 1:3,000) on aerial imagery from the National Agriculture Image Program (USDA-FSA-APFO 2004). Because the sage-grouse location data were collected 2005–2007, it is possible that some anthropogenic features were omitted or committed in the analysis.

For the analysis, we transformed each anthropogenic feature layer originally modeled as lines and polygons into point features. For linear features, we placed a point every 125 m, which was determined largely by computing limitations. The point frequency should not affect the results comparing the observed point pattern with the null model. For the buildings layer, a centroid point was placed in each polygon.

Analysis

To determine geographic relationships between sage-grouse locations and each of the anthropogenic feature types, we employed a multi-scale measure of spatial dependence for point patterns. We used the pair correlation function (PCF) to compare observed with expected number of anthropogenic feature points within concentric rings surrounding sage-grouse locations.

In the bivariate form, the PCF is defined (Stoyan and Stoyan 1994, Schurr et al. 2004):

$$\hat{g}_{12}(r) = \frac{1}{2\pi r}\frac{A^2}{n_1 n_2}\sum_{i=1}^{n_1}\sum_{j=1}^{n_2} w_{ij}^{-1} k_h(r - |x_i - y_i|)$$

where $\hat{g}_{12}(r)$ is the PCF at a specified radius, A is the total point-pattern area, and n_1 and n_2 are the number of sage-grouse points and anthropogenic feature points, respectively. The x_i are locations of sage-grouse points, y_i are the locations of anthropogenic feature points, and w_{ij} is a weighting function that accounts for edge effect bias created by unobservable anthropogenic feature points outside the study area. We used the "translation" edge correction described by Torquato (2002) and Pommerening and Stoyan (2006), which extrapolates the point-pattern spatial structure within the study area to infinitely outside the study area. This edge correction is also recommended for study areas with complex shapes (Baddeley and Turner 2005). The PCF looks at a neighborhood of points surrounding the specified radius and gives greater weight to points near the radius and less weight to points further away. This type of weighting is known as an Epanečnikov kernel and is specified by k_h, where h is the bandwidth parameter specifying the size of the radius neighborhood that will receive weighting. Points lying

outside the bandwidth will not be considered in the calculation at that radius.

The PCF is a variation of Ripley's K (Ripley 1981), which measures spatial association within cumulative circles rather than rings. For this application, PCF is the preferred method because it is a more responsive analysis at multiple scales and can identify specific distances of avoidance or clustering. In a Ripley's K analysis, the results at larger distances are influenced by the shorter distances, which may obscure the spatial association at any given scale.

We computed the PCF function initially with $r = 150$ m, because this is the estimated largest possible location error associated with GPS and radio triangulation (Garmin 2011, Shepherd et al. 2011). We subsequently computed the PCF function every 150 m to a maximum of $r = 5$ km to assess the spatial relationship at different scales across the study area. We chose a bandwidth of 75 m because it was half the distance between PCF calculations, and because it provided enough smoothing to the PCF graph to aid in interpretation while not over-smoothing the results.

The empirical $\hat{g}_{12}(r)$ considers all the points of type 1 (sage-grouse) and calculates the intensity of points of type 2 (anthropogenic feature) surrounding it in a ring with a specified radius. The empirical value can then be compared with the expected number of points at the same radius, which is derived from a null PCF model constructed from Monte Carlo point simulations. A deviation between the empirical and expected curves suggests dependence between points of type 1 and 2. Empirical values larger than the expected curve at a given distance suggest that the 2-point types are clustering around each other at that scale. Smaller values than expected suggests the point types are exhibiting avoidance at that scale.

To test the significance of the spatial association between sage-grouse locations and anthropogenic features, we compared the empirical plot of $\hat{g}_{12}(r)$ to a null model constructed from 1,000 Monte Carlo simulations. We simulated point patterns designed to mimic the observed spatial pattern of sage-grouse habitat use. The map of sage-grouse telemetry points exhibited strong clustering (Fig. 2a). This strong spatial autocorrelation is a violation of sample independence (see Legendre and Fortin 1989), so a completely spatially random (CSR) null model or parametric statistical test is inappropriate. Therefore, the simulated points used in comparison with the spatially dependent data reflected the same intensity of clustering to prevent false positive findings of significance (Fig. 2b; Fortin and Payette 2002). We also ran the simulations using a CSR model for comparison purposes.

Computation of $\hat{g}_{12}(r)$ and the simulations were carried out using the Spatstat package (Baddeley and Turner 2005) in the statistics program R 2.10.1 (R Development Core Team 2009). Using the "Kppm" command in Spatstat, we fitted a homogenous Poisson cluster point process model to the sage-grouse data using the PCF function with the same parameters described previously. The simulated cluster patterns were realized following the Matern cluster process (see Moller and Waagepetersen 2003), which creates point patterns using 3 parameters: κ is the intensity of parent points generated through a Poisson process; μ is the average number of offspring points surrounding each parent point; and R is the radius of the cluster of offspring points centered

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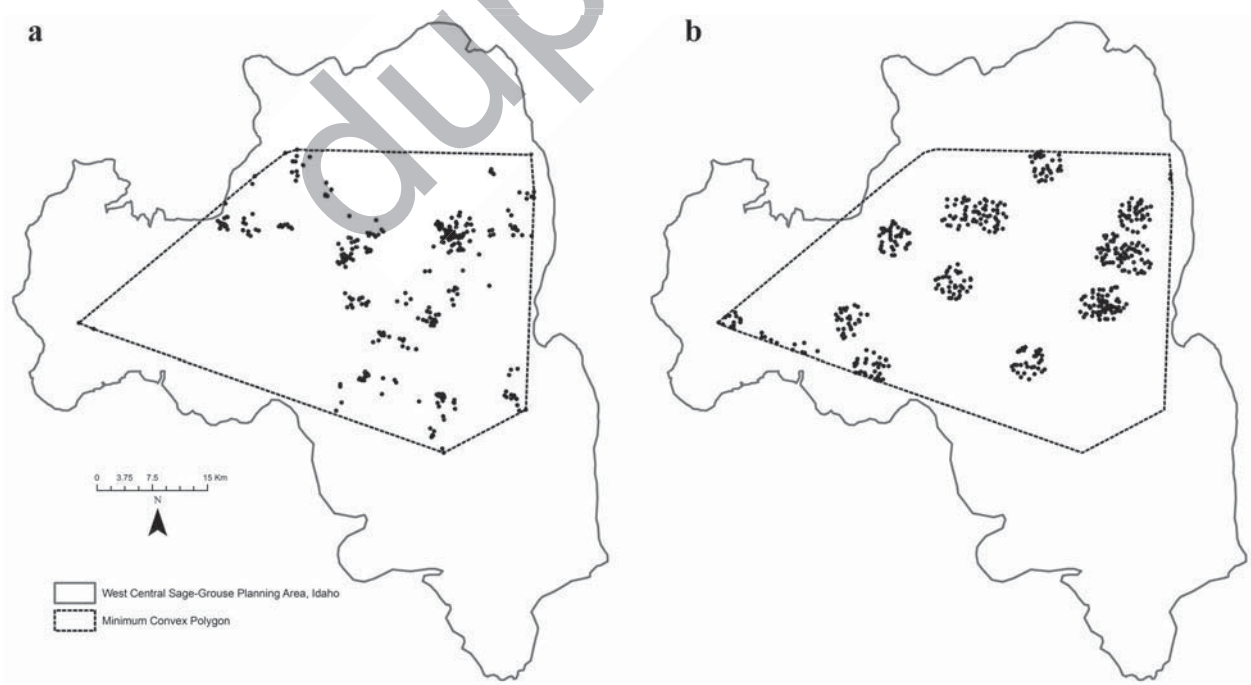

Figure 2. (a) Known sage-grouse locations in the west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette counties) observed April 2005 to December 2007. The locations are bounded by a minimum convex polygon that served as the simulation boundary. (b) Example of a simulated cluster-point pattern created from a homogenous Poisson cluster-point process model. We used 1,000 realizations of the simulated cluster-point patterns as a null model to assess spatial dependency between observed sage-grouse locations and anthropogenic features.

on the parent point. The simulated points were allowed to occur only within available habitat, which we defined as a minimum convex polygon surrounding all of the sage-grouse locations. The Bureau of Land Management, Idaho, considers nearly all of the land within the minimum convex polygon to be sage-grouse habitat (US Bureau of Land Management 2009). Accordingly, simulated points were permitted to occur anywhere within the minimum convex polygon except in water bodies or towns. From the simulations, we created 95% significance envelopes for the clustered and CSR null models to illustrate the difference in statistically significant findings between the 2 simulation methods. For a given radius, values of $\hat{g}_{12}(r)$ outside of the clustered significance envelope were considered to be significantly different from random arrangements of points showing the same spatial dependence as the sage-grouse locations. This would indicate clustering around or avoidance of anthropogenic features by sage-grouse at those distances.

RESULTS

Fitting a homogenous Poisson cluster point process model to the sage-grouse data using the PCF function produced a clustered point pattern with $\kappa = 6.200333\text{e-}09$, $\mu = 47.51922$, and $R = 1{,}748$ m. The significance envelopes exhibited a typical funnel shape where PCF variability was greatest at near distances and shrinks at larger scales (Fig. 3). This was due to the fact that closer concentric rings have less total area and thus a greater opportunity for PCF variability. The funnel-shaped envelopes also tilted upward as scale increased. This is caused by the spatial clustering of the anthropogenic features we are testing. In the study area, there is more open space than there is developed space, so the simulated points were, on average, farther away from anthropogenic features than closer.

Selection of the null model proved to highly influence the statistical inference. The results indicated that observed sage-grouse exhibited avoidance of buildings by 150 m (Fig. 3a) because the PCF value at that distance was less than the clustered 95% significance envelope. The CSR null model produced a much narrower significance envelope, which equates to a much lower standard of statistical significance. The CSR null model indicated that sage-grouse were avoiding buildings by up to 3.45 km. At larger distances, the empirical PCF values were within the simulation significance envelope, which suggested no significant spatial relationship between sage-grouse and building locations.

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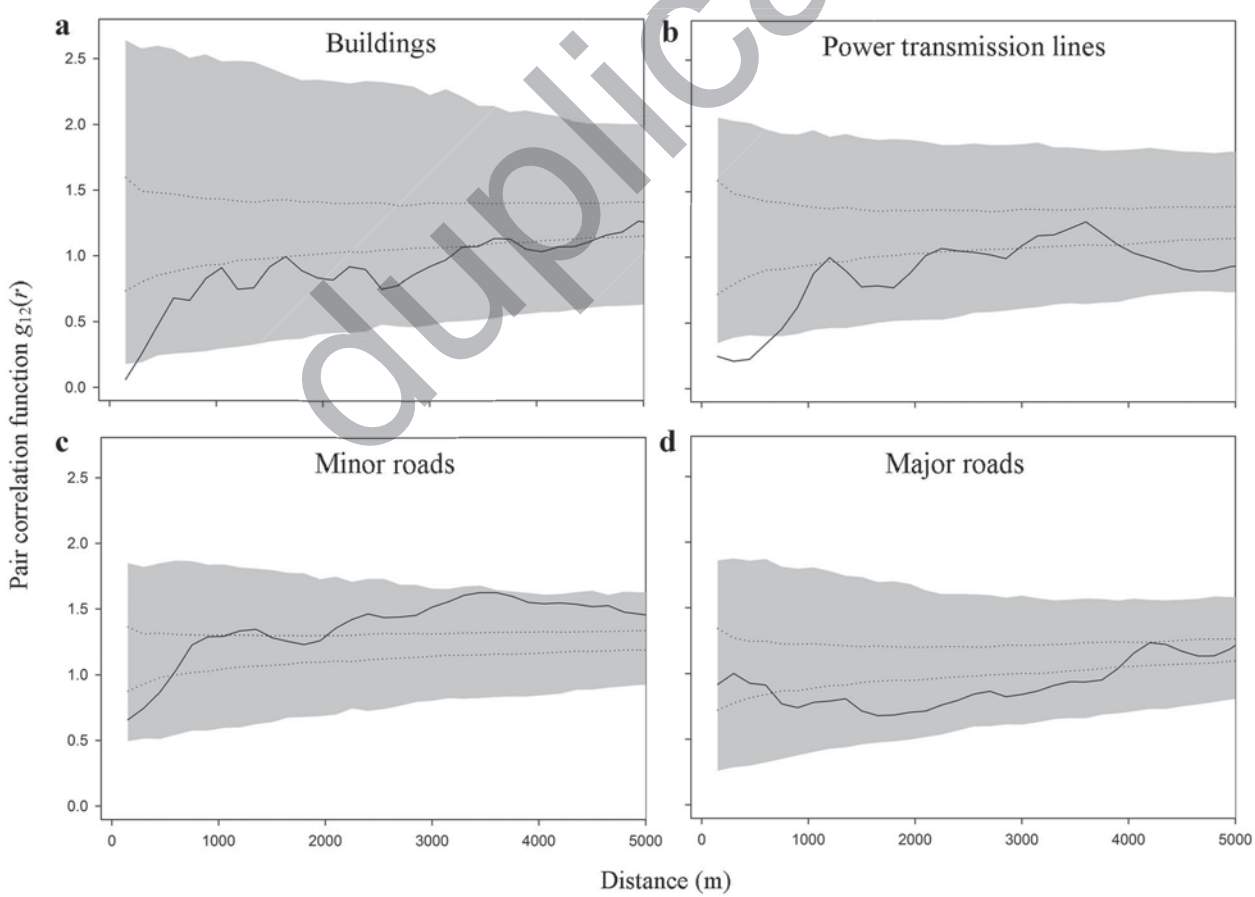

Figure 3. Bivariate pair correlation function, $\hat{g}_{12}(r)$, for greater sage-grouse locations and (a) buildings, (b) power transmission lines, (c) minor roads, and (d) major roads. Sage-grouse locations were collected April 2005 to December 2007. The empirical curve (solid line) is plotted against 2 95% significance envelopes: one determined from 1,000 clustered point-pattern simulations (shaded area); and one determined from 1,000 point patterns that were completely spatially random (dotted lines). This study occurred in the west central sage-grouse planning area, Idaho, USA (Washington, Adams, Gem, and Payette Counties).

Sage-grouse showed avoidance of power transmission lines up to distances of 600 m (Fig. 3b) because the PCF values at 150, 300, 450, and 600 m were less than the clustered significance envelope. At all other scales, the empirical PCF values were within the significance envelope, which suggested no significant spatial relationship. The CSR null model again showed that sage-grouse avoided the features at a greater distance of 1.05 km. At larger scales, the empirical curve dipped in and out of the CSR envelope.

Sage-grouse did not appear to avoid minor roads in the study area because the PCF empirical curve landed within the clustered null model significance envelope at all scales (Fig. 3c). The CSR null model showed that sage-grouse avoided minor roads by 450 m. At larger scales (3–4 km), the empirical curve was far above the CSR envelope and nearly left the bounds of the clustered model envelope. This suggests that, at these distances, there were far more sage-grouse near minor roads than was expected.

Sage-grouse also did not appear to avoid major roads in the study area because the PCF empirical curve landed within the clustered null-model significance envelope at all scales (Fig. 3d). There was agreement in the CSR null model up to 600 m, after which the empirical curve was below the envelope at all scales up to 3.9 km, which suggests avoidance at those distances.

DISCUSSION

This study showed that results from point-pattern simulations could vary greatly between those that incorporate spatial structure and those that employ a CSR method. The CSR null model produced significance envelopes much narrower than the clustered null model, thus setting a much lower standard for significance testing, which may lead to false positive results. This demonstrates the need to explicitly account for spatially dependent data in ecological studies, especially wildlife studies that have presence-only sampling.

Although an improvement over a CSR null model, the homogeneous clustered simulations were not a perfect representation of the observed data. The data appeared to exhibit non-stationary or an inhomogeneous cluster pattern probably caused by differences in seasonal habitat use. Sage-grouse aggregate during the spring lekking season and disperse when breeding has concluded. Analyzing and simulating the data by season and sex may produce improved null models but was not attempted due to small sample size.

Our results support Braun's conjecture (1998; personal communication) that sage-grouse avoid farms and ranch houses. However, he suggested that adult sage-grouse were avoiding occupied farms and ranches by 800 m, while hens with broods might come closer to seek out wet sites. Our study found avoidance up to 150 m, but we did not distinguish between occupied and unoccupied home sites, nor did we consider differences based on sex or season. Sage-grouse may show greater avoidance of occupied houses or farms because of the associated sounds such as human voices or motorized vehicles, or the presence of domestic animals such cats, dogs, horses, or other livestock.

Our findings on sage-grouse and power transmission lines support other studies suggesting avoidance behavior. Braun (1998) concluded that sage-grouse infrequently use areas within 1 km of a power line, and Hanser et al. (2011) found there was less probability of sage-grouse pellet occurrence within 500 m of power lines. Power lines and transmission structures can serve as perches for avian predators in landscapes with few naturally tall structures (Ellis 1987, Connelly et al. 2004). Sage-grouse may also avoid traditional leks if perches or raptors are visible (Hall and Haney 1997). In California, USA, as distance to overhead power lines decreased, peak male lek attendance also decreased (Hall and Haney 1997). Other studies have found power lines to have a benign effect on sage-grouse. In a 10-year range-wide study, Johnson et al. (2011) found no negative effects of power lines on lek counts, but did report that lek trends were reduced when communication towers were nearby.

Though previous research has shown that sage-grouse may avoid major highways (Hanser et al. 2011), have lower lek attendance (Braun 1986, Johnson et al. 2011), and have lower nest initiation rates near roads (Lyon and Anderson 2003), our results show sage-grouse to be minimally affected by minor and major roads in our study area. There was only one 2-lane highway in the study area and most of the minor roads were composed of dirt or gravel and had infrequent traffic. Anecdotally, some sage-grouse actually lek directly on minor roads in the study area (Gray 2009), and perhaps roads provide an open area in the sagebrush where mating displays can be seen (Connelly et al. 1981, Gates 1985). At some scales for minor roads (3–4 km), more sage-grouse were near roads than was expected to almost a significant level. The reason this occurred is unknown. Sage-grouse may be attracted to riparian areas, agricultural fields, or water developments that are often near farms and ranches. In the summer, sage-grouse have been observed using riparian areas and crop fields, which provide a food source (Dunn and Braun 1986, Schroeder et al. 1999). Topography may be important because leks are often on gentle slopes or in valley bottoms (Rogers 1964), and sage-grouse may simply occupy lands that are popular for human settlements, including locations with roads.

Sage-grouse have been observed being influenced by energy infrastructure at greater distances compared with our results. In Alberta, Canada, sage-grouse avoided energy wells by up to 1.9 km during the winter (Carpenter et al. 2010). In Wyoming, yearling males established themselves less often than expected on leks within 3 km of producing wells and more often on leks farther than 3 km from producing wells (Holloran et al. 2010). Fewer yearling females nested within 950 m of infrastructure than was expected (Holloran et al. 2010). Yearling males and females reared within 1.65 km of a producing well pad or haul road had lower annual survival rates (Holloran et al. 2010). At 5 study sites in Wyoming, lek counts were negatively associated with the presence of producing wells within 800 m, 1.2, 1.6, and 4.8 km at each respective site (Harju et al. 2010). Two other study sites showed no reduced lek counts. In the Powder River Basin of Wyoming and Montana, USA, female sage-grouse in the

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winter were more likely to occupy habitats with no natural gas wells within 4 km^2 compared with the legal maximum density of 12.3 wells (Doherty et al. 2008).

Sage-grouse have distinct patterns of habitat use during different times of the year, which will likely affect their tolerance of anthropogenic features (Connelly et al. 2000, 2011). Lumping the seasons and sexes together possibly masked or coarsened the precision of some of the results. For example, during the late brood-rearing period (Jul–Sep), the diet of the chicks changes primarily to forbs and they will choose their habitat based on their availability (Patterson 1952). The hen and chicks may use irrigated crop fields, wet meadows, and riparian areas closer to anthropogenic features (Dunn and Braun 1986, Connelly et al. 1988). During the autumn as the forbs desiccate or are killed by frost, sage-grouse switch their diet back to sagebrush (Patterson 1952, Wallestad et al. 1975). A study in Colorado, USA, found that sage-grouse abandoned irrigated hay fields when the irrigation stopped or after the first frost (Gill and Glover 1965). Had the analysis been separated by season, we might have seen different habitat use between summer and autumn in relation to anthropogenic features.

MANAGEMENT IMPLICATIONS

Our results can directly inform land managers who are planning infrastructure and other development projects in or near sage-grouse habitat. We revealed a zone of influence around buildings and power lines that affects the occurrence of sage-grouse within their habitat. Our results indicate that anthropogenic features reduce the total amount of habitat available to the species by a factor larger than just the footprints of the features themselves. Planning and zoning commissions, utility companies, and other government entities can use these results to develop building regulations and plan infrastructure routes that are sensitive to sage-grouse populations and habitat. Specific actions that planning entities can take to protect greater sage-grouse populations and habitats in Idaho are to 1) identify goals for species and habitat protection in the county comprehensive plan, 2) incorporate the spatial data from this study and other studies on species of concern into county land use maps, and 3) develop zoning ordinances that encourage the implementation of 'on-the-ground' conservation actions by private landowners that minimize or mitigate the zone of influence from anthropogenic features (Haines et al. 2012).

ACKNOWLEDGMENTS

We would like to thank the entities responsible for funding *Sage-grouse Habitat in Idaho: A Practical Guide for Land Owners and Managers*: The University of Idaho College of Natural Resources, Idaho Governor's Office of Species Conservation, Idaho Department of Fish and Game, Bureau of Land Management Idaho, US Fish and Wildlife Service, Laura Moore Cunningham Foundation, and Idaho Rangeland Resource Commission. The funding from that publication made this research possible. Special thanks go to J. Hinson and M. Soulen-Hinson for everything they did to support this research. This publication is issued as Contribution no. 1077 of the Idaho Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow.

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Associate Editor: Gervais.

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A Literature Review of Transmission Line Effect Distances

Effect Distance Value	Source	Comments
No effect detected at 5 and 18km of a lek.	(Johnson et al. 2011)	Authors examined trends in lek counts and anthropogenic features (1997-2007). No general pattern/association was found across the entire study area with transmission at tested 5km and 18km of lek.
200 m	(Ellis 1985)	The erection of a transmission line located within 650 ft (200 m) of an active sage-grouse lek, and between the lek and day-use areas, in northeastern Utah resulted in a 72 percent decline in the mean number of displaying males and an alteration in daily dispersal patterns during the breeding season within 2 years. This project also reported that the frequency of raptor–sage-grouse interactions during the breeding season increased 65 percent and golden eagle interactions alone increased 47 percent between pre- and post-transmission line comparisons.
360 m +/- 60, 630 m +/- 40	(Robel et al. 2004)	Data are from a 6 year study of energy development on lesser prairie-chickens in Kansas. Distances are mean (+/- SE) distance to electric power lines avoided by 90% of 187 nesting prairie checking and mean distance to power lines across which 95% of 18,866 telemetry locations of prairie chickens were absent, respectively.
450-650 m	(Hagen et al. 2004)	In Kansas, the average displacement of prairie-chicken use sites was about 450 meters from power lines and the average displacement of nests was about 650 meters from power lines.
400m	(Pitman et al. 2005)	Data are from a study on lesser prairie-chickens in Kansas and found that nest proximity was "seldom less than 400 meters from a transmission line" (Table 3)
500m	(Hanser et al. 2011)	Wyoming Basins Ecoregional Assessment: Study of responses of sage-grouse to anthropogenic effects. Authors tested effects at .5 km and 1km and found the most significant effect of transmission lines on sage-grouse abundance at .5 km.
500m	(Pruett et al. 2009)	Oklahoma prairie-chicken study found that displacement of prairie-chickens was at least 500m from a power line.
600 m	(Braun 1998)	In Colorado, pellet transects illustrated declining habitat use by sage-grouse up to 600 meters from power lines.
600 m	(Gillan et al. 2013)	Using a spatial statistical approach with telemetry data from Idaho, this study found that sage-grouse avoided power transmission lines by 600 m.
0-4.7 km	(LeBeau 2012)	A wind turbine effects and infrastructure study that examined infrastructure related to wind development within the two study areas in SE Wyoming and found that the estimated odds of sage-grouse selecting brood-rearing habitat within the Seven Mile Hill study area increased as distance from nearest overhead transmission line increased up to 4.7 km (90% CI: 2.2–18.5 km), then declined. However, LeBeau also found that sage-grouse selected *for* nesting habitat closer to transmission lines within Simpson Ridge study area.

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4.8 km	(Rodgers 2003)	In California, power lines resulted in sage-grouse lek abandonment and reduced lek attendance up to 3 miles away.
6.4 km	(Steenhof et al. 1993, Connelly et al. 2004)	Additionally, higher densities of power lines within 4 mi (6.4 km) of a lek may negatively influence lek persistence. Power lines may be locally significant causes of mortality due to collisions. Potentially more important, poles and towers associated with transmission lines have been shown to influence raptor and corvid distributions and hunting efficiency resulting in increased predation on sage-grouse.

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