# *Board of County Commissioners - Staff Report*

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**Meeting Date:** August 23, 2016

**Presenter:** Hamilton Smith

**Submitting Dept:** Planning and Development

**Subject:** Notice of Award – Focal Species Habitat Mapping Study

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**Statement / Purpose:**

Consider approval of a Notice of Award to Alder Environmental for the preparation of a Focal Species Habitat Mapping Study in Teton County.

**Background / Description (Pros & Cons):**

The Jackson/Teton County Comprehensive Plan (Comprehensive Plan) calls for the protection of native species populations through a system of regulations and requirements that are based on relative value of habitat. The outcome, as guided by the Comprehensive Plan, would be used to update both the Natural Resources section of the LDRs and the Natural Resource Overlay (NRO) to protect wildlife habitat and wildlife movement corridors. The first step in this process was the completion in 2013 of a Geographic Information System (GIS) layer of vegetation and non-vegetation cover on all lands in Teton County, Wyoming, excluding most large acreages under federal ownership. Teton County now can use the vegetation map as the foundation of a broader effort to define important wildlife habitat to update the Town and County Land Development Regulations regarding habitat protection.

The second step in in this process is to complete a focal species habitat map, the product for which a Notice to Award is before you today. Staff expects the contractor to identify important habitat characteristics of focal species (vegetation cover, slope, aspect, etc.), map the important habitat characteristics in GIS format, and assess the relative value of important habitats.

The primary steps in developing a revised NRO and Natural Resource regulations are summarized below:

1. Develop comprehensive map of vegetation types in the County (completed)

2a. Define habitat needs of a subset of important species that require conservation measures (proposed)

2b. Combine habitat maps for individual focal species into a summary layer representing important wildlife habitat on private lands in Teton County (proposed)

3. Revise the NRO based on the focal species habitat maps (staff)

The award before you today will fund the study to tackle steps 2a and 2b as outlined above, with the aim to identify the important habitat for species in need of conservation management or deemed culturally and economically important in Teton County. A list of 17 focal species was developed for consideration in this study derived by creating a list of State (WGFD) and Federal (BLM, USFS, and USFWS) vulnerable species, with consultation from WGFD biologists in the Jackson office and the Natural Resources Technical Advisory Board (NRTAB). The precise methodology is summarized in a Memo from the NRTAB to Alder Environmental, provided as Attachment 1.

The County entered into a contract in 2013 with the aim to develop a similar product defining important habitats for wildlife exclusively through the use of data, which severely limited the number of species in that project to those for which data was available. The 2013 project was deemed unsuccessful through a process of professional peer-review. Due to critique of the previous study methodology from local experts in the field, including local Game and Fish biologists, Staff proposed to the Board that a new Request for Proposals (RFP) be advertised with greater specificity and a more defined scope.

Important lessons were learned through the challenges met during preparation of the first Focal Habitat Feature Study. The current study is not dependent upon analysis of raw point data (animal locations) to derive habitat associations. The consultant has not been asked to gather raw data from private researchers. The current RFP provides three concise, systematic tasks for the consultant to use as a framework for the study, and the completion of each task shall be followed by a peer-review phase by which the project will be evaluated by experts in the field prior to 1) payment of the consultant for completion of the assigned task, and 2) the ability for the consultant to move forward with the subsequent task in the study. This series of tasks and preparation and submittal of the study final report will be conducted on a firm 6-month timeline from the date of signature of the contract.

One proposal for the preparation of this study was received from Alder Environmental. The applicant stressed that due to the aggressive 6-month timeline it was difficult for a small firm to allocate the time and resources required of senior staff to meet this expectation. Whereas, the overall value of the contract was likely too small to attract larger firms with the staff capacity to handle this contract entirely in-house. The Alder Environmental approach is to spearhead a team of local experts that will allow for expedited research and analysis on multiple species at the same time. Due to this approach, there are added costs for project management and team coordination that were not included in the original estimated cost of services.

**Options for Consideration by the Board**

**Option 1: Alder Environmental Proposal, with 14 Focal Species in Task B and Task C – Cost $54,800.00**

Alder Environmental submitted a proposal as the lead of a collaborative team of local biological and ecological researchers and professionals. Their original proposal includes a cost of $54,800.00 (Attachment 2). The original budget is based on the analysis of 14 (rather than 17, due to an error) species in Task B and does not include NRTAB Meeting and Project Management line items that have been added to Task C in the revised cost of service. If Option 1 is chosen, the consultant will be required to fulfill the Task B requirements to insure peer-review standards are met without reimbursement. The removal of individual species from the analysis will reduce costs by an estimated $1,691.00, per species (Attachment 3). The applicant would proceed with the understanding that Board guidance is to reduce the focal species list by three (3), and proceed with the habitat mapping and consolidation of all habitat map tasks, with 14 species. Removal of any number of species is a deviation from the methods defined by Staff and NRTAB to select the focal species, which will result in incremental reductions in the overall completeness the product. It is very difficult to make any additional value judgements on the impact of species removal, other than to say that the final output loses resolution with each species removed.

**Option 2: Alder Environmental Revised Proposal, with 17 Focal Species in Task B and Task C – Cost $58,430.00**

A revised proposal budget of $58,430.00 was submitted by Alder Environmental on August 1st (Attachment 2). This budget will enable the applicant team to evaluate the habitat needs of the 17 focal species, and carry this analysis through the mapping task, and description of combined important habitats for wildlife in the County. Option 2 includes Task B NRTAB Meeting and Project Management line items that were excluded from the original bid in Option 1. This proposal meets the intent of the Comprehensive plan to base future LDR amendments and management decisions on the full suite of focal species as defined by Staff, NRTAB, and WGFD. Subsequent to the review of the Proposal Addendum and discussion, the NRTAB passed a motion by unanimous vote to recommend to the Board of County Commissioners approval of the Alder Environmental proposal for a not to exceed cost of $58,430.00.

**Option 3: Alder Environmental Revised Proposal, with 9 Focal Species in Task B and Task C – Cost $44,902.00**

To meet the advertised Estimated Cost of Services ($45,000.00), the applicant provided a revised estimate which establishes a cost per species for Task A and Task B. To bring the proposed budget down to $45,000.00 the applicant would have to reduce the list of Focal Species to be included in the analysis to nine (9). This would result in a more generalized product. NRTAB did not support this approach as it is unlikely that all important habitats would be represented. To consider reducing the list of focal species to nine calls into question the legitimacy of the entire approach, given that there are more than nine primary habitat types that occur on private lands in the County. It is the habitat that the County is entrusted to maintain and protect, and it is paramount to this Study to describe the important habitats used by vulnerable species, and those species that have significant cultural and economic importance.

**Option 4: No Award of Contract**

If the Board elects not to award the contract to the consultant team represented by Alder Environmental, it will be important to evaluate the Teton County Comprehensive Plan guidance for natural resource protection standards, and how best to integrate available data including the County Vegetation Map to describe the relative critical value of different habitat types for identified focal species, as stated in Policy 1.1.a. The update of the Natural Resource Regulations will likely be put on hold while assessing future approaches to updating natural resource protection through the description of important habitats for focal species.

**Accountability**

Maintaining the project timeline and adhering to the approved budget are paramount to the success of this project. The contract for this award will be designed with firm date-certain deadlines. The applicant will receive payments based on the delivery of final products by task, once deemed sufficient by Staff. A peer-review process has been built in to the contract for each task, and the consultant will not be able to proceed with subsequent tasks, until the methods and results from a proceeding task are approved. In the event that the NRTAB and/or WGFD cannot adhere to timeline schedules for peer-review of specific task deliverables, Staff will provide the necessary review and feedback to insure the consultant team is able to stay on schedule. A project timeline with meeting dates will accompany the study contract.

**Stakeholder Analysis & Involvement:**

If the contract is awarded as recommended by the NRTAB, the project will allow Teton County to fulfill its stewardship obligation to best protect important wildlife habitat and movement corridors as set forth in the Teton County Comprehensive Plan, and as such is relevant to residents and visitors of Teton County. One letter was received as Public Comment from the Jackson Hole Conservation Alliance (Attachment 3) that supports proceeding with this project. The Wyoming Game and Fish Department has also come to the table, and been closely involved through participation in NRTAB meetings, and preparation of the RFP for this project. Game and Fish biologists were also instrumental in the drafting of the recommended list of focal species (Attachment 4, Appendix 1), and are a vested stakeholder given the agency's commitment to participate in the peer-review process that follows each of the three primary study tasks identified in the RFP.

**Fiscal Impact:**

The recommended budget for the Focal Species Habitat Mapping Study is $58,430.00, where staff anticipated the budget to be $45,000.00. This estimate was based upon time and consultant fees to produce the habitat mapping and report. The estimate did not take into account project management, oversight, five meetings, and meeting preparation, which is now a requirement of the RFP; however, the budget was estimated well

before the RFP was written. In addition, staff anticipated the contract to be awarded in Fiscal Year 2016, where $15,000.00 was budgeted—the remaining $30,000.00 is in the Fiscal Year 2017 budget. At this time no budget amendment is necessary if the recommended $58,430.00 budget is approved for the contract. A budget amendment may be necessary in the future, depending upon the Board's approval of other projects in the LDR Revision budget line item.

**Staff Impact:**
Senior Planner Hamilton Smith will provide project oversight. A portion of his time is already allotted for through participation in the NRTAB meetings. Additional time will be required for review of project deliverables, and participation in the peer-review process. Total staff time between the Senior Planner and Planning Manager Susan Johnson is estimated to be 12-15 hours on a monthly basis, which will be required through the 6-month duration of the study.

**Legal Review:**
Weisman.

**Staff Input / Recommendation:**
Staff recommends that the Board of County Commissioners authorize Staff to issue a Notice of Award to Alder Environmental for the Focal Species Habitat Mapping Study in an amount not to exceed $58,430.00, pursuant to the Project Scope provided in the Proposal to Conduct Focal Species Habitat Mapping Project (July 15, 2016; Attachment 1) and the Revised Focal Species Habitat Mapping Proposal Budget (August 1, 2016; Attachment 2), and authorize Staff to proceed with drafting a contract to be considered by the Board at a subsequent meeting.

**Attachments:**
Attachment 1 – Memo: NRTAB methodology for initial species list, Focal Species Habitat Mapping Project (August 12, 2016)
Attachment 2 - Proposal to Conduct Focal Species Habitat Mapping Project, Alder Environmental (July 15, 2016)
Attachment 3 - Proposal Addendum and Revised Budget with Cover Letter, Alder Environmental (August 1, 2016)
Attachment 4 - Public Comment, Jackson Hole Conservation Alliance (June 10, 2016)
Attachment 5 – Request for Proposals, Focal Species Habitat Mapping Project for Teton County, Wyoming (June 24, 2016)

**Suggested Motion:**
1. I move to approve a Notice of Award to Alder Environmental for the Focal Species Habitat Mapping Study based on the analysis of 17 species in an amount not to exceed $58,430.00, pursuant to the Project Scope provided in the Proposal to Conduct Focal Species Habitat Mapping Project (July 15, 2016; Attachment 1) and the Revised Focal Species Habitat Mapping Proposal Budget (August 1, 2016; Attachment 2).
2. I move to authorize Staff and the County Attorney's Office to proceed with contract negotiations between Teton County and Alder Environmental to be signed by the Board at a subsequent meeting.

***Should the Board chose to go with an alternate option as described in the Background/Description section, a revised motion shall be defined by the Board and Staff.***

Attachment 1

**MEMO**

**To: Megan Smith, Alder Environmental**

**From: Natural Resources Technical Advisory Board (NRTAB)**

**Date: August 12, 2016**

**Re: NRTAB methodology for initial species list, Focal Species Habitat Mapping Project**

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Following up with discussion during the meeting on August 2, 2016 with Alder Environmental, this memo is intended to clarify the methodology used by NRTAB to create the initial species list (as provided in Appendix I of the RFP).

NRTAB began by gathering data from the following sources:

- WGFD (SGCN tiers)
- USFWS (designated T/E or experimental pop status and/or critical habitat)
- BTNF (sensitive species)
- BLM (sensitive species)

This list was cross-checked with TNC's Wyoming vulnerable species list and Nature Mapping JH's list of amphibians, mammals, and birds. Any species not found in Teton County were then removed. See the attached spreadsheet "CompiledSppList" for the full species list (1st tab) and the Teton County only reduced species list (2nd tab). NRTAB then consulted with Susan Patla and Aly Courtemanch to arrive at a final species list for the RFP. Species were selected that met the following criteria:

- "focal" or "important" species (i.e. are good indicators of ecosystem health), or have economic/cultural significance within Teton County.
- Not rare and are present on private lands (note that "rare" is not associated with definitions used for endangered or threatened species, but simply indicates that a species observed population and habitat use in Teton County is relatively small).
- Have sufficient data or demonstrable habitat associations derived from review of literature or well-documented expert opinion.

After the list was compiled, the NRTAB reviewed the habitat types represented to confirm that there were no obvious omissions of known important habitats in Teton County*. See the attached spreadsheet "SpeciesList_habitat" for general habitat descriptions. The NRTAB emphasizes that we look forward to a critical evaluation of this list along with any recommended changes from the contractor. The implications of habitat redundancy or omission will have to be assessed with regard to the overall goals and methodology of the study. In particular, the weighting scheme used in Task C will be influential on the final representation of individual species' habitat.

*During review of the Teton County reduced species list with Susan Patla, the NRTAB identified a lack of open agricultural grassland associates. Northern Harrier was added as an indicator species for this habitat type, which is abundant on private lands.

Attachment 2

# PROPOSAL TO CONDUCT

# FOCAL SPECIES HABITAT MAPPING PROJECT

FOR

TETON COUNTY, WYOMING

Respectfully Submitted
July 15, 2016

By:

ALDER ENVIRONMENTAL, LLC

*Water • Wetlands • Ecological Consulting*

P.O. 6519, Jackson, Wyoming 83002
(307) 690-3625 brian@alderenvironmental.com

## INTRODUCTION

What follows is Alder Environmental's (Alder) proposal to conduct the *Focal Species Habitat Mapping Project for Teton County, Wyoming*. Through this proposal, Alder Environmental is taking a unique approach the cornerstone of which is a high level of collaboration and team work by a strong team of biological and ecological researchers and professionals uniquely qualified to provide the most up to date species and habitat information and expertise to Teton County.

Through this team's collaborative work process, we will be able to develop a geographic assessment indicating relative importance of habitats throughout Teton County. This map layer and background, species based research will assist Teton County's Natural Resources Technical Advisory Board (NRTAB) and Planning Department to update land development regulations based on current natural resources information. Furthermore, it is our team's goal is to develop a system by which the final product can incorporate future research findings through an adaptable process.

## PROJECT APPROACH AND COLLABORATIVE PHILOSOPHY

Teton County, WY is fortunate to not only have an abundance of wildlife but also citizens that care deeply about this wildlife and a strong community of biological and ecological researchers, consultants and educators continually working to increase our ecologic knowledge and ability to live harmoniously within this beautiful landscape. With this proposal, it is Alder Environmental's intent to capitalize on this local knowledge base and build a collaborative team of professionals who, together, will provide the best information and GIS-based product available.

Much of the baseline information and ecological research requested in Teton County's *Focal Species Habitat Mapping Project* Request for Proposals (RFP) document is known. Relevant, local research has been conducted on many of the Focal Species and their important habitats. Therefore, it makes perfect sense to build a team of professionals with the best available data, results, knowledge and research skills to collaboratively create one product that will inform Teton County Planning's work with regard to future land development regulations.

Our current team members have been chosen based on areas of expertise with the Focal Species listed in Appendix I of the RFP and research abilities. In addition to our team members, we will reach out to experts in the field to incorporate their relevant research and expert knowledge. Potential organizations who may be able to provide further data, research and expert knowledge include, but are not limited to, Wyoming Natural Diversity Database (WYNDD), Wyoming Migration Initiative, Wyoming Game and Fish Department (WGFD), Wyoming Wetlands Society and Nature Mapping Jackson Hole (Jackson Hole Wildlife Foundation).

It is Alder's Team's intent to create a system which will have the capacity to incorporate future research results. This system will allow for the periodic update of underlying biological information and project results. An up to date, accurate and relevant base of natural resources knowledge underlying land use regulations is beneficial to all involved. A system that allows peer-reviewed research to be incorporated in a timely manner will assure Teton County Land Development Regulations remain relevant within our ecologic landscape.

## TEAM MEMBERS AND ROLES

**Brian Remlinger**, Alder Environmental – Project Oversight

**Megan Smith**, Alder Environmental – Project Lead/ Manager, Research Collaborator and GIS Specialist

**Bryan Bedrosian**, Teton Raptor Center's Senior Avian Ecologist – Expert Raptor Research Collaborator

**Kevin Krasnow**, PhD, Teton Science Schools Graduate Program's Research and Graduate Faculty – Expert Ungulate Research Collaborator and GIS Collaborator/ Advisor

**Christine Paige**, Ravenworks Ecology Independent Wildlife Biologist/ Owner – Research Collaborator

**Amy Kusak**, Independent Environmental Consultant/ Planner – Research Collaborator and GIS Technician

**Corrina Riginos**, PhD, Independent Research Ecologist and Adjunct Professor – Expert Ungulate and Wildlife Movements Advisor

**Deb Patla**, Greater Yellowstone Amphibian Monitoring Project Coordinator/ Biologist – Expert Amphibian Advisor

**Krissy Copeland**, Alder Environmental – GIS Technician

*Team member resumes and further detail on qualifications are included below.*

## SCOPE OF WORK

### TASK A. IDENTIFY IMPORTANT HABITAT CHARACTERISTICS OF FOCAL SPECIES

***Species List***

An important first step to this project that was not included in the request for proposals but has been added here will be the collaborative review and fine-tuning of the Focal Species List included in Appendix I of the RFP with team members and NRTAB representatives. While the species included in the list provide a representation of habitats available in Teton County, it is the team's professional opinion that this list can be fine-tuned to ensure representation of all important habitats in Teton County as well as assure that species included are indeed the best representatives of these habitats. Teton County Planning staff and a NRTAB board member both indicated that there is room for adjustments to this list as appropriate upon initiation of the project. This proposal is written based on the indicated list but if significant adjustments are made to the list, adjustments can be made to the proposal. A few items (not an exhaustive list) that may direct the Focal Species List fine-tuning process include:

(a) Aspen habitat is not well represented by the species listed. Aspen habitat is certainly of importance to species listed (e.g. moose and elk) but as a secondary habitat it may not be well represented in the final product. Aspen is a declining habitat in the Rocky Mountain Region (Guyon & Hoffman, 2011). One major threat to aspen's longevity is the impacts from residential development both removing habitat and negatively affecting species using aspen habitat proximate to the development. Therefore, it is important to ensure from the beginning that aspen habitat is well represented throughout this project. Species that are dependent on aspen stands and therefore could be included in this list are the Ruffed-Grouse (year-round resident and aspen habitat breeder), the Mountain Bluebird (iconic summer resident), or MacGillivray's Warbler (Anderson and Anderson 2001).

(b) human and bear interactions have been increasing over the past decade in Teton County and therefore it should be confirmed that their habitat requirements are either well represented by other species or include a bear species (likely black bears) as a Focal Species.

(c) several species included on the Appendix I list have similar habitats and therefore may be providing duplicative habitat requirements (e.g. Northern Goshawk and Great Gray Owls share riparian conifer habitats). The implications of duplicate habitat representatives on the final product should be considered at the project's outset.

***Methods***

Once a final list of Focal Species has been determined and approved by the NRTAB and Teton County Planning staff, the species will be distributed between team members based first on expertise and secondarily on research abilities. Team members with prior and current research knowledge of particular species will be assigned those species (e.g. Bryan Bedrosian, Raptor Center, will be contributing the Great Gray Owl and other raptor species information). Remaining species will be distributed between team members based on research abilities. All species' important habitats will be thoroughly researched starting with (1) primary research sources (e.g. published, locally-based research projects – in some cases, these primary research sources will have been conducted by the assigned team member) and then with (2) secondary research sources (e.g. published, northern Rocky Mountain based, peer-reviewed, research projects, agency documents such as WYNDD, USFS and BLM Species Assessment reports, etc). In the case of secondary research sources, emphasis will be made to find peer-reviewed research projects which incorporate objectively collected observational data on the Focal Species. In cases where the team member conducting this species important habitat research is not an expert on a particular species, we will strive to have the habitat information reviewed by an expert advisor (either team member or otherwise) to assure accuracy.

In all cases, team members will employ a framework for itemizing and summarizing important habitat information. This framework will assist the team to produce easily digestible and consistent information, including cited resources, while also allowing the flexibility needed to address individual species habitat requirements. One component of this framework will be a spreadsheet table listing variables used (in the case of existing habitat layers) or to be used (in the case of habitat layers that will be created in Task B) for species habitat layers. It is possible that for year-round resident species, two important habitat layers may be created, summer and winter habitats. Reproductive habitat and migration routes would be incorporated appropriately.

Habitat variables, or descriptors, that will be researched along with biotic and abiotic associations and selection criteria include, but are not limited to:

| biotic factors | abiotic factors |
|---|---|
| dominant species | slope |
| age classes | aspect |
| health indicators | elevation range |
| canopy cover | stream order |
| minimum patch area | water temperature |
| disturbance interactions | |

***Deliverables***

A narrative for each of the identified Focal Species will be provided in a consolidated and comprehensive product delivered both in hard copy and electronically (PDF). These narratives will include and describe important habitat variables, characteristics and ecological function for each species. Additionally, narratives will include a spreadsheet component listing habitat characteristic, the GIS data sources to be used for creation of a habitat layer, the selection criteria (corresponding to species' habitat

requirements) to be used for each identified GIS data source and the ecologic function of the habitat components.

At this juncture in the project, the submission of both narratives and spreadsheet information with detailed information on available GIS data layers and selection criteria will allow Alder's Team, NRTAB and TC Planning staff to review the feasibility of various species' habitat layers before proceeding to Task B. Additionally, this review period provides an opportunity to confirm that all important habitat types present in Teton County will be represented in the final analysis for Task C.

**TASK B. MAP IMPORTANT HABITAT FOR EACH FOCAL SPECIES**

There are two methodologies that will be employed to accomplish Task B. The two methodologies are based on whether the information gathering in Task A was based on primary research sources or on secondary research sources.

Primary Research Sources

If the habitat information gathered in Task A is based on primary research sources from which a species specific important habitat map for Teton County has been produced from observational data, or could produce a habitat layer with relative ease, then this habitat layer will be used whenever possible. If the results of this primary research need to be re-analyzed to better fit the constraints of this project or expanded to encompass all of Teton County, then this analysis will be done if possible within the time and monetary parameters of this project. In all cases, methodology for creation of the resulting habitat layer, variables included in this analysis, the map's accuracy and citation of the primary research will be included in the layer's metadata and associated spreadsheet.

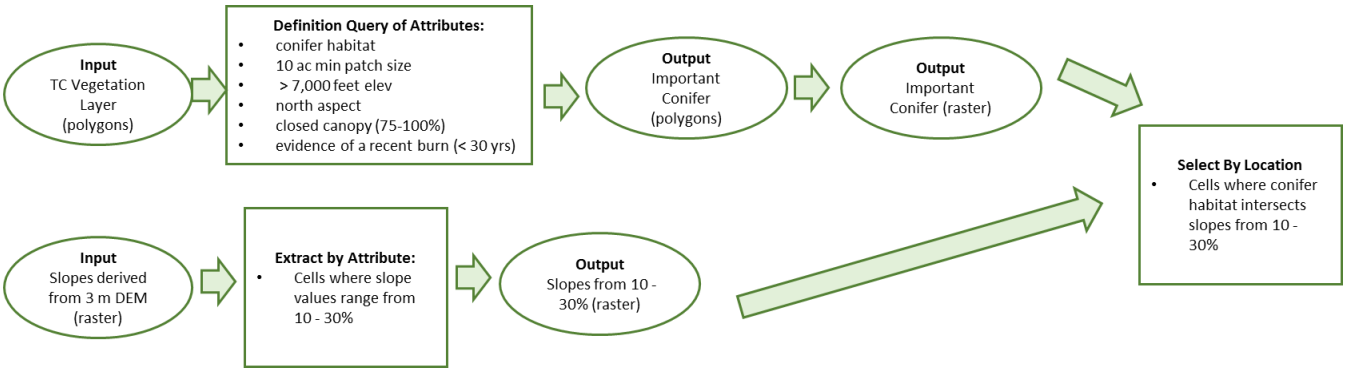
Secondary Research Sources

If the habitat information gathered in Task A is based on secondary research sources, a species specific important habitat layer for Teton County will be produced. For year-round resident species, two important habitat layers may be created, summer and winter habitats with reproductive habitat and migration routes incorporated appropriately into one or the other of these important habitat layers. The creation of these habitat layers will be based on the habitat variables and selection criteria outlined in the Task A narrative and spreadsheet. The Teton County vegetation data (Cogan and Johnson, 2013) will be a primary component in these habitat layers.

***GIS Methodology***

GIS methodology employed to create important habitat layers from secondary research sources information will be standardized to the greatest extent feasible. Habitat layers will be produced using a suite of query and selection functions available in ArcGIS. The tools employed will be based on the input source layers being used (vector vs. raster data sources) and the desired selection criteria. Select by attribute, select by location and definition queries will be essential tools for working with vector data layer inputs. Spatial queries and selection functions will be essential tools for working with raster data layers as inputs. Once all criteria have been queried vector data will be converted to raster data and a final spatial analysis will result in a single raster layer indicating the important habitat for each species found in Teton County. Through this methodology, it is possible that the resulting species habitat layer could indicate relative importance of habitat. An example of a hypothetical GIS workflow is displayed in Figure 1. This workflow, while hypothetical, is an example of a GIS model which could be replicated for different species using the same or similar input source layers (e.g. vegetation, slope, aspect, etc.) with differing selection criteria.

**Figure 1. GIS Habitat Layer Hypothetical Workflow**




***Verification of Habitat Layers Using Observational Data***

In both cases, primary or secondary research based habitat layers, local observational point data will be employed as a verification of the habitat map's results. The observational data (queried by season) will be overlaid on the habitat layer(s) and a select by location function will be used to assess the percentage of observations that positively correlate with the habitat layer. If the percentage of observations is low, then further evaluation of that habitat layer will be needed. Observational point data to be used will include Nature Mapping Jackson Hole and WGFD Wildlife Observation System (WOS) data. It is important to note that these observational data sets will not be employed in the creation of the habitat layers but rather used as a verification of the habitat identification process.

***Deliverables***

GIS layers of important habitat in Teton County will be produced for each Focal Species with comprehensive metadata and associated spreadsheet.

Additionally, a statistic that could be easily calculated from these habitat layers would be the abundance of each species' habitat and its availability in Teton County. This information, along with other considerations, could inform the relative importance of various habitat layers for use in Task C.

## TASK C. ASSESSMENT OF RELATIVE VALUE OF IMPORTANT HABITAT SPECIES

The role of Task C in this project is to use the research collected and created in Task A and B to transfer the project from the context of individual focal species and their habitats to the landscape context of important habitats, ecological function and connectivity throughout the County. Within this broad, landscape context, the critical assessment that Task C will make is to determine the relative values of habitats and movement corridors through the valley not only for the focal species identified but also for all wildlife species within the system.

As with all projects, there comes a point where subjective decisions and scientifically based interpretations of results must be made. The key to these subjective decisions and interpretations is to base them in ecological understanding of system and to address the question at hand in a manner that is accessible to the intended audience. It is Alder's Team's approach that these decisions and interpretations are best made through a collaborative approach of knowledgeable people (our Team, NRTAB, WGFD and TC Planning Staff) rather then in isolation by a few. Furthermore, the goal of Task C is to produce an assessment (GIS map and narrative) of the relative value of important habitats in Teton County. The audience for these products will be the Teton County Planning staff and the Board of County Commissioners to use in their work amending and developing land development regulations.

***Methods***

A weighted system will be designed to describe the relative critical value of different habitat types within the system using the Spatial Analysis Overlay toolset in ArcGIS. The GIS data input for this weighted system will be the Focal Species Important Habitat layers created in Task B. This weighted system will be described *a priori* and will assign ranking values to critical components of the landscape and species use of the landscape. These critical components will be identified through the answering of intermediate questions. The results of Task A and B will be used to answer these important, intermediate questions. The results of these questions will not only be used to inform the relative value of important habitats but could also assist Teton County Planning staff in their prioritization and development of land use regulations. Example questions could include:

- Are there areas where multiple Focal Species Important Habitats overlap?
- Are there habitat types that are particularly critical to wildlife species?
- Are there habitat types within the County that are particularly abundant or scarce?
- Are there movement corridors through the County that are of high importance?
- Are there important species habitats or vegetation cover types that are in decline?
- Is there a particular habitat patch size, habitat associations or edge effects that are particularly beneficial or have a negative effect on wildlife's habitats (either groups of species or specific species)?
- Are there movement corridors through the County that appear at risk and could be restored through future land regulations and management decisions?
- Are there particular habitats or habitat associations that would benefit from a development buffer to maintain ecological integrity of the system? Are these habitat types threatened by development?
- Is there a particular species of concern that should be prioritized?

Once these intermediate questions have been answered, the team of knowledgeable researchers and professionals will collaborate to create a justifiable, logical and defensible weighted system that identifies GIS raster layers to be used as inputs and assigns weights or relative importance to these layers. A hypothetical weighted system framework is displayed in Figure 2.

**Figure 2. Hypothetical Weighted System Displaying Relative Values of Input Layers**

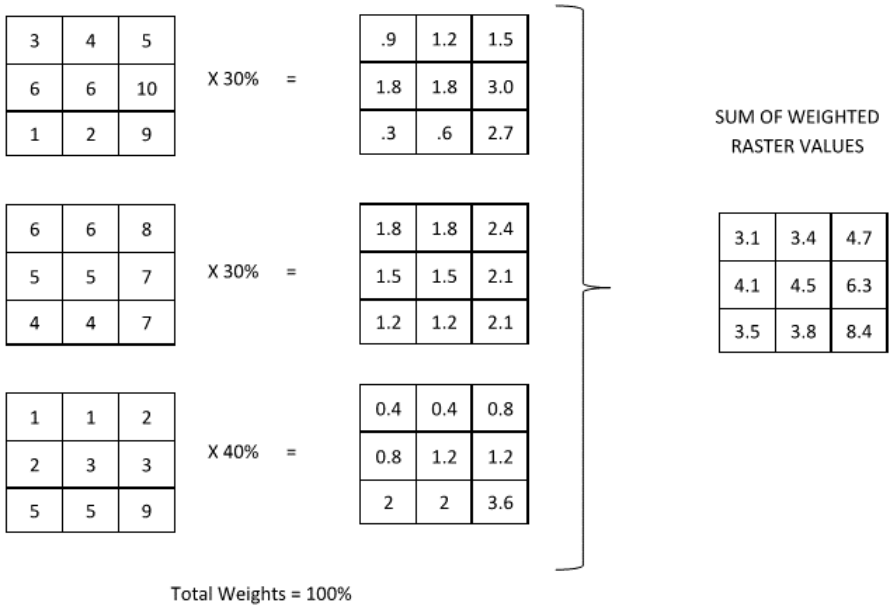
| Input Raster Layer | Weight |
|---|---|
| areas important to multiple focal species | 30% |
| migration and important movement corridors | 20% |
| critical aspen habitat of a patch size > 10 ac | 15% |
| 250 ft. buffer area around aspen habitats >10 ac in size | 5% |
| scarce habitat types | 15% |
| major riparian corridors | 15% |
| **TOTAL** | **100%** |

***Important Note**: This is a hypothetical weighted system example and **not** based in objective research*

The weighted system of relative importance between inputs will be decided *a priori* and then applied to a weighted sum raster calculation. The output will be a raster layer indicating the relative importance of landscape features and habitat areas across the County.

Figure 3 3 illustrates the raster calculations used for a weighted sum overlay and produce a layer of relative importance.

**Figure 3. Illustration of Weighted Sum Raster Calculations**




***Deliverables***

The final product of Task C will be a map illustrating the relative importance of habitats throughout Teton County and a Final Report (draft for peer-review and final). This GIS layer will be attributed with relative importance values and the metadata will include methodology, input layers and assigned weights. The Final Report will be a consolidation of all products from Tasks A, B and C, including, at a minimum:

- species habitat assessments,
- focal species important habitat layers, metadata, methodologies and citations,
- important intermediary questions, resulting interpretations and influence on relative weighting system framework,
- a logical and defensible justification for the weighted system developed,
- a detailed methodology and metadata for the final relative importance map and
- the final, relative importance habitat map.

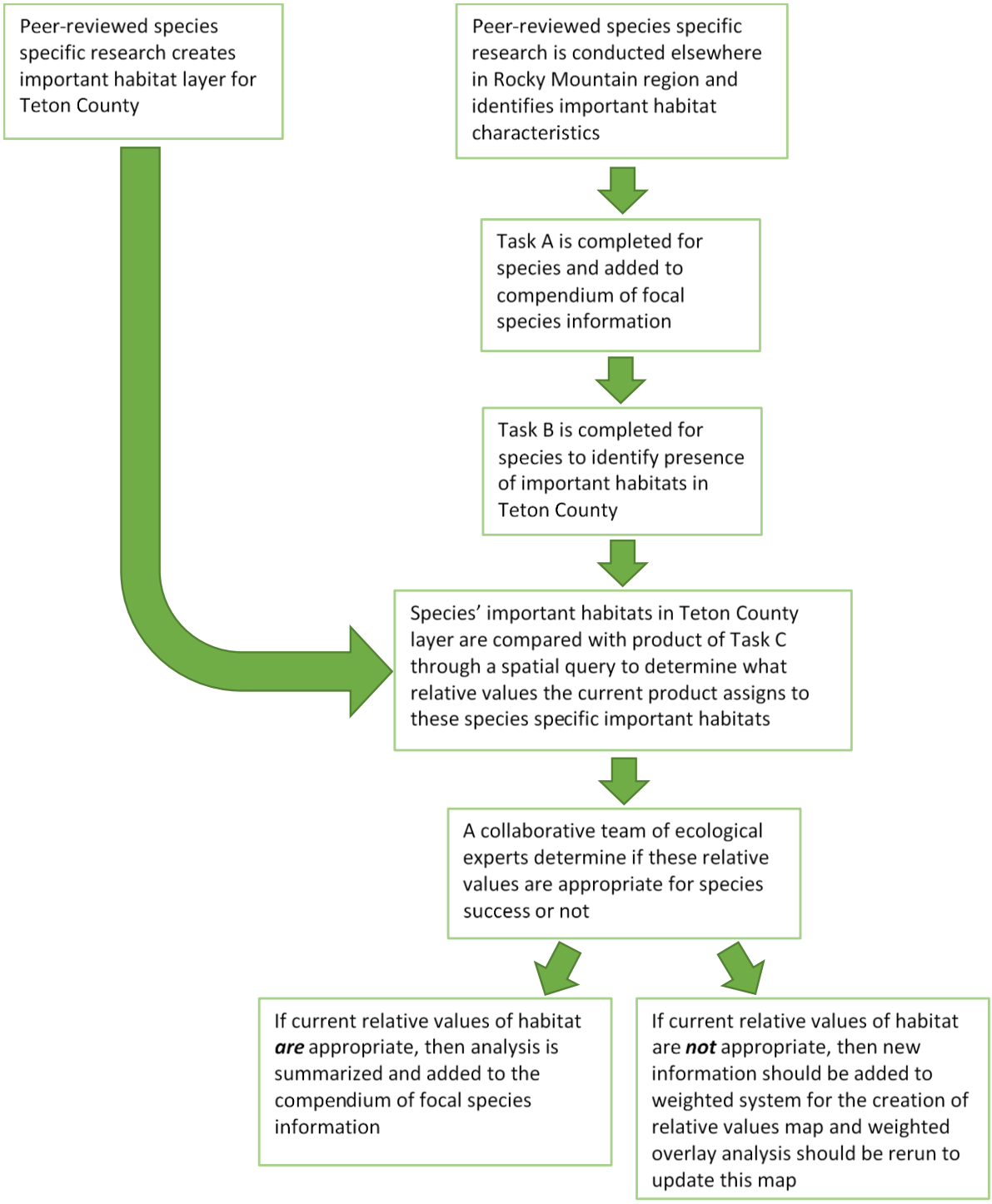
The methodologies in this report will be written so as to be repeatable for the incorporation of new species or habitat information to the final, relative values habitat map. Additionally, insights and interpretations of the research, intermediary products and final GIS relative importance layer that Alder's Team, NRTAB, Planning Staff, WGFD and involved experts deem as potentially informative to Teton County Planning staff and the Board of County Commissioners' work updating land development regulations will be included in the Final Report. Deliverables will be submitted in both hard copy and electronic format.

## ADAPTABILITY TO INCORPORATE FUTURE RESEARCH

A key component to this system of determining relative habitat importance across the landscape is that it can incorporate future research findings as they become available. For instance, if a peer-reviewed

research project on a sensitive species were to determine that species' important habitats, these findings could be incorporated into this product. An example scenario is described below in Figure 4.

**Figure 4. Incorporation of Future Research Species Specific Important Habitat Information**



## PRELIMINARY TIMELINE

This ambitious timeline is based on the assumption that the contract will awarded on August 9, 2016. If this is not the case, or other delays surrounding collaboration between the project team and Teton County Planning or NRTAB take place then the project timeline will be adjusted accordingly. The proposed timeline is an ambitious one which will require timely responses and feedback from all parties involved in this project. Alder Environmental's Team will do our utmost to adhere by this ambitious timeline. Another assumption implicit in this timeline is that NRTAB meetings and/ or ability to collaborate with Alder's Team will align in a timely fashion with the Team's need for feedback and input. Intermediary and major decision meetings and collaboration with both NRTAB and TC Planning Staff, while not specifically called out, are implied throughout the preliminary timeline. A high level of effective and efficient communication will be required for the success of this ambitious schedule.

| Task | Month | Specific Tasks/ Deliverables |
|---|---|---|
| Task A | August | Fine-Tune Focal Species List |
| Task A | August and September | Research and develop Species Important Habitat Assessments |
| Task B | October and November | Refine methodology and produce Important Habitat GIS Layers |
| Task C | December | Develop relative values and weighted sum methodology |
| Task C | January | Final Draft Report |
| Task C | Mid-February | Final Report and GIS Products |

## COMPANY AND COLLABORATIVE TEAM'S QUALIFICATIONS

Alder Environmental LLC has been in business for six years and currently employs four environmental consultants and one office staff with over 50 years of combined experience and a diversity of expertise in the natural resource professions in the region. Alder Environmental LLC's team consists of a diversified and highly qualified consulting staff with local expertise in natural resource assessments, spatial mapping and assessment of critical habitats, natural resources and wildlife habitat assessments, water monitoring, wetland delineations and habitat restoration.

The team of professionals Alder Environmental has assembled to work on this project have a tremendous number of years of experience (total estimated at >100 years) in biological sciences and spatial analysis (GIS). The team's expertise ranges from specific species and their habitats to landscape scale habitat and species assessments. Past projects have focused on disturbance effects, movement corridors and environmental planning. Please see the team's resumes for further details.

## ESTIMATED COST OF SERVICES

Acknowledging that this RFP is functioning within budget constraints and that our Estimated Cost of Services is higher than the proposed budget, Alder Environmental is open to discussions with regard to project budget, scope, project phasing and costs. There are several means by which project proposal costs could be altered including, but not limited to, trimming down the list of Focal Species for whom individual important habitat layers will be created. A fine-tuning of the number of species addressed would both remove redundancy of habitats as well as lessen the cost of the proposal for both Tasks A and B. Furthermore, if phasing of the project through a sequence of contracts is of interest to Teton County Planning Department, and would assist with budget constraints, this is an option that Alder Environmental would be willing to entertain.

| TASK | PERSONNEL | TOTAL |
|---|---|---|
| Task A - Species List Refinement | Alder & Team Experts | $ 1,120 |
| Task A - Focal Species Habitat Research (3 Species @ 3 hours ea) | Alder & Team Experts | $ 1,110 |
| Task A - Focal Species Habitat Research (14 Species @ 8 hours ea) | Alder & Team Experts | $ 12,400 |
| Task A - Meetings/ Team Coordination | Alder & Team Experts | $ 3,440 |
| Task A - Compilation of Materials for TC Planning | Alder | $ 1,000 |
| | | |
| Task B - Refine GIS Methodology to be consistent between species | Alder & Team Experts | $ 1,880 |
| Task B - Refinement of Habitat Map (1 Species @ 4 hours) | Team Expert | $ 440 |
| Task B - Creation of Habitat Maps (13 Species @ 8 hours ea | Alder & Team Experts | $ 12,140 |
| Task B - Meetings/ Team Coordination | Alder & Team Experts | $ 3,000 |
| | | |
| Task C - Framework/ Weighted System Development | Alder & Team Experts | $ 4,520 |
| Task C - Framework Conference with NRTAB & TC Planning | Alder & Team Experts | $ 2,120 |
| Task C - Develop Relative Importance Habitat Map | Alder & Team Experts | $ 1,320 |
| Task C - Develop Draft Report and Compile all GIS Products | Alder | $ 5,730 |
| Task C - Develop Final Report | Alder | $ 2,240 |
| | | |
| On-going - Monthly Reports to TC Planning (6 months) | Alder | $ 990 |
| | | |
| **Total Hours** | 31.0 | $ 53,450 |
| **EXPENSES** | **Units** | |
| Computer Software Fees | 1 | $ 1,000 |
| Printing of Paper Reports | 2 | $ 350 |
| | | |
| **PROPOSAL TOTAL ESTIMATED COST OF SERVICES** | | **$ 54,800** |

## CONDITIONS AND ADDITIONAL SERVICES

Teton County will be invoiced at the completion of each task by Alder Environmental for work completed. Terms are net 30 days. Additional services approved by Teton County will be billed at the rates provided below.

## EXCEPTIONS

Alder Environmental has no exceptions to the requirements of this Request for Proposals.

## PROFESSIONAL REFERENCES

**Susan Patla, Non-game Biologist, Jackson, WY, Wyoming Game & Fish Department**
(307) 733-2383 ext. 229, susan.patla@wyo.gov
Related Example Projects:

- 3 Creek Ranch Environmental Analysis Update (*2016 – in process*)
- 3 Creek Ranch Natural Resources Management Plan Updates (*2016 – in process*)
- Wild Red Trumpeter Swan Habitat Creation Project, Sublette County (*2014*)
- North American Wetlands Conservation Act (NAWCA) Upper Green River Proposal (*2012*)

**Roger Smith, 3 Creek Ranch Naturalist, 3 Creek Ranch**
(307) 690-9507, rsmith@3creekranchhoa.com
Related Example Projects:

- 3 Creek Ranch Environmental Analysis Update (*2016 – in process*)
- 3 Creek Ranch Natural Resources Management Plan Updates (*2016 – in process*)

**Carlin Girard, Water Resource Specialist, Teton Conservation District**
(307) 733-2110, carlin@tetonconservation.org
Related Example Projects:

- Fish Creek Sampling and Analysis Plan (*2015*)
- Fish Creek Biannual Biological and Chemical Sampling (*2014-2016*)

**Brian Schilling, Pathways Coordinator, Jackson Hole Community Pathways**
(307) 732-8573, bschilling@tetonwyo.org
Related Example Projects:

- Categorical Exclusion WYDOT Reports, Mitigation Plans, Wetland Delineations and Environmental Resource Reviews for various Pathways Projects including Broadway/ WY22, South Park and Karn's Meadow (*2014-2016*)

## LITERATURE CITED

Anderson, E. M., and S. H. Anderson 2001 "An Investigation of Wild Ungulate Impacts on Landbirds and Their Upland Aspen Habitat in Jackson Hole, Wyoming." Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming.

Cogan, D. and S. Johnson. 2013. Final Report and GIS Data: Vegetation and Non-Vegetation Cover Type Mapping for Teton County. Jackson, Wyoming. Available online at: http://www.tetonwyo.org/plan

Guyon J and J. Hoffman. 2011. Survey of Aspen Dieback in the Intermountain Region. USFS Report R4-OFO-Report 11-01. Accessed July 2016 at: http://www.western-aspen-alliance.org/files/links/AspenSurvey.pdf

## INSURANCE

Certificates of insurance available upon request.

**Workers' Compensation:** Per State Statute. Certificate included.

**General Commercial Liability:** Hartford Insurance (#34SBMIS0921), Commercial General Liability, $1,000,000/$2,000,000

**Professional Liability:** Continental Casualty (#EEH288350938), Professional Errors and Omissions, $500,000/$1,000,000

**Auto Liability:** Geico Insurance (#41446915956), Auto Liability $500,000/$1,000,000

## LIABILITY

Alder Environmental agrees to indemnify and hold harmless Teton County, WY government and its agencies against all forms of liability, claims, damages and demands, including attorney's fees and litigation expenses, of every kind and nature and that which results from or in any manner arises out of, or in connection with, the performance of work under this contract.

## COMPANY AND TEAM MEMBERS RESUMES

# ALDER ENVIRONMENTAL, LLC

*Water • Wetlands • Ecological Consulting*


## BRIAN E. REMLINGER

*Owner/Principal Scientist*

PO Box 6519
Jackson, WY 83002

(307) 733-5031
brian@alderenvironmental.com


## EDUCATION

**Graduate Certificate** — **Environmental Water Science** — 2004
University of Idaho, Moscow, ID
Coursework- Hydrologic Applications of GIS and Remote Sensing
Aquatic Restoration Ecology
Environmental Hydrology
Sampling and Analysis of Environmental Contaminants

**Bachelor of Science** — **Soil Science** — 1999
**Minor** — **Environmental Science and Technology**
California Polytechnic State University, San Luis Obispo, CA

## EXPERIENCE

**Owner & Principal Environmental Consultant** — 2010 - present
Alder Environmental LLC, Jackson, WY

**Project Manager & Environmental Consultant** — 2005 - 2010
Intermountain Aquatics Inc., Driggs, Idaho

**Geographic Information Systems (GIS) Consultant** — 2005
Independent Contractor, Jackson, WY

**Water Resources Specialist** — 2001 - 2005
Teton Conservation District, Jackson, WY

**Water Laboratory Technician & Water Systems Operator** — 1999-2001
Teton Village Water and Sewer District, Teton Village, WY

**Soils Material Technician** — 1998
Robert Prater Associates, Soil and Geotechnical Engineers, San Diego, CA

## PROFESSIONAL CERTIFICATIONS

**Professional Wetland Scientist** — 2012
Society of Wetlands Scientists Professional Certification Program
Recognized Areas of Expertise:

- Design and construction for wetland enhancement, restoration, creation, and mitigation
- Surface/subsurface hydrology measurements/monitoring
- Local/state/federal regulations and legal decisions

## PROFESSIONAL TRAINING & WORKSHOPS

**Biofiltration, Bioretention & Constructed Wetlands for Improving Stormwater Quality** — 2007
University of Washington Civil Engineering Program, Seattle, WA

**Riparian Ecology & Restoration** — 2003
USDA Natural Resources Conservation Service**,** Jackson, WY

**Applied Fluvial Geomorphology** — 2002
Dave Rosgen, Wildland Hydrology, Pinedale, WY

**Cooperative Riparian Restoration & Management** — 2002
National Riparian Service Team, Jackson, WY

**Watersheds & Riparian Zones** — 2001
Dr. Quentin Skinner, University of Wyoming, Laramie, WY

**Water Quality Monitoring Training** — 2001
Wyoming Association of Conservation District, Wyoming DEQ, Casper, WY

ALDER ENVIRONMENTAL, LLC

*Water • Wetlands • Ecological Consulting*

# MEGAN A. SMITH

*Wildlife Biologist/Ecologist*

PO Box 6519
Jackson, WY 83002

(307) 690-3625
megan@alderenvironmental.com

## EDUCATION

**Master of Science** — **Conservation Biology** — 2008
Antioch University New England, Keene, NH
*Thesis:* "The Effects of Residential Development on Avian Communities and Individual Species in Quaking Aspen: The Importance of Habitat Conservation on Private and Public Lands"

**Professional Residency** — **Environmental Education & Natural Science** — 2004
Teton Science Schools, Kelly, WY

**Bachelor of Arts** — **Environmental Studies: Environmental Science Education** — 1995
Middlebury College, Middlebury, VT

## EXPERIENCE

**Wildlife Ecologist, Alder Environmental, WY** — 2012-present
Manage all aspects of wildlife consulting projects including conservation easement baseline inventories, NEPA documents and wildlife monitoring and habitat assessment including authoring reports, study design, field work and GIS analysis.

**GIS Specialist, Pierson Land Works, WY** — 2012-2013
Manage GIS projects working with AutoCAD, MapInfo, Global Mapper and Google Earth products.

**USFS Sensitive Species Objectives, Sundance Consulting, ID** — 2012
Conducted literature review and authored background and risk factors sections of sensitive species objectives documents for the USFS Bridger-Teton National Forest.

**Project Coordinator, Jackson Hole Wildlife Foundation, WY** — 2010 – 2012
Managed all aspects of Nature Mapping Jackson Hole citizen-science project: database, website updates, conducted GIS/ statistical analysis, volunteer trainings, reports and public presentations.

**Wolverine Camera Trap Study, Wildlife Conservation Society, WY** — 2011
Volunteered with backcountry fieldwork (hair sample collection, camera operation, baiting traps) on camera trap study.

**Ecologist, Conservation Research Center, WY** — 2008 - 2010
Managed all aspects of ungulate habitat assessments: supervision, authored reports, GIS analysis, agency and public presentations.

**Earthwatch Project Coordinator, Conservation Research Center, WY** — 2008
Trained and managed citizen science volunteer researchers in songbird nest searching, resighting and data collection.

**Sage-Grouse Research Technician, Patricelli Lab Uni. of California Davis, Lander, WY** — 2008
Monitored Sage Grouse populations to investigate the effects of energy development noise through playback experiments.

**Songbird Point Count Research Technician, Hubbard Brook Experimental Forest, NH** — 2007
Conducted fixed radius point count bird surveys; playback experiments; resighting; nest searching and territory mapping.

**Graduate Teaching Assistantships, Antioch University New England, Keene, NH** 2006-2007
Ecological Research Design (statistics), Spring 2007; GIS, 2006-2007; Community Ecology, Fall 2006

**Master's Student, Conservation Research Center, WY** 2006
Generated and analyzed GIS landscape data examining birds breeding in aspen habitat along a human development gradient.

**Fuels Project Research Technician, Conservation Research Center, WY** 2005
Initiated vegetation study monitoring fuel loading in forest parcels of a residential matrix.

## PRESENTATIONS & TRAININGS

**The Wildlife Society, Wyoming Conference**
*Nature Mapping: citizen scientists collecting wildlife data on public & private lands, presentation,* 2011
**North American Moose Conference**
*Nature Mapping: citizen scientists collecting wildlife data on public & private lands, presentation,* 2011
**The Wildlife Society, Wyoming Conference** *Platte Valley Habitat Assessment Preliminary Results, presentation*, 2010
**The Wildlife Society, Montana Conference**
*Effects of Residential Development on Avian Communities Breeding in Aspen Habitat, poster*, 2008
**GIS for Conservation Biologists Guest Lecturer, Antioch University New England**
*The Effects of Residential Development on Avian Communities Breeding in Aspen Habitat*, 2006
**Creating Healthy, Supportive Work Environments** – *NewLevel Group,* 2012
**Facilitating Effective Meetings** – *Leadership at Play,* 2012
**Managing the NEPA Process and Writing Effective NEPA Documents** – *The Shipley Group*, 2008

## PUBLICATIONS & REPORTS

**Smith, M.A.** and B.E. Remlinger. 2013. *Conservation Easement Baseline Inventories* contracted by The Conservation Fund. Five inventory reports including vegetation, wildlife, property use and GIS documentation.

**Smith, M.A**., S. Kilpatrick, B. Younkin, L. Work and D.G. Wachob. 2011. *Assessment of Moose Crucial Winter Habitat Conditions in Western Wyoming. Alces (47)151-162.*

**Smith, M.A.** and B. Younkin, reports contracted by the Wyoming Game &Fish Dept. (primary author):
*Sublette Moose Habitat Assessment: Upper Green River to LaBarge Creek* April 2010
*Wyoming Range Mule Deer Habitat Assessment: Deer Hills, Calpet & Little Colorado* March 2010
*Wyoming Range Mule Deer Habitat Assessment: South LaBarge* January 2010
*Platte Valley Mule Deer Habitat Assessment: Northern Section* December 2009
*Platte Valley Mule Deer Habitat Assessment: Southern Section* February 2009

**Smith, M.A** and D.G. Wachob. (in preparation) *Effects of Low Density Residential Development on Avian Communities in Aspen Stands*

## VOLUNTEER COMMITTEES & PROFESSIONAL AFFILIATIONS

**Jackson/ Teton County Pathways Task Force**, 3 year appointment, 2012-present
**The Wildlife Society**, 2009-present
**Society for Conservation Biology**, 2005-2008

# Bryan Bedrosian

bryan@tetonraptorcenter.org
307.690.2450

## Education

| | | |
|---|---|---|
| University of Wisconsin- Stevens Point | B.S. (Biology) | 2001 |
| Arkansas State University – Jonesboro, WI | M.S. (Biology) | 2005 |

## Positions

Teton Raptor Center, Wilson, WY – *Senior Avian Ecologist* 2015-Current
Primary responsibilities include research project design, employee oversight, coordination, field work, data analysis, manuscript and report preparation, education, and fundraising.

Craighead Beringia South, Kelly, WY – *Avian Program Director* 2001 – 2015
Primary responsibilities include research project design, employee oversight, coordination, field work, data analysis, manuscript and report preparation, and fundraising.

## Recent Research Projects

| | |
|---|---|
| *Great Gray Owl Habitat Use and Demographics* – Principle Investigator | 2012-Present |
| *Flammulated Owl Abundance in Teton County* – Principle Investigator | 2016-Present |
| *Goshawk Ecology in Teton County* – Principle Investigator | 2016-Present |
| Bald Eagle Genetic Dispersal and Management Areas in the GYE – Co-PI | 2016-Present |
| Monitoring Avian Productivity and Survivorship for songbirds – Principle Investigator | 2015-Present |
| *Golden Eagle Migratory Behavior* – CO-Principle Investigator w/ Raptor View Research | 2006-Present |
| *Hybrid satellite GPS, downloadable transmitter manufacturing* – Principle Investigator | 2011-Present |
| *Golden Eagle Distribution, Abundance, and Winter-Range* – Principle Investigator | 2011-Present |
| *Raptor Migration Patterns in the GYE* – Collaborator w/ Grand Teton NP | 2010-Present |
| *Sage Grouse Ecology in Western WY*– Principle Investigator | 2007-Present |
| *Behavior of Ravens in Sage-Grouse Habitat* – Collaborator w/Hayden-Wing Assoc. | 2012-Present |
| *Golden Eagle Demographics in south-central Montana* - Principle Investigator | 2010-2014 |
| *Lead Ingestion in Avian Scavengers* - CO-Principle Investigator | 2004-2012 |
| *Bald Eagle Habitat Use in Relation to Energy Development* – CO-Principle Investigator | 2011-2014 |
| *Common Raven Ecology in Jackson Hole* – Principle Investigator | 2001-2012 |

## Select Peer Reviewed Publications

Bedrosian, B. E. 2005. Nesting and post-fledging ecology of Common Ravens in Jackson Hole. M.S. Thesis. Arkansas State University, Jonesboro, AR

Bedrosian, B., S. Cain, S. Wolff, and D. Craighead. 2015. Migratory pathways, timing and home ranges of southern Greater Yellowstone Osprey. Journal Raptor Research. 325-332.

Bedrosian, B and D. Craighead. 2007. Evaluation of techniques for attaching transmitters to Common Raven fledglings. Northwestern Naturalist. 88:1-6.

Bedrosian, B. and D. Craighead. 2005. Band Wear in Common Ravens (Corvus corax). N.A. Bird Bander. 32:149-152.

Bedrosian, B., J. Loutsch, and D. Craighead. 2008. Using morphometrics to determine the sex of Common Ravens. Northwestern Naturalist. 89:46-52.

Bedrosian, B., D. Craighead, and T. Rogers. 2008. Record mass for North American Golden Eagle.

Journal of Raptor Research. 42:156-157.
Bedrosian, B, R Crandall, and D Craighead. 2012. Lead exposure in bald eagles from big game hunting, the continental implications and successful mitigation efforts. PLoS One.
Bedrosian, B, C. Parish, and D. Craighead. 2009. Differences in blood lead levels detection techniques: Analysis among and between three techniques and four avian species. In: RT Watson, M Fuller, M Pokras, and WG Hunt (Eds). Ingestion of Lead from Spent Ammunition: Implications for Humans and Wildlife. The Peregrine Fund, Boise, ID
Bedrosian, B. and A. St. Pierre. 2007. Frequency of injuries in three species of wintering raptors in Northeast Arkansas. Wilson Bulletin. 119:296-298.
Bui, T.D., J.M. Marzluff, and B. Bedrosian. 2010. Common raven activity in relation to land use in western Wyoming: implications for greater sage-grouse reproductive success. Condor 112:65-78
Craighead, D. and B. Bedrosian. 2008. Blood lead levels of Common Ravens with access to big-game offal. Journal of Wildlife Management. 72:240-245.
Crandall, R. H., B. E. Bedrosian, and D. Craighead. 2015. Habitat selection and factors influencing nest survival of golden eagles in south-central Montana. Journal Raptor Research. 49:413-428.
Domenech, R., B. Bedrosian, R. Crandall, and V. Slabe. 2015. Space use and habitat selection by adult migrant golden eagles wintering in the western United States. Journal Raptor Research. 49:429-440.
Fedy, B. C., Aldridge, C. L., Doherty, K. E., O'Donnell, M., Beck, J. L., Bedrosian, B., Holloran, M. J., Johnson, G. D., Kaczor, N. W., Kirol, C. P., Mandich, C. A., Marshall, D., McKee, G., Olson, C., Swanson, C. C. and Walker, B. L. 2012. Interseasonal movements of greater sage-grouse, migratory behavior, and an assessment of the core regions concept in Wyoming. The Journal of Wildlife Management, 76: 1062–1071.
Lish, J., R. Domenech, B.E. Bedrosian, D. Ellis, and M. Payton. 2016. Wing-loading in North American Golden Eagles (*Aquila chrysaetos*). Journal of Raptor Research. 50:70-75.
Pauli, J, B. Bedrosian and N. Osterberg. 2006. Effects of blowdown on small mammal populations. American Midland Naturalist. 156:151-162.
Rogers, T., B. Bedrosian, and K. Foresman. 2011. Lead exposure in large carnivores in the Greater Yellowstone Ecosystem. Journal of Wildlife Management.
Schulwitz, S., B. Bedrosian and J.A. Johnson. 2014. Low neutral genetic diversity in isolated Greater Sage-grouse populations in northwest Wyoming. Condor. 116:560-573.

**Professional Appointments**

- Member, Western Golden Eagle Team 2016-Current
- Member, Wyoming Golden Eagle Working Group 2016-Current
- Member, Montana Golden Eagle Working Group 2011-Current
- Member, Jackson Hole Airport Wildlife Damage Management Advisory Board 2012-Current
- Founder, Wildlife Unleaded 2012-Current
- President, The Wildlife Society; Wyoming Chapter 2011-2013
- Board Member, Nature Mapping Jackson Hole 2010-2014

**Certified Training**

U.S. National Bird Banding Laboratory Certified Net Launcher Trainer

Bryan Bedrosian
bryan@tetonraptorcenter.org
307.690.2450
U.S. National Bird Banding Laboratory Certified Trainer for Affixing Raptor Transmitters

**Relevant Business Experience**

Owner/Founder – Trapping Innovations, LLC Founded 2009
Invented and started a business manufacturing safe and effective wildlife net launchers used primarily for eagles and other birds. Oversee all operations, sales and production.

**Other Professional Collaborations**

- Institute for Zoo and Wildlife Research; Germany — White-tailed Sea Eagle Research
- Jackson Hole Airport; Jackson, WY — Sage-grouse Research
- National Geographic Society; Florida — Alligator Project
- Norwegian Institute for Nature Research; Norway — White-tailed Sea Eagle Research
- Cimmeron National Grassland; Oklahoma — Lesser Prairie Chicken Research
- Harris Environmental; Washington — Raven Research
- The Peregrine Fund; Arizona — Golden Eagle Project

# Kevin Krasnow, PhD.

Research and graduate faculty, Teton Science Schools Graduate Program
Adjunct Assistant Professor, Haub School of Environment and Natural Resources, Univ. of Wyoming
700 Coyote Canyon Road
Jackson, WY 83001
Phone: (307) 203-7511  Email: kevin.krasnow@tetonscience.org

*I am a disturbance ecologist and educator seeking sustainable solutions to pressing environmental questions. My research focuses on understanding disturbance ecology, global change, ecosystem resilience, and effective science education.*

## EDUCATION

2012 **University of California, Berkeley**, Ph.D.
- Research focused on fire history, prescribed fire effects, and aspen ecology

2007 **University of Colorado, Boulder**, M.S. Geography
- Masters thesis on fuel mapping, fire simulation, and strategic fire mitigation

2004 **San Francisco State University**, California Teaching Credential, Biological Sciences

1998 **Stanford University**, B.S. Human Biology

1998 **Wilderness Medicine Institute**, Wilderness Emergency Medical Technician (WEMT)

## EMPLOYMENT HISTORY

2012 - pres. **Research and graduate faculty**, Teton Science Schools, Jackson, WY
- Designed and delivered courses on ecology and social ecological systems
- Mentored graduate students in experimental design and statistical analysis
- Conducted research on fire history and aspen ecology
- Directed educational research within the organization

2010-2011 **Forest Fuels and Fire Simulation Specialist**, Boulder County, CO
- Created forest fuel maps and conducted county-wide wildfire simulation
- Created wildfire risk maps for wildfire protection planning

2002-2005 **Science Department Chair**, Gateway High School, San Francisco, CA
- Led department to formulate science curriculum scope and sequence
- Mentor Teacher (’04, ’05)

2002-2005 **Director, Gateway Outdoor Leadership and Science Program (GOLS)**

- Founded, funded, and instructed this experiential leadership and ecology program
- Logged over 600 student-field-days per year

2000-2005 **Teacher,** Gateway High School, San Francisco, CA

- Courses included Biology, Chemistry, Environmental Civics, and Outdoor Leadership and Science

1999–2002 **Lead instructor**, Voyageur Outward Bound School, Beartooth Mountains, Montana

1997-1998 **Research assistant**. Stanford Center for Adolescent Study, Stanford, CA

## PUBLICATIONS

**Peer Reviewed:**

**Krasnow, K.D.,** S.L. Stephens. 2015. Evolving paradigms of aspen ecology and management: Impacts of stand condition and fire severity on vegetation dynamics. Ecosphere 6(1).

Collins, B. M., Das, A. J., Battles, J. J., Fry, D. L., **Krasnow, K. D.,** & Stephens, S. L. 2014. Beyond reducing fire hazard: fuel treatment impacts on overstory tree survival. Ecological Applications, 24(8), 1879-1886.

**Krasnow, K.D.,** A.S. Halford, and S.L. Stephens. 2012. Aspen restoration in the eastern Sierra Nevada: effectiveness of prescribed fire and conifer removal. Fire Ecology 8(3): 104-118.

**Krasnow, K**., T. Schoennagel, T.T. Veblen. 2009. Forest fuel mapping and evaluation of LANDFIRE fuel maps in Boulder County, Colorado, USA. Forest Ecology and Management 257, 1603-1612.

**Krasnow, K**., T. Shoennagel, T.T. Veblen. 2007. Forest fuel maps of the montane zone of Boulder County, Colorado (data for fire simulation modeling, masters thesis product). Archived at the Boulder County Forest Service office and the Boulder Open Space and Mountain Parks office. These maps were used for a community wildfire protection plan.

**Curriculum:**

**Krasnow, K.D.** and Wachob, D. 2015. Wildland fire: human perspectives, and fire management in Jackson Hole, Wyoming. National Socio- Environmental Synthesis Center, Case 2014-7.

**Other publications:**

Shinneman, D.J., **Krasnow, K.D.,** McIlroy, S.K. 2015. The role of fire in aspen ecology and restoration. Western Aspen Alliance management brief #3. June, 2 pp.

Shinneman, D.J., Halford, A.S., Howell, C., **Krasnow, K.D**., Strand. E.K. 2015. Management of aspen in a changing environment. Colorado State University Extension and USDA Forest Service Great Basin Factsheet Series, number 12.

Riginos, C., Newcomb, M., Wachob, D., Schechter, J., **Krasnow, K.D.** 2015. The Coming Climate: Ecological and Economic Impacts of Climate Change on Teton County.

Sibold, J., **Krasnow, K.D.,** Abendroth, D. 2015. Fire History of Grand Teton National Park and surrounding areas: Did an historical map from 1898 capture the distribution of late 19th century fire? Year one report to Grand Teton National Park on preliminary results of fire history study.

Riginos, C.R., **Krasnow, K.D.,** Hall, E., Graham, M. Sundaresan, S., Brimeyer, D., Fralick, G., Wachob, D. 2013. Mule Deer (Odocoileus hemionus) Movement and Habitat Use Patterns in Relation to Roadways in Northwest Wyoming. Final report to Wyoming Department of Transportation.

**Krasnow, K**. 2011. Boulder County Community Wildfire Protection Plan, Chapter 14 – Assessing Wildfire Risk.

**Krasnow, K.D.** 2012. Managing novel forest ecosystems: understanding the past and present to build a resilient future (PhD Dissertation).

**Krasnow, K**. Forest Fuel Mapping and Strategic Wildfire Mitigation in the Montane Zone of Boulder County, Colorado. (2007 Masters Thesis).

**Recent Press:**

Planet Jackson Hole on fire regime research in Jackson Hole, September 8, 2015.

Wyoming public media on our climate change report, June 17, 2015.

Jackson Hole News and Guide on climate change report, June 10, 2015.

Wyofile on climate change report, June 9, 2015.

Planet Jackson Hole on climate change report, June 9, 2015.

**In Preparation for peer-reviewed publication:**

**Krasnow, K**., S.L. Stephens. Spatial, temporal, and latitudinal components of historic fire regimes in the mixed conifer forests of the Sierra Nevada Mountains.

**Krasnow, K.,** S.L. Stephens. Human assisted migration, carbon allocation, and intraspecific competition in western aspen.

Sibold, J. **Krasnow, K.D.** Abendroth, D. Fire history of Grand Teton National Park and surrounding areas.

Riginos, C.R., **Krasnow, K.D.,** Hall, E., Graham, M. Sundaresan, S., Brimeyer, D., Fralick, G., Wachob, D. 2013. Mule Deer (Odocoileus hemionus) Movement and Habitat Use Patterns in Relation to Roadways in Northwest Wyoming.

## GRANTS AND FELLOWSHIPS

2016 **Wyoming State Forestry Collaborative Assistance Program (FCAP),** Support for collaborative northwestern Wyoming aspen working group focused on research, education, and stewardship, $10,000

2015 **Fuels reserve fund**, **Grand Teton National Park**, Fire history and regeneration dynamics of low-elevation Douglas fir forests in the Grand Teton area, PI, $53,000

2015 **State Historic Records Advisory Board**, Historical landscape photo preservation, update, and dissemination, PI, $1,000

2014 **Fuels reserve fund**, **Grand Teton National Park**, Fire History of Grand Teton National Park, Co-PI, $21,000

2011 **Baker – Bidwell Forestry Fellowship**, Department of Environmental Science, Policy, and Management, UC Berkeley, $16,000

2011 **Travel, Research, an Educational Experience (TREE) Grant**, Association for Fire Ecology, $2,000

2009-2010 **Bureau of Land Management**, Aspen restoration and monitoring research grant $7,500

2005-2007 **Chancellors Fellowship**, University of Colorado, Bolder, $33,000

2004 **John Ernest Foundation**, Environmental Education Grant $2,000

2004 **GAP** employee matching grant for the GOLS program, $1,000

2002 **Duetche Bank**, Environmental Leadership Grant, $2,000

2001-2004 **San Francisco Education Fund**, Leadership and professional development grant, $12,000

## AWARDS / HONORS

2012 **Teaching Effectiveness Award**, UC Berkeley http://gsi.berkeley.edu/krasnowk-2012/

2010 **Outstanding Graduate Student Instructor Award,** UC Berkeley

1998 **Stanford University, Biology department**, Biology Excellence (top 5% of biology students)

1998 **Stanford University**, Children in Society certificate recipient

1997 **National Outdoor Leadership School (NOLS),** Kenya – Elected small group expedition leader, Mount Kenya Expedition.

## ADVISING

2015-2016 Julie Thomsen – *Exploring the Impacts of Teton Science Schools' Field Education Programs on Visiting Teachers' Beliefs and Practices about Place-Based Education*, master's committee.

2012 – pres. Supervised graduate student field-based ecological research and statistical analysis, advised graduate students on future graduate study and theses projects.

2009 - 2011 Supervised and advised undergraduates in the UC Berkeley Sponsored Projects for Undergraduate Research (SPUR) program for 5 semesters (Bradley Kerr, Paul Cheng, Chris McCoy, Carlin Starrs, Timbo Stillinger, Julien Vollerang, Lisa Roshenthal, Ariel Thompson, Pablo Beimler).

Summer 2009 Supervised and advised undergraduate student from the Environmental Leadership Pathway program in field data collection and anaylsis (Stephanie Nale)

## TEACHING EXPERIENCE

*University courses:*

2012 - pres. **Community Ecology of the Greater Yellowstone Ecosystem** (UW ZOO 5430)

2012 - pres. **Winter Ecology** (Univ. of Wyoming - ZOO 5405)

2013 - pres. **Advanced Elements of Field Ecology Course Design** (NASC 5620)

2013 - pres. **Ecological Inquiry** (Univ. of Wyoming – ZOO 5420)

2013 **Skills of a Winter Naturalist** (Univ. of Wyoming - ENR 4890-03 NASC 4800-63)

2013 **Wildlife and Plant Adaptations to Winter** (UW- ENR 4890-09 NASC 4800-60)

2010 **Wildland Fire Science Lab** (UC Berkeley - ESPM 181A) → Received outstanding instructor award

2010 **Teaching Environmental Science** (UC Berkeley - UGIS 80)

*High school courses:*

2000-2005 **Biology and Honors Biology**

2002-2005 **Gateway Outdoor Leadership and Science (GOLS) Program**. Designed a unique curriculum to develop leadership skills, natural history knowledge, critical thinking, physical fitness, and outdoor skills through experiential lessons and service learning.

2004-2005 **Environmental civics**. Developed curriculum and co-taught this senior level class that focused on the causes, consequences, and possible solutions for pressing issues in social ecological systems.

## OUTREACH / SERVICE

2013 - pres. **Western Aspen Alliance** – Steering committee

2010-2012 **Student Association for Fire Ecology (SAFE)**, UC Berkeley. President.

2011-2012 **Graduate Student Representative to the Ecosystem Science Division** of the ESPM Department (elected position)

2007-2008 **Graduate Student Association Chair**, UC Berkeley (elected position)

2001-2005 **Inner City Outings, Sierra Club**. San Francisco Bay Chapter.

- Certified outing leader and new leader trainer

2001-2005 **Stanford Outdoor Outreach Program (SOOP),** Palo Alto, California

- New leader trainer and volunteer

## CONTRIBUTED PRESENTATIONS

**Krasnow, K.D.**., S.L. Stephens. *Disturbance and maintenance of aspen ecosystems*. Association for Fire Ecology and International Association of Wildland Fire – Large Wildfire Conference. May 19-23, 2014. Missoula, Montana.

**Krasnow, K.D** *Spatial and temporal dynamics of historical fire regimes in Sierran mixed conifer forests, California*. Association for Fire Ecology - International Fire Congress. December 3-7, 2012. Portland, Oregon.

**Krasnow, K.D**., A.S. Halford, S.L. Stephens. *Wildfire, management, and regeneration of quaking aspen (Populus tremuloides) in the Sierra Nevada and Glass Mountains, California.* Interior West Fire Ecology Conference: Challenges & Opportunities in a Changing World. November 14-17, 2011. Snowbird, Utah.

**Krasnow, K.D**. *Negotiating fire climate interactions: Adaptive management of quaking aspen in the Sierra Nevada*. Bay Area Conservation Biology Symposium. February 12th, 2011. Berkeley, CA.

**Krasnow, K.D**. *Forest fuel mapping and validation of Landfire fuel maps in the montane zone of Boulder County, Colorado*. Fire in the Southwest: Integrating fire into management of changing ecosystems. January 28-31, 2008. Tucson, Arizona.

**Krasnow, K.D**. *Risk management in wilderness education programs*. Annual California Network of Educational Charter Schools Conference. March 28th, 2003. Los Angeles, California.

## INVITED PRESENTATIONS

**Krasnow, K.D.** *Evolving paradigms of aspen ecology and management*. Learn at lunch webinar, Utah State University, March 19, 2016.

**Krasnow, K.D**. *Wildlife management issues and controversies in the Greater Yellowstone Ecosystem*. Road Scholar Jackson Hole, August 20, 2015.

**Krasnow, K.D**. and Rogers, P.C. *Aspen habitat: a dynamic portrait*. Wyoming Game and Fish annual Aspen Days, August 10, 2015, Pinedale, WY.

**Krasnow. K.D**. *Changing paradigms of aspen ecology and management*. Native Plant Society, Teton Chapter, September 23, 2015, Jackson, WY.

**Krasnow. K.D**. *Regenerating Aspen*. University of California Forest Research and Outreach Reforestation Webinar, Feb. 26, 2014

**Krasnow. K.D**. *Fire Science for Sustainability*. Webcast interview on InnovatingSMART.com, Feb. 22, 2011 http://innovatingsmart.podbean.com/2011/02/22/

**Krasnow. K.D**. *Forest management in wilderness areas*. Western Wilderness Conference. April 8-11, 2010. University of California, Berkeley.

**Krasnow. K.D**. *Aspen ecology and restoration in the Sierra Nevada*. Department of Environmental Science, Policy, and Management Forestry Seminar. April 22, 2010.

## POSTER PRESENTATIONS

**Krasnow. K.D**, S.L. Stephens. *Disturbance and aspen regeneration in the Sierra Nevada*. Restoring the West Conference. October 16-18th, 2013. Logan, Utah.

**Krasnow. K.D**., A.S. Halford, S.L. Stephens. *Wildfire, management, and regeneration of quaking aspen (Populus tremuloides) in the Sierra Nevada and Glass Mountains, California, USA.* Ecological Society of America, August 12, 2011. Austin, TX.

**Krasnow. K.D**. *Post Fire Aspen Restoration and Human Assisted Migration in the Angora Fire Area, Lake Tahoe, California*. Pre and Post Wildfire Management Conference. February 10, 2010. Sacramento, CA.

**Krasnow. K.D**., T. Schoennagel, T.T. Veblen. *Fuel Mapping and Strategic Wildfire Mitigation in Boulder County, Colorado*. Association of American Geographers Annual Conference. April 18, 2007. San Francisco, CA.

## MANUSCRIPT REVIEWS

*Global Change Biology*
*Forest Ecology and Management*
*Restoration Ecology*
*Environmental Modeling*
*Fire Ecology*
*Landscape Ecology*
*Ecology and Society*

## AFFILIATIONS

Association for Fire Ecology
Student Association for Fire Ecology
Ecological Society of America
Society for Conservation Biology
International Association for Wildland Fire
Association of American Geographers
Association for Experiential Education

# *L. CHRISTINE PAIGE*

*962 Dusty Trail Rd., Driggs, Idaho, USA 83422*

*Cell 406-544-6143* *chrispaige@gmail.com*


## PROFILE

*I work toward practical conservation solutions for wildlife, their habitats, and wild places.*

- Skilled in science outreach & communications; extensive writing and editing experience.
- Seasoned wildlife biologist with expertise in field studies and conservation biology.
- Passionate about hands-on conservation solutions to protect imperiled wildlife and their habitats.
- Keen interests in wildlife behavior and ecology, human-wildlife coexistence and climate change.
- Experienced project manager; strong organizational, logistical and interpersonal skills.
- Passion for outdoor photography and backcountry travel.
- Experience working and traveling in the wilds of North America and worldwide, including Arctic and Coastal Alaska, Northern Rockies, Desert Southwest, Botswana, Tanzania, Peruvian Amazon, western Mexico, Costa Rica, the Caribbean, Hawaii, and South Pacific.

## PROFESSIONAL EXPERIENCE

RAVENWORKS ECOLOGY, Driggs, Idaho 1996 – Present

***Independent Wildlife Biologist / Owner***

I provide expertise in wildlife conservation for agency and conservation clients. I research and write conservation guidelines, management assessments and status reviews, and provide outreach and communications for wildlife conservation and management. I also design and conduct wildlife field surveys. Projects include:

*Science to Solutions.* A series of outreach articles on recent science findings for sage grouse conservation. Sage Grouse Initiative, USDA Natural Resources Conservation Service.

*Wildlife Friendly Fences.* Published two manuals on wildlife friendly fence designs for landowners, sponsored by the Wyoming Land Trust and Montana Fish, Wildlife and Parks. Also consult on wildlife friendly fence projects for agencies and landowners.

*Upper Snake River Wetland Conservation Plan*. Wrote the wildlife analysis for the plan on contract with Alder Environmental Services, Jackson, WY.

*Polar Bear Recovery Plan.* Contributed text and literature research to the polar bear recovery plan, U.S. Fish and Wildlife Service, Fairbanks, Alaska.

*Pika Habitat and Occupancy Surveys, Grand Teton National Park.* Supervised field crew and field logistics for pika surveys in Grand Teton NP and Greater Yellowstone Ecosystem.

*Sensitive Waterbird Surveys.* Conducted occupancy surveys of colonial nesting waterbirds throughout western Montana for Montana Fish, Wildlife and Parks and Montana Audubon.

*Sagebrush Shrub-steppe Important Bird Areas*. Guided the delineation of five greater sage-grouse IBA's totaling 10,000 square miles across Montana on behalf of Montana Audubon.

*Sagebrush Breeding Bird Surveys*. Designed and conducted for Sun Ranch, Madison Valley, Montana.

*Prairie Grassland Breeding Bird Surveys.* Conducted for Montana Natural Heritage Program.

*Riparian Breeding Bird Surveys.* Conducted for Lava Lake Land and Livestock, Hailey, Idaho.

*State of the Parks: Waterton-Glacier International Peace Park Science Report*. Researched and written for National Parks Conservation Association, Fort Collins, Colorado.

*America's Wildlife: the Challenge Ahead*. Authored a report to Congress on the status of U.S. wildlife populations as background information for the State Wildlife Grants legislation. Researched and written for the Association of Fish and Wildlife Agencies, Washington, D.C.

## PROFESSIONAL EXPERIENCE *(Continued)*

FREELANCE, Jackson, Wyoming 1989 – Present

***Science and Natural History Writer/Editor***

- Writer of natural history articles concerning wildlife and conservation. Published in *Montana Outdoors, Audubon, Wildlife Conservation, Bugle, Montana Magazine, Wild Outdoor World* and others.
- Editor and writer, *Vital News*, news magazine of the Vital Ground Foundation, 2005–2010.
- Writer, *Habits and Habitats* column for *Bugle* magazine, Rocky Mountain Elk Foundation, 2003–2009.

ECOTOUR ADVENTURES, Jackson, Wyoming 2013

***Naturalist Guide*** (part time)

- Guided private wildlife tours in Grand Teton National Park.

JACKSON HOLE WILDLIFE FOUNDATION, Jackson, Wyoming 2010

***Interim Executive Director***

- Served as interim director during period of transition for the foundation. Provided continuity for administration, programs, and outreach to volunteers. Wrote grant proposals, developed new education materials, coordinated activities with board of directors.

NATIONAL WILDLIFE FEDERATION, Missoula, Montana 2003

***Coordinator, Sage-Grouse Adopt-a-Lek Program***

- Coordinated sage-grouse lek survey program in Montana, Wyoming and Nevada.
- Adapted survey protocols; trained and supervised volunteers; coordinated field efforts and agency contacts.
- Managed and summarized data; managed budget; produced summary reports.

MONTANA NATURAL HERITAGE PROGRAM AND U.S. FOREST SERVICE, Missoula, Montana 1995

***Coordinator, Migratory Bird Program, Northern Region***

- Directed, implemented and supervised annual land-bird monitoring program on 13 national forests.
- Trained and supervised 20 field assistants; coordinated surveys, data sharing and reports with interagency partners.
- Provided expertise on bird ecology and management issues to agency managers and biologists.
- Served as Partners in Flight representative to regional and national working groups.

U.S. FOREST SERVICE, Missoula, Montana 1992 – 1995

***Biologist, Migratory Bird Program, Intermountain Research Station and Northern Region***

- Supervised field study of songbird habitat fragmentation in northern Idaho.
- Managed region-wide neo-tropical migratory bird program: supervised development and implementation of regional bird monitoring program.
- Promoted communication between researchers and resource managers; served on national and regional Partners in Flight working groups.

FLATHEAD NATIONAL FOREST, Kalispell and Whitefish, Montana 1990 – 1991

***Wildlife Biologist***

- Designed protocols and coordinated monitoring projects for species of concern and management indicator species, including pileated woodpecker, barred owl, pine marten and bald eagle.
- Researched and wrote regional bald eagle management guidelines, site-specific conservation plans, and an evaluation of old-growth monitoring strategies.

## ADDITIONAL FIELD EXPERIENCE

WILDLIFE CONSERVATION SOCIETY, Iringa, Tanzania, 2004.
**Wildlife Biologist** (*volunteer***)**, Cheetah and African wild dog social surveys, aerial hippo surveys.

BOTSWANA PREDATOR CONSERVATION PROGRAM, Botswana, 2002.
**Research Assistant** (*volunteer*), African wild dog study, Okavango Delta.

UNIVERSITY OF MONTANA, western Mexico, 1990.
**Research Assistant**, Wintering songbird study.

SMITHSONIAN INSTITUTION and USFWS, Peruvian Amazon, 1989.
**Research Assistant**, Songbird ecology and breeding behavior study.

UNIVERSITY OF MONTANA, Division of Biology, Missoula, Montana, 1986.
**Research Assistant**, Songbird & spruce budworm study.

USFWS, Turks and Caicos, British West Indies, 1985.
**Research Assistant**, Wintering Kirtland's warblers study.

WASHINGTON STATE UNIVERSITY, Pullman, Washington, 1984.
**Research Assistant**, Oregon Cascades old-growth forest wildlife study.

NORTH DAKOTA STATE UNIVERSITY, North Dakota Badlands, 1981.
**Research Assistant**, Prairie falcon and golden eagle study.

WASHINGTON DEPT. OF FISH AND WILDLIFE, San Juan Islands, Washington, 1980.
**Research Assistant**, Bald eagle nesting study.

## EDUCATION

UNIVERSITY OF MONTANA, Missoula, Montana
***Master of Science in Wildlife Biology,*** 1990. Emphasis in wildlife ecology, populations and monitoring.

THE EVERGREEN STATE COLLEGE, Olympia, Washington
***Bachelor of Arts in Environmental Studies,*** 1980.

SCHOOL FOR INTERNATIONAL TRAINING, EXPERIMENT IN INTERNATIONAL LIVING, Kathmandu, Nepal, ***Semester Abroad***, 1979. Training in int'l development and environmental issues.

NATIONAL OUTDOOR LEADERSHIP SCHOOL, Lander, Wyoming
***Semester Wilderness Leadership***, 1978. Wilderness travel & leadership training.

## VOLUNTEER SERVICE

USGS Breeding Bird Survey, *Volunteer*, Montana & Wyoming, 1993 – Present.

Jackson Hole Wildlife Foundation, *Board Member,* 2012-2013; *Volunteer* 2011-2014.

National Wildlife Federation, *Volunteer***,** Sage-Grouse Adopt-a-Lek Program, Montana, 2004 – 2009.

Cornell Lab of Ornithology, *Volunteer,* Ivory-billed Woodpecker Search, White River National Wildlife Refuge, Arkansas, 2006.

## TECHNICAL & OUTREACH PUBLICATIONS

Paige, C. 2015. A Wyoming Landowner's Handbook to Fences and Wildlife: Practical Tips to Fencing with Wildlife in Mind; Second Edition. Wyoming Wildlife Foundation, Laramie, WY. 56 pp. *http://www.wyomingwildlifefoundation.org/*

Sage Grouse Initiative. 2015. Hi-Res Maps Sharpen Focus on Sage Grouse Habitat. Science to Solutions Number 7. Sage Grouse Initiative. 4pp. *http://www.sagegrouseinitiative.com/*

Sage Grouse Initiative. 2015. Sage Grouse Conservation Benefits Migratory Mule Deer. Science to Solutions Number 6. Sage Grouse Initiative. 4pp. *http://www.sagegrouseinitiative.com/*

Sage Grouse Initiative. 2014. Wildfire and Cheatgrass: New Science Helps Reduce Threats to Sage Grouse. Science to Solutions Series Number 5. Sage Grouse Initiative. 6pp. *http://www.sagegrouseinitiative.com/*

Sage Grouse Initiative. 2014. Private Lands Vital to Conserving Wet Areas for Sage Grouse Summer Habitat. Science to Solutions Series Number 4. Sage Grouse Initiative. 4pp. *http://www.sagegrouseinitiative.com/*

Sage Grouse Initiative. 2014. Predicting the Outcome of Wyoming's Sage Grouse Conservation Strategy. Science to Solutions Series Number 3. Sage Grouse Initiative. 4pp. *http://www.sagegrouseinitiative.com/*

Sage Grouse Initiative. 2014. Conifer Removal Restores Sage Grouse Habitat. Science to Solutions Series Number 2. Sage Grouse Initiative. 4pp. *http://www.sagegrouseinitiative.com/*

Sage Grouse Initiative. 2014. Marking High-risk Fences Saves Sage Grouse. Science to Solutions Series Number 1. Sage Grouse Initiative. 4pp. *http://www.sagegrouseinitiative.com/.*

Paige, C. 2012. A Landowner's Guide to Wildlife Friendly Fences, Second Edition. Montana Fish, Wildlife and Parks, Helena, MT. 56 pp. *http://fwp.mt.gov/fishAndWildlife/livingWithWildlife/.*

Paige, C. 2012. A Landowner's Guide to Fences and Wildlife: Practical Tips to Make Your Fences Wildlife Friendly. Wyoming Land trust, Pinedale, WY. 52 pp. *http://www.wyomingwildlifefoundation.org/*

Vital Ground. 2005—2011. *Vital News*. Editor and writer, news magazine of the Vital Ground Foundation, Missoula, MT. *www.vitalground.org*

Vital Ground. 2008, 2010. Biennial Reports for 2008, 2009-2010. Vital Ground Foundation, Missoula, MT. 28 pp. *www.vitalground.org*

Paige, C. 2008. A Landowner's Guide to Wildlife Friendly Fences. Montana Fish, Wildlife and Parks, Helena, MT. 44 pp.

Montana Audubon, 2008. Nomination Proposal: Montana Important Bird Areas for Greater Sage-Grouse. Montana Audubon, Helena, MT.

Paige, C. 2006. Montana All-Bird Conservation: A Status Survey. Report for Montana Fish, Wildlife and Parks, Helena, MT.

Paige, C. 2005. Bird Survey of Riparian and Wetland Areas Lava Lake Land and Livestock, Idaho. Internal report. Lava Lake Foundation for Science and Conservation. Hailey, ID.

Paige, C. 2003. Sage-Grouse Adopt-A-Lek Program: 2003 Field Report and Project Summary. National Wildlife Federation, Missoula, MT.

NPCA. 2002. State of the Parks: Waterton-Glacier International Peace Park. Science assessment of threats to park resources. National Parks Conservation Association, Fort Collins, CO.

Paige, C. 2001, 2002. Shelter Island Bald Eagle Territory Conservation Recommendations and Nesting Season Report. Private contract.

The Nature Conservancy. 1999, 2000, 2001. Species Management Abstracts. Management and natural history syntheses for 28 individual bird species. The Nature Conservancy, Migratory Birds Program. *www.conserveonline.org* under Library.

Paige, L.C. 2000. America's Wildlife: The Challenge Ahead. A Report to Congress. International Association of Fish and Wildlife Agencies, Washington, D.C.

Ritter, S.A. and Paige, C. 2000. Landowner Tips: Keeping Birds in the Sagebrush Sea. Wyoming Wildlife. Reprinted as brochure by Partners in Flight.

Paige, C. and S.A. Ritter. 1999. Birds in a Sagebrush Sea: Managing Sagebrush Habitats for Bird Communities. Partners in Flight Western Working Group, Boise, ID. *http://www.partnersinflight.org/wwg/sagebrush.pdf*

Paige, C. 1997. Program status and strategic planning for landbird conservation. USDA Forest Service Landbird Conservation Program, Washington, D.C.

Paige, C. 1997. The State of America's Wild Birds: 1997 Partners in Flight Progress Report. National Fish and Wildlife Foundation, Washington, D.C.

Paige, C. 1977. Upper Whitefish Lake site-specific bald eagle nest management plan. Montana Department of Natural Resources Northwestern Land Office.

Hutto, R.L. and C. Paige. 1995. USDA Forest Service Northern Region Landbird Monitoring Project Field Methods. USDA Forest Service Region 1. Missoula, MT.

Paige, C. 1995. A literature review of grazing effects on grassland birds. Internal report. USDA Forest Service Region 1. Missoula, MT.

Hejl, S.J. and C. Paige. 1994. A preliminary assessment of birds in continuous and fragmented forests of western red cedar/western hemlock in northern Idaho. Pp. 189-197 in Baumgartner, D.M., J. E. Lotan, and J.R. Tonn, editors. Interior cedar-hemlock-white pine forest: ecology and management. Symposium Proc. Dept. of Natural Resource Sciences, Washington State Univ. Pullman, WA.

Paige, C. 1994. Notes on the importance of post-fire habitat to bird communities. Internal report. USDA Forest Service Region 1. Missoula, MT.

Paige, C. 1993. Northern Region Landbird Monitoring Program: 1993 Field Season Report. Internal report to USFS Region 1. Missoula, MT.

Paige. C. 1993. Thinking about cowbirds in effects analysis. Internal report. USDA Forest Service Region 1. Missoula, MT.

Manley. P., W. Block, F. Thompson, G. Butcher, C. Paige, L. Suring, D. Winn, D. Roth, C. Ralph, E. Morris, C. Flather, and K. Byford. 1993. Guidelines for monitoring populations of neotropical migratory birds on national forest system lands. Monitoring Task Group, USDA Forest Service, Washington, D.C.

Paige, C. 1991. Reports on Tally Lake and Whitefish Lake Bald Eagle Territories. Internal reports. Tally Lake Ranger District, Flathead National Forest. Whitefish, MT.

Paige, C. 1991. Interim report on the Swift Creek Bald Eagle Nesting Territory. Internal report. Tally Lake Ranger District and Montana Dept. of State Lands. Whitefish, MT.

Paige, C., B. Madden and B. Ruediger. 1991. Habitat Management Guidelines for Bald Eagles in Northwestern Montana. Montana Bald Eagle Working Group. Missoula, MT.

Paige, C. 1990. Protocol for monitoring pileated woodpeckers and barred owls on the Flathead National Forest. Internal report. Flathead National Forest. Kalispell, MT.

Paige, C. 1990. Monitoring pileated woodpeckers and barred owls: report on the 1990 field season. Internal report. Flathead National Forest. Kalispell, MT.

Paige, C. 1990. Monitoring marten on the Flathead National Forest. Internal report. Flathead National Forest. Kalispell, MT.

## FREELANCE ARTICLES

Paige, C. 2015. Putting the Crosshairs on Deadly Crossings. *Bugle Magazine. May-June 2015.*

Paige, C. 2014. The Red Tree Blues. *Bugle Magazine. May-June 2014.*

Paige, C. 2014. A Wall of Protection. *Montana Outdoors. Jul-Aug 2014*. Reprinted with permission.

Paige 2012. Survival Spray: want to live through a bear attack? *The Ethic, Journal of the Pope & Young Club. Winter 2012.* Reprinted with permission.

Paige, C. 2012. Survival Spray: Want to live through a bear attack? *Bugle Magazine, Sep-Oct*.

Paige, C. 2012. Building a Better Bear Trap. *Montana Outdoors*. March-April: 19-19.

Paige, C. 2003—2009. Habits and Habitat. *Bugle Magazine*. Bi-monthly natural history column. Archived online at *www.rmef.org/bugle*.

Paige, C. 2008. Grizzly Affairs. *Big Sky Weekly Summer Visitor's Guide*. Reprinted by permission.

Paige, C. 2008. State of the Grizzly. *The Montana Pioneer*. March. Reprinted by permission.

Paige, C. 2008. Special Report: State of the Grizzly. *Montana Outdoors*. March-April. Available online at: *http://fwp.mt.gov/mtoutdoors/HTML/articles/2008/StateOfTheGrizzly.htm*

Paige, C. 2001. Sagebrush Country. *Bugle Magazine*. Nov-Dec.

Paige, C. 2001. Bears of the World. *Wild Outdoor World Magazine*. Nov-Dec.

Paige, C. 2000. Secrets of the Sage. *Wild Outdoor World. September*: 46-49.

Paige, C. 2000. Forests for All. *Wild Outdoor World*. March: 25-40.

Paige, C. 1998. Bear Busters. *Montana Outdoors* 29(6):25-29.

Paige, C. 1998. Lizard Lessons. *Audubon* 100(5):120.

Paige, C. 1998. Scare Bears. *Audubon* 100(3):21.

Paige, C. 1998. Hounding Bears. *Wildlife Conservation* 101(2):15.

Paige, C. 1998. Hand to Hand, Heart to Heart: In a global economy, a breath of fair trade. *Ecological Economics Bulletin* 3(2)6-10. Reprinted with permission.

Paige, C. 1997. Tracking Down an Avian Trickster. *Montana Outdoors* 28(2):8-13.

Paige, C. 1996. Sweet Rescue. *Montana Magazine*, Nov/Dec:64-66.

Paige. C. 1996. Hand to Hand, Heart to Heart: In a global economy, a breath of fair trade. *Intermountain Woman* 1(4):10-15.

# Amy K. Kuszak

5185 HHR Ranch Road
Wilson, WY 83014
Phone: (307) 739-0384 / email: amykuszak@gmail.com


## EXPERIENCED ENVIRONMENTAL PLANNER

Qualified to review and/or prepare environmental documentation. Experience in conducting natural resource and wildlife surveys. Eighteen years of experience in the field of natural resources and environmental policy. Experience working for or with multiple federal agencies, state, county, and city governments, private consultants and landowners.

## PROFESSIONAL EXPERIENCE

**Self Employed, Jackson, WY**
ENVIRONMENTAL PLANNER — July 2010 – Present

♦ Member of a consulting team for a multi-jurisdictional fiber optics project. Responsible for local jurisdiction planning and permitting. Assist with Federal agency planning and permitting. Responsible for local environmental document preparation and assist with Federal environmental document preparation. Tasks include land owner contact and easement negotiations, title search, coordination with multiple jurisdictions including three National Forests, Grand Teton National Park, Bureau of Land Management, Department of Commerce, State of Wyoming, Town of Jackson, Teton County, WY, Jackson Hole Land Trust, The Nature Conservancy, Teton County Scenic Preserve Trust, and Friends of Pathways.

♦ Consult on environmental issues and in accordance with Teton County Land Development Regulations and federal law. Prepared environmental and planning permit application documentation for public and private development projects. Coordinate between local, state and federal agencies.

**Teton County Planning Department, Jackson, WY**
ENVIRONMENTAL/SENIOR PLANNER — November 2002 – August 2010

♦ Lead public workshops and public hearing presentations to Planning Commission and Board of County Commissioners. Duties include writing staff reports for development applications and Land Development Regulations amendments. Responsible for all aspects of project management. Research and design of natural resource amendments to Comprehensive Plan and Land Development Regulations. Responsible for all aspects of Planning, Building and Engineering Departments' environmental review. Advise County staff and applicants on natural resource regulations and policies.

**Pioneer Environmental Service, Inc., Jackson WY**
ENVIRONMENTAL ANALYST / WETLAND SCIENTIST — August 2000 – October 2002

♦ Advise clients on environmental issues and in accordance with Teton County Land Development Regulations and federal law. Project management including but not limited to preparation of cost estimate and scope of work, task delegation, report production, preparation of permit applications, and maps for submission to clients, Teton County, and/or the federal government in order to meet project deadlines. Collect and analyze field and empirical environmental data. Completed wetland delineation course.

**Katz, Okitsu and Associates, San Diego, CA**
GIS ANALYST
TRANSPORTATION PLANNER — October 1998 – August 2000

♦Analyze transportation and land use data for a wide array of development projects. Balance and prioritize several projects simultaneously. Responsibilities extend from participation in initial proposal writing to the production of technical reports. Delegate project tasks in order to meet project deadlines. Meet with clients, County and City staff. Customize and research of database, GIS, and cartographic software for use in the transportation industry.

**USDA Forest Service, Lincoln National Forest, NM** — May 1998 – August 1998
WILDLIFE SURVEYOR / GIS SPECIALIST — June 1999 – August 1999

♦Biological surveying for a variety of plants and wildlife which required certification for threatened and endangered species. Aid in development of survey protocol for the forest sensitive Sacramento checkerspot butterfly. Annual report development for threatened and endangered species. GIS analysis for the forest urban interface project. GIS habitat monitoring and modeling.

## AREAS OF EXPERTISE

- strong verbal and written communication skills
- community involvement
- technical writing
- environmental policy
- environmentally sensitive design
- wildlife habitat enhancement and creation
- geographic information systems
- development design
- database design
- cartographics
- graphics
- modeling
- wildlife surveying
- natural resource surveying
- well versed in geographic software
- research
- wetland delineation

## EDUCATION

**Graduate coursework in Geography with an emphasis in Resource and Environmental Quality**
San Diego State University
August 1998 - May 2000

**Bachelor of Arts in Geography and Anthropology**
Language: Spanish
Hunter College of the City University of New York
February 1996

***Cum laude graduate**
***Graduate Scholarship**

# CORINNA RIGINOS

P.O. Box 12446 – Jackson, WY – (307)-413-2280 – criginos@gmail.com
www.corinnariginos.com


I work to understand and conserve areas of unique biodiversity through a combination of research, education, and close partnerships with natural resource managers. I have experience in a range of topics, including wildlife-vehicle collisions; large herbivore movement, migration, and habitat selection patterns; rangeland monitoring, management, and restoration; and impacts of invasive species, land-use change, and climate change on natural systems.

## EDUCATION

| | | |
|---|---|---|
| Ph.D. | 2008 | University of California, Davis: Ecology. |
| B.S. | 2000 | Brown University: Environmental Science (*Magna Cum Laude*) |

## APPOINTMENTS

**Research Associate** *October 2015-present*
Utah State University, Department of Wildland Resources

**Research Associate** *July 2015-present*
Northern Rockies Conservation Cooperative, Jackson, WY

**Adjunct Associate Professor** *April 2013-present*
Department of Zoology and Physiology & Haub School for Environment and Natural Resources, University of Wyoming, Laramie, WY

**Ecological Society of America Early Career Fellow (honorary)** *2015-2019*
One of a handful of early career ecologists chosen for their past and potential future contributions to the field in terms of scholarship, education, and conservation.

**Research Ecologist, Teton Research Institute** *April 2013-April 2015*
Teton Science Schools, Jackson, WY

- Led the ecological research program at the Teton Research Institute
- Conducted original research on topics including: mule deer movement ecology; wildlife-vehicle collision patterns and potential mitigations across Wyoming; impacts of climate change on Teton County
- Built partnerships with NGOs and agencies in the Greater Yellowstone Ecosystem
- Managed projects and field personnel
- Raised money for research
- Coordinated outreach activities designed to reach the broader public as well as >12,000 participants that are reached by Teton Science Schools' programming each year

**Berry Biodiversity Conservation Center Postdoctoral Fellow** *June 2012-April 2013*
University of Wyoming, Laramie, WY

- Conceived and led design and execution of study on the invasive ant *Pheidole megacephala* and its destabilizing effects on an African savanna ecosystem through disruption of an ant-plant mutualism
- Designed and taught graduate seminar

**Council on Science and Technology Postdoctoral Fellow** *Sept 2008-May 2012*
Princeton University, Princeton, NJ

- Conceived and led design and execution of studies on (a) using livestock to engineer rangelands for wildlife conservation, (b) ecosystem functioning, breakdown, and restoration in an African savanna.
- Led a team of scientists, NGO workers and local stakeholders to develop user-friendly methods and a 100-page manual for pastoralist-based rangeland monitoring, currently being used on 35,000 $km^2$ in sub-Saharan Africa.
- Managed a staff of six field assistants and a fleet of five vehicles across two major research projects in rural Kenya
- Designed and taught undergraduate field course over four years
- Managed budgets and raised money for research

**Doctoral Research** *Sept 2003-June 2008*
Ecology Graduate Group, University of California, Davis, CA

- Conceived and led design and execution of studies to test (a) how replacement of native wild herbivores with domestic cattle contributes to woody encroachment in African savannas, and (b) the consequences of increasing woody vegetation for wildlife and livestock.

**Fulbright U.S. Student Scholar** *Aug 2000-Dec 2002*
University of Stellenbosch, Stellenbosch, South Africa

- Studied the effects of livestock grazing and disturbance on population and community ecology of succulent shrubs in the Succulent Karoo, South Africa.

## FELLOWSHIPS AND AWARDS

- Shapiro Award for Academic Excellence (best dissertation thesis in ecology), UC Davis, 2009
- National Science Foundation Graduate Research Fellowship, 2003 ($96,000)
- Graduate Scholars Fellowship, UC Davis, 2003 ($32,000)
- Fulbright Fellowship, 2000 ($20,000)
- Phi Beta Kappa, Brown University, 2000

## GRANTS AND CONTRACTS

National Geographic Society: Landscape-scale consequences of mutualism disruption: invasive ant threatens a widespread ant-plant mutualism in East Africa. PI. (pending)

Meg and Bert Raynes Wildlife Fund: For everything there is a season, but the seasons are a'changing. Phenology shifts in the Tetons. PI. 2016. ($3,000)

NSF Population and Community Ecology: Landscape-scale consequences of mutualism disruption: invasive ants threaten a widespread ant-plant mutualism in East Africa. *Co-PI*. ($1,200,00)

National Fish and Wildlife Foundation: Priority areas for reducing Golden eagle-vehicle mortalities. *PI.* 2016-2017 ($102,000)

Wyoming Department of Transportation: Traffic thresholds in deer-vehicle collisions. *PI.* 2016 ($38,000)

Meg and Bert Raynes Wildlife Fund: For everything there is a season, but the seasons are a'changing. Phenology shifts in the Tetons. PI. 2015. ($3,000)

Wyoming Department of Transportation: Planning-support for mitigation of wildlife-vehicle collisions and highway impacts on migration routes in Wyoming. *PI.* 2014-16 ($27,000)

NSF Long-term Research in Environmental Biology: KLEE: Scaling up and scaling out at the Kenya Long-term Exclosure Experiment in Laikipia rangelands. *Lead author and Co-PI.* 2013-2018. ($449,900)

Livestock-Climate Change CRSP: A cost-effectiveness framework for landscape rehabilitation and carbon sequestration in northern Kenya. *Lead author and Co-PI.* 2010-2012. ($80,000)

USAID and Laikipia Wildlife Forum, Kenya: Sub-contract to provide training and support for rangeland monitoring and to develop a database for archiving monitoring data in Laikipia, Kenya. *Project Leader.* 2009-2012. ($36,000)

USAID and CARE International: Sub-contract to produce a monitoring manual for the Horn of Africa region. *Project Leader.* 2009-2010. ($50,000)

Princeton University Water, Savannas, and Society Initiative: Can simulated cattle migrations facilitate wild herbivores? *Lead author and Co-PI.* 2008-2011. ($150,000)

NSF Long-term Research in Environmental Biology: KLEE: Scaling up and scaling out at the Kenya Long-term Exclosure Experiment in Laikipia rangelands. *Co-author and Co-PI.* 2008-2013. ($499,800)

NSF International Research Fellowship Program: Can simulated cattle migrations facilitate wild herbivores? *Author and PI.* 2008-2010. ($25,000)

Phi Beta Kappa, Northern California Association. 2006. ($5,000)

NSF Doctoral Dissertation Improvement Grant: Tree-grass interactions in an East African savanna: the role of wild and domestic herbivores. 2005-2007. ($12,000)

Ben Madson Research Fellowship, Department of Plant Sciences, UC Davis. 2005. ($2,000)

Jastro-Shields Research Fellowship, Ecology Graduate Group, UC Davis. 2004, 2005, 2007. ($2,500 each)

## PEER-REVIEWED PUBLICATIONS

* Denotes paper authored with a student I have mentored or co-mentored

*Charles, G., L.M. Porensky, **C. Riginos**, K.E. Veblen, and T.P. Young. Grazing intensity drives herbaceous productivity, but herbivore identity constraints variability in productivity in an African savanna. *Ecological Applications*, in review.

Odadi, W.O., D.M. Kimuyu, K.E. Veblen, **C. Riginos**, and T.P. Young. Fire-induced negative responses of cattle to shared foraging with native ungulates in an African savanna. *Journal of Applied Ecology*, in review.

Sensenig, R.L., D.K. Kimuyu, J.C.R. Guajardo, K.E. Veblen, **C. Riginos**, and T.P. Young. Species-specific ant behaviors help explain short-term and long-term shifts in an acacia ant community after fire. Submitted via Axios to *Ecology, Ecological Applications, Journal of Ecology, Oecologia*.

**Riginos, C**., M.W. Graham, M.J. Davis, A. Johnson, A. May, K. Ryer, and L.E. Hall. Wildlife warning reflectors and white cloth reduce deer-vehicle collisions and risky behavior. *Wildlife Society Bulletin.* In review.

*Kimiti, D.W., **C. Riginos**, and J. Belnap. Low-cost grass restoration using erosion barriers in a degraded African rangeland. *Restoration Ecology*. In review.

Veblen, K.E., L.M. Porensky, **C. Riginos**, and T.P. Young. Are cattle surrogate wildlife? Savanna plant community composition explained by total herbivory, not herbivore identity. *Ecological Applications*. In press. Available online: http://onlinelibrary.wiley.com/doi/10.1890/15-1367.1/full

Pringle, R.M., D. Kimuyu, R.L. Sensenig, T.M. Palmer, **C. Riginos**, K.E. Veblen, and T.P. Young. 2015. Synergistic indirect effects of elephants and fire in an African savanna. *Journal of Animal Ecology* 84: 1637-1645.

Cotterill-Oriol, A., M. Valeix, L.G. Frank, **C. Riginos**, and D.W. Macdonald. 2015. The landscape of coexistence: consequences of fear for large carnivores living in human-dominated areas. *Oikos* 124: 1263-1273.

***Riginos, C.,** M.A. Karande, D.I. Rubenstein, and T.M. Palmer. 2015. Disruption of a protective ant-plant mutualism by an invasive ant increases elephant damage to savanna trees. *Ecology* 96: 654-661.

**Riginos, C.** 2015. Climate and the landscape of fear in an African savanna. *Journal of Animal Ecology* 84: 124-133.

*Kimuyu, D.K., R.L. Sensenig, **C. Riginos**, K.E. Veblen, and T.P. Young. 2014. Native and domestic browsers and grazers reduce fuels, fire temperatures, and acacia-ant mortality in an African savanna. *Ecological Applications* 24: 741-749.

Porensky, L.M., S.E. Wittman, C. **Riginos**, and T.P. Young. 2013. Herbivory and drought interact to enhance diversity and spatial patterning in a savanna understory. *Oecologia* 173: 591-602.

Donihue, C.M., L.M. Porensky, J. Foufopoulos, **C. Riginos**, and R.M. Pringle. 2013. Glade cascades: indirect legacy effects of pastoralism enhance the abundance and spatial structuring of arboreal fauna. *Ecology* 94: 827-837.

**Riginos, C.**, L.M. Porensky, K.E. Veblen, W.O. Odadi, R.L. Sensenig, D. Kimuyu, F. Keesing, M.L. Wilkerson, and T.P. Young. 2012. Lessons on the relationship between pastoralism and biodiversity from the Kenya Long-term Exclosure Experiment (KLEE). *Pastoralism* 2:10.

Herrick, J.E., S. Andrews, G. Baldi, B.T. Bestelmeyer, J. Brown, J. Davies, M. Duniway, K.M. Havstad, D. Peters, J. Quinton, **C. Riginos**, P. Shaver, D. Steinaker, and S. Twomlow. 2012. Revolutionary land use change in the 21st century: is (rangeland) science relevant? *Rangeland Ecology and Management* 65: 590-598.

**Riginos, C.**, J.E. Herrick, S.R. Sundaresan, C. Farley, and J. Belnap. 2011. A simple graphical approach to quantitative monitoring of rangelands. *Rangelands* 133: 6-13.

Sundaresan, S.R., **C. Riginos**, and E.S. Abelson. 2011. Management and analysis of camera trap data: alternative approaches (response to Harris et al., 2010). *Bulletin of the Ecological Society of America.* April 2011.

Augustine, D.J., K.E. Veblen, J.R. Goheen, **C. Riginos** & T.P. Young. 2011. Pathways for positive cattle-wildlife interactions in semi-arid rangelands. In *Conserving Wildlife in African Landscapes: Kenya's Ewaso Ecosystem (*N.J. Georgiadis, ed.). Smithsonian Contributions to Zoology Number 632: 55-72.

**Riginos, C.** and J.H. Herrick. 2010. *Monitoring Rangeland Health: A Guide for Pastoralist Communities and Other Land Managers in Eastern Africa, Version II.* Nairobi, Kenya: ELMT-USAID/East Africa.

http://jornada.nmsu.edu/monit-assess/manuals/StickMethod

Treydte, A.C., **C. Riginos**, and F. Jeltsch**.** 2010. Enhanced use of beneath-canopy vegetation by grazing ungulates in African savannahs. *Journal of Arid Environments* 74: 1597-1603.

Sundaresan, S., and **C. Riginos.** 2010. Lessons learned from biodiversity conservation in the private lands of Laikipia, Kenya. *Great Plains Research* 20: 2-10.

Goheen, J.R., T. M. Palmer, F. Keesing, **C. Riginos**, and T.P. Young. 2010. Large herbivores facilitate savanna tree establishment via diverse and indirect pathways. *Journal of Animal Ecology* 79: 372-382.

**Riginos, C.**, J.H. Herrick, J. Belnap, S.R. Sundaresan, J.S. Worden, and M.F. Kinnaird. 2009. *Monitoring Rangeland Health: A Guide for Facilitators and Pastoralist Communities, Version I.* Nairobi, Kenya: ELMT-USAID/East Africa.

**Riginos, C.,** J.B. Grace, D.J. Augustine, and T.P. Young. 2009. Local versus landscape-scale effects of savanna trees on grasses. *Journal of Ecology*, 97: 1337-1345.

**Riginos, C.** 2009. Grass competition suppresses savanna tree growth across multiple demographic stages. *Ecology* 90: 335-340.

**Riginos, C.**, and J.B. Grace. 2008. Tree density, wild ungulate habitat use and the herbaceous community in a Kenyan savanna: Top-down versus bottom-up effects. *Ecology* 89: 2228-2238.

Okello, B.D., T.P. Young, **C. Riginos**, D. Kelly and T. O'Connor. 2008. Short-term survival and long-term mortality of *Acacia drepanolobium* after a controlled burn. *African Journal of Ecology* 46:395-401.

**Riginos, C.**, M.S. Heschel, and J. Schmitt. 2007. Maternal effects of drought stress and inbreeding in *Impatiens capensis* (Balsaminaceae). *American Journal of Botany* 94: 1984-1991.

**Riginos, C.** and T.P. Young. 2007. Positive and negative effects of grasses and wild and domestic herbivores on *Acacia* saplings in an East African savanna. *Oecologia* 153: 985-995.

**Riginos, C.**, S.J. Milton, and T. Wiegand. 2005. Context-dependent interactions between adult shrubs and seedlings in a semi-arid shrubland. *Journal of Vegetation Science* 16: 331-340.

Heschel, M.S. and **C. Riginos.** 2005. Mechanisms of selection for drought stress tolerance and avoidance in *Impatiens capensis* (Balsaminaceae). *American Journal of Botany* 92: 37-44.

**Riginos, C.** and M.T. Hoffman. 2003. Changes in population biology of two succulent shrubs along a grazing gradient. *Journal of Applied Ecology* 40: 615-625.

## MEDIA COVERAGE

*Science* online: Invading ant threatens unique African ecosystem. 8 September, 2014. http://news.sciencemag.org/africa/2014/09/invading-ant-threatens-unique-african-ecosystem

*New York Times*: Tree-Protecting Ants Can't Protect Themselves. 15 September, 2014. http://www.nytimes.com/2014/09/16/science/tree-protecting-ants-cant-protect-themselves.html

*WyoFile:* Climate change likely to kill Yellowstone's forests. 9 June, 2015. http://www.wyofile.com/report-climate-change-likely-to-kill-yellowstone-forests/

*Jackson Hole News and Guide*: Future could scorch Tetons. 10 June, 2015. http://www.jhnewsandguide.com/news/environmental/future-could-scorch-tetons/article_d8529b00-3e5c-549a-8664-beb9a21975c3.html

*Planet Jackson Hole*: Teton temperatures rising. 10 June, 2015. http://planetjh.com/2015/06/09/the-buzz-teton-temperatures-rising/

*Wyoming Public Radio:* Study claims Yellowstone forests could disappear due to climate change. 17 June, 2015 http://wyomingpublicmedia.org/post/study-claims-yellowstone-forests-could-disappear-due-climate-change

*Jackson Hole News and Guide*: A scrap of white cloth is found to deter deer. 15 July, 2015. Re-published in: *Deseret News* (Salt Lake City, UT), *Billings Gazette* (Billings, MT), *Post Register* (Idaho Falls, ID), *U.S. News Hub*, *S.F. Gate* (San Francisco, CA), *Cheyenne Sun Times* (Cheyenne, WY), *Boise Sun Times* (Boise, ID), and *Seattle PI* (Seattle, WA):

http://www.jhnewsandguide.com/news/environmental/a-scrap-of-white-cloth-is-found-to-deter-deer/article_167e479b-aad0-5631-9f1f-3dafcebfc225.html

*KSL Channel 5 (Salt Lake City)*: http://www.ksl.com/?sid=35536549&nid=148

*Buckeye Sportsman radio:* http://buckeyesportsman.net/podcast/august-1-2015/

*Brainerd Outdoors radio:* www.brainerdoutdoors.com

## REPORTS

**Riginos, C.,** Graham, M.W., Smith, C.S., Davis, M., and Johnson, A. 2015. Effects of wildlife warning reflectors ("deer delineators") on wildlife-vehicle collisions in central Wyoming. FHWA-WY-15/03F.

**Riginos, C.,** and Newcomb, M. 2015. The coming climate: ecological and economic impacts of climate change on Teton County. Charture Institute and Teton Research Institute.

**Riginos, C.,** K. Krasnow, L.E. Hall, M. Graham, S.R. Sundaresan, D. Brimeyer, G. Fralick, and D. Wachob. 2013. Mule deer (*Odocoileus hemionus*) movement and habitat use patterns in relation to roadways in northwest Wyoming. FHWA-WY-13/08F.

**Riginos, C.**, E. Wakoli, D. Melly, and D. Kimiti. 2012. Restoration in Laikipia's community lands: successes, challenges, and lessons learned. Report to the Laikipia Wildlife Forum and USAID.

**Riginos, C.**, J.E. Herrick and P. Shaver. 2012. Maximizing returns on investments in land management with ecological site information. Research Brief #6, Adapting Livestock Systems to Climate Change – Global Collaborative Research Support Program (USAID).

**Riginos, C.**, J. Belnap, and D. Kimiti. 2012. Cost effectiveness of simple technologies to reduce erosion and promote grass establishment. Research Brief #4, Adapting Livestock Systems to Climate Change – Global Collaborative Research Support Program (USAID).

## TEACHING AND MENTORING

- Fellowship Coordinator, Wyoming Chapter of The Wildlife Society's fellowship program (2014-2015)
- Mentored 8 students/interns (B.A.; 2 B.Sc.; 3 M.Sc.; 1 Ph.D.; senior thesis), 2008-2014.
- Instructor, ECOL 5620: Conservation and Management of Grazing Systems, University of Wyoming, Fall 2012.
- Instructor, EEB 320: Ecology and Conservation of African Landscapes, Princeton University, Spring semesters 2009-2012.

## OUTREACH AND PROFESSIONAL SERVICE

*Public understanding of science*

- Lead organizer of the Jackson Hole Wildlife Symposium, December 2014 (>150 participants)
- Developed interactive educational materials on wildlife-vehicle collisions for display at the National Museum of Wildlife Art and for Teton Science Schools programs, which collectively reach >12,000 participants each year
- Founded and edited (2 years) the *Mpala Memos* newsletter of the Mpala Research Centre, for local stakeholders
- Authored 12 popular articles for stakeholders and the public in Kenya
- Numerous public presentations of research in Kenya and Wyoming
- Research featured in prominent popular press (see above)

*Outreach and partnership with land managers and development agencies*

- Worked closely with the Wyoming Department of Transportation and Wyoming Game and Fish Department on design, analysis, and interpretation of two studies on wildlife-vehicle collisions
- Regularly advise Teton County Planning department on issues of roads and wildlife
- In collaboration with several NGOs and with funding from USAID, developed methods for simple, quantitative monitoring of rangeland health in East Africa
- Authored the guidebook *Monitoring Rangeland Health: A Guide for Pastoralist Communities and Other Land Managers in Eastern Africa* (published by USAID)
- These monitoring methods now being used by organizations with a footprint of 35,000 $km^2$ in Kenya and Namibia
- Have led numerous outreach workshops in Kenya and Ethiopia on rangeland monitoring

*Capacity building*

- Serve as an affiliate faculty member at the University of Nairobi's Department of Land Resource Management and Technology.
- Through this partnership, have supported, trained, and mentored six Kenyan post-bachelors and one post-masters students. All have gone on to more permanent employment or further study.
- Have also supported three groups of undergraduates (~40 each) from the University of Nairobi to visit field sites and research projects. Without such support, Kenyan students have very little exposure to field research.

*Peer and editorial review*

- Have reviewed >40 manuscripts and book chapters for *Ecology Letters*, *Ecology*, *Journal of Ecology*, *Journal of Arid Environments*, *Oecologia*, *Society and Natural Resources*, *Journal of Vegetation Science, Society and Natural Resources, Land Degradation and Development, Ecography, Forest Ecology and Management* and *East African Journal of Natural History*
- Reviewer for Natural Research Foundation (South Africa) grant proposals'

## OTHER SKILLS AND QUALIFICATIONS

- Proficient in variety of statistical methods including GLMMs, zero-inflated models, resource selection functions, structural equation modeling, and Brownian bridge movement modeling
- Software skills: R, ArcGIS, Access
- Trained in rangeland assessment (Interpreting Indicators of Rangeland Health), Jornada Experimental Range, November 2009
- Wilderness First Responder (current)

# Debra A. Patla

P.O. Box 420, Moran, WY 83013 *Phone*: 307-543-0975 *E-mail*: dpatla@hughes.net

## Education

| | |
|---|---|
| M.S. Biology, Idaho State University, Pocatello, ID | 1997 |
| M.A. History, University of California, San Diego | 1979 |
| B.A. Chinese Studies, University of California, San Diego | 1977 |

## Affiliations

Northern Rockies Conservation Cooperative, research associate since 1997;

Greater Yellowstone Network, National Park Service Inventory & Monitoring Program;

Idaho State University, Herpetology Laboratory, 1993 - 2009.

## Experience

Field coordinator, National Park Service Greater Yellowstone Network Amphibian Monitoring Project. 2002 - present.

Contract biologist: National Elk Refuge, Bridger-Teton National Forest, U.S. Forest Service, Region 2, Idaho State University, and conservation groups. 1997 – present

Research Assistant, Amphibian and reptile inventory and surveys in Yellowstone National Park, Idaho State University. 1995 – 2002.

Biological Technician (seasonal), Targhee National Forest, US Forest Service. 1987 – 1996.

## Thesis

Patla, D.A. 1997. Changes in a population of spotted frogs in Yellowstone National Park between 1953 and 1995: the effects of habitat modification. M.S. Thesis, Idaho State University, Pocatello.

## Recent Publications

Patla, D.A., S. St-Hilaire, A. Ray, B.R. Hossack, C.R. Peterson. 2016. Amphibian mortality events and ranavirus outbreaks in the Greater Yellowstone Ecosystem. Herpetological Review 47(1): 50-54.

Hossack, B.R., W.R. Gould, D.A. Patla, E. Muths, R. Daley, K. Legg, P.S. Corn. 2015. Trends in Rocky Mountain amphibians and the role of beaver as a keystone species. Biological Conservation 187:260-269.

Ray A, A. Sepulveda, B.R. Hossack, D.A. Patla, D. Thoma , R. Al-Chokhachy. 2015. Monitoring Yellowstone's wetlands: can long-term monitoring help us understand their future? Yellowstone Science 23 (1): 42-53.

Ray A, A. Sepulveda, B. Hossack, D. Patla, K. Legg. 2014. Using monitoring data to map amphibian breeding hotspots and describe wetland vulnerability in Yellowstone and Grand Teton National Parks. Park Science 31(1): 112-119.

Bennetts R, P.S.Corn, R. Daley, W.R. Gould, C. Jean, D.A. Patla, C.R. Peterson, A. Ray. 2013. Cooperative amphibian monitoring protocol for the Greater Yellowstone Network: Narrative, version 1.0. Natural Resource Report NPS/GRYN/NRR—2013/654. National Park Service, Fort Collins, Colorado.

Gould WR, D.A.Patla, R. Daley, P.S. Corn, B.R. Hossack, R. Bennetts, C.R. Peterson. 2012. Estimating occupancy in large landscapes: evaluation of amphibian monitoring in the Greater Yellowstone Ecosystem. Wetlands 32:379-389.

## ADDITIONAL SERVICES RATE SHEET

ALDER ENVIRONMENTAL, LLC

*Water • Wetlands • Ecological Consulting*

# 2016 Schedule of Rates & Fees

## LABOR

| Category | Hourly Rate |
|---|---|
| Principal/Project Manager | $120 |
| Professional Wetland Scientist | $120 |
| Senior Wildlife Ecologist | $110 |
| Senior Water/ Wetland Scientist | $110 |
| Field Scientist/ Wetland Delineator | $95 |
| GIS Specialist | $85 |
| Restoration Manager | $85 |
| Field Technician | $75 |
| Travel Time (greater than 1 hour) | 1/2 hourly rate |
| Administrative | $50 |
| Sub-Consultants/Subcontractors | Cost plus 10% |

## EXPENSES

| Item | Fee |
|---|---|
| Vehicle Mileage | $0.65 per mile |
| GPS/ Mapping Unit (resource grade) | $50 per day |
| Water Quality Meter | $50 per day |
| Sampling Pump & Controller | $50 per day |
| Water Velocity Meter | $50 per day |
| Equipment Rental | Cost plus 10% |
| Large Format Map Plots and Document Binding | Cost plus 10% |
| Black and White Prints and Copies (8.5x11) | $0.15 per page |
| Black and White Prints and Copies (11x17) | $0.20 per page |
| Color Prints and Copies (8.5x11) | $0.50 per page |
| Color Prints and Copies (11x17) | $5 per page |
| Mailing, Shipping and Fax | Cost plus 5% |
| Laboratory Analysis Fees | Cost plus 5% |
| Fees Paid on Client's Behalf | Cost plus 5% |
| Field Supplies | Cost plus 5% |
| Commercial Travel (e.g. air fare) | Cost |
| Lodging (dependent on area) | Cost |
| Per Diem (overnight stay) | Federal Government Rate |

Updated July 1, 2016

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Attachment 3

NRTAB -

What follows is I believe information that will help answer Susan's bullet follow-up questions from our conversation. Brian and I look forward to discussing this further with you tomorrow at 3.

Have a great day,

Megan

Hi Megan,
Are you available to meet next Tuesday 8/2 at 3:00? Also, can you get me an addendum (or perhaps incorporate into your proposal) that incorporates the following by the end of this week:

· address discrepancies in species # between Task A & B;

· Task C: expand on example in Figure 3 to make it realistic—put in the description of the factors and how you got there (Siva or Renee can discuss this one with you);

· break down meeting schedules and why costs so much;

· Alder write another budget proposal that includes reduction of species

Thanks. And thanks again for your time on the phone today.

Susan Johnson
Planning Manager
Teton County Planning and Development
PO Box 1727
200 South Willow Street
Jackson, WY 83001
(Ph)307-733-3959
(Fax)307-733-4451

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*Water • Wetlands • Ecological Consulting*

## Revised Focal Species Habitat Mapping Proposal Budget

## August 1, 2016

| TASK | TOTAL |
|---|---|
| **Labor** | |
| Task A - Species List Refinement (incl 1 mtg x 2 hrs x 3 people + prep) | $ 1,120 |
| Task A - Focal Species Habitat Research (3 Species @ 3 hours ea) | $ 1,110 |
| Task A - Focal Species Habitat Research (14 Species @ 8 hours ea) | $ 12,400 |
| Task A - NRTAB Meetings including prep (1 mtg x 2 hrs x 3 people + prep) | $ 1,130 |
| Task A - Project Management (formerly Team Coordination) | $ 2,310 |
| Task A - Compilation of Materials for TC Planning | $ 1,000 |
| | |
| | |
| Task B - Refine GIS Methodology to be consistent between species | $ 1,880 |
| Task B - Refinement of Habitat Map (1 Species @ 4 hours) | $ 440 |
| Task B - Creation of Habitat Maps (16 Species @ 8 hours ea) | $ 12,880 |
| Task B - NRTAB Meetings including prep (1 mtg x 2 hrs x 3 people + prep) | $ 1,130 |
| Task B - Project Management (formerly Team Coordination) | $ 1,870 |
| | |
| Task C - Framework/ Weighted System Development | $ 4,520 |
| Task C - Framework Conference with NRTAB & TC Planning | $ 2,120 |
| Task C - Develop Draft Relative Importance Habitat Map | $ 1,320 |
| Task C - Develop Draft Report and Compile all GIS Products | $ 5,730 |
| Task C - Develop Final Relative Importance Habitat Map | $ 440 |
| Task C - Develop Final Report | $ 2,240 |
| Task C - NRTAB Meetings including prep (1 mtg x 2 hrs x 3 people + prep) | $ 1,130 |
| Task C - Project Management (formerly Team Coordination) | $ 1,320 |
| | |
| On-going - Monthly Reports to TC Planning (6 months) | $ 990 |
| **Labor Subtotal** | $ - |
| **Total Hours** | $ 57,080 |
| **EXPENSES** | |
| Computer Software Fees | |
| Printing of Paper Reports | |
| **Expense Subtotal** | **$ 1,350** |
| **ESTIMATED TOTAL** | **$ 58,430** |

**Costs Reduction by Species**

For each species that needs extensive research, the average cost is:

| Task | Budget | Average Approx. Cost |
|---|---|---|
| Task A | $12,400 ÷ 14 species | $ 886 |
| Task B | $12,880 ÷ 16 species | $ 805 |
| **Per Species Total** | | **$ 1,691** |

Costs in **Task C** are not measurably reduced by fewer species.

**Resulting Overall Proposal Cost**

| Number Species Removed from Project | Average Cost Reduction | Resulting Proposal Total |
|---|---|---|
| **1** | $ 1,691 | **$ 56,739** |
| **2** | $ 3,382 | **$ 55,048** |
| **3** | $ 5,073 | **$ 53,357** |
| **4** | $ 6,764 | **$ 51,666** |
| **5** | $ 8,455 | **$ 49,975** |
| **6** | $ 10,146 | **$ 48,284** |
| **7** | $ 11,837 | **$ 46,593** |
| **8** | $ 13,528 | **$ 44,902** |
| **9** | $ 15,219 | **$ 43,211** |
| **10** | $ 16,910 | **$ 41,520** |

ALDER ENVIRONMENTAL, LLC

*Water • Wetlands • Ecological Consulting*

# Focal Species Habitat Mapping Project

# Further Explanation on Process

# Task A

Task A research sets up the selection model for Task B

| biotic factors | abiotic factors |
|---|---|
| dominant species | slope |
| age classes | aspect |
| health indicators | elevation range |
| canopy cover | stream order |
| minimum patch area | water temperature |
| disturbance interactions | |

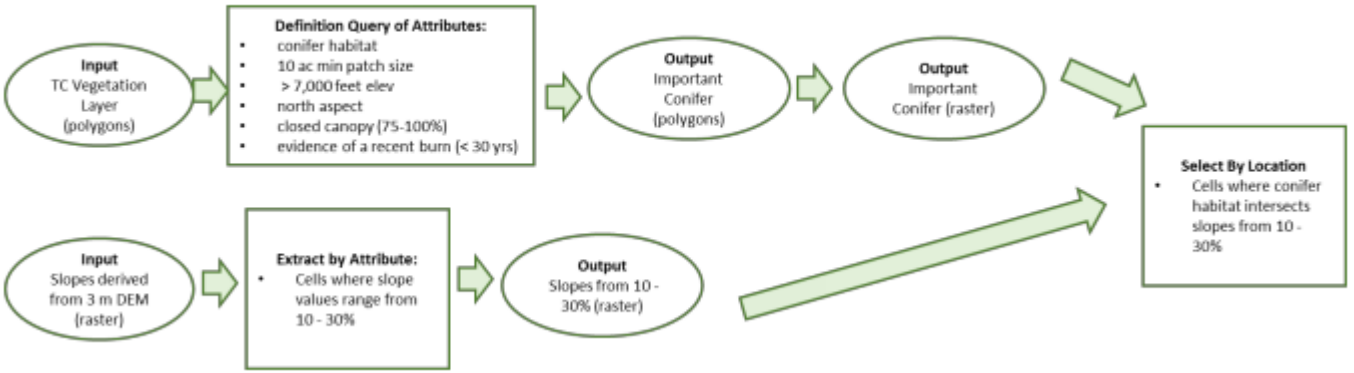
***Deliverables***

A narrative for each of the identified Focal Species will be provided in a consolidated and comprehensive product delivered both in hard copy and electronically (PDF). These narratives will include and describe important habitat variables, characteristics and ecological function for each species. Additionally, narratives will include a spreadsheet component listing habitat characteristic, the GIS data sources to be used for creation of a habitat layer, the selection criteria (corresponding to species' habitat requirements) to be used for each identified GIS data source and the ecologic function of the habitat components.

At this juncture in the project, the submission of both narratives and spreadsheet information with detailed information on available GIS data layers and selection criteria will allow Alder's Team, NRTAB and TC Planning staff to review the feasibility of various species' habitat layers before proceeding to Task B. Additionally, this review period provides an opportunity to confirm that all important habitat types present in Teton County will be represented in the final analysis for Task C.

# Task B

**Figure 1. GIS Habitat Layer Hypothetical Workflow**




***Verification of Habitat Layers Using Observational Data***

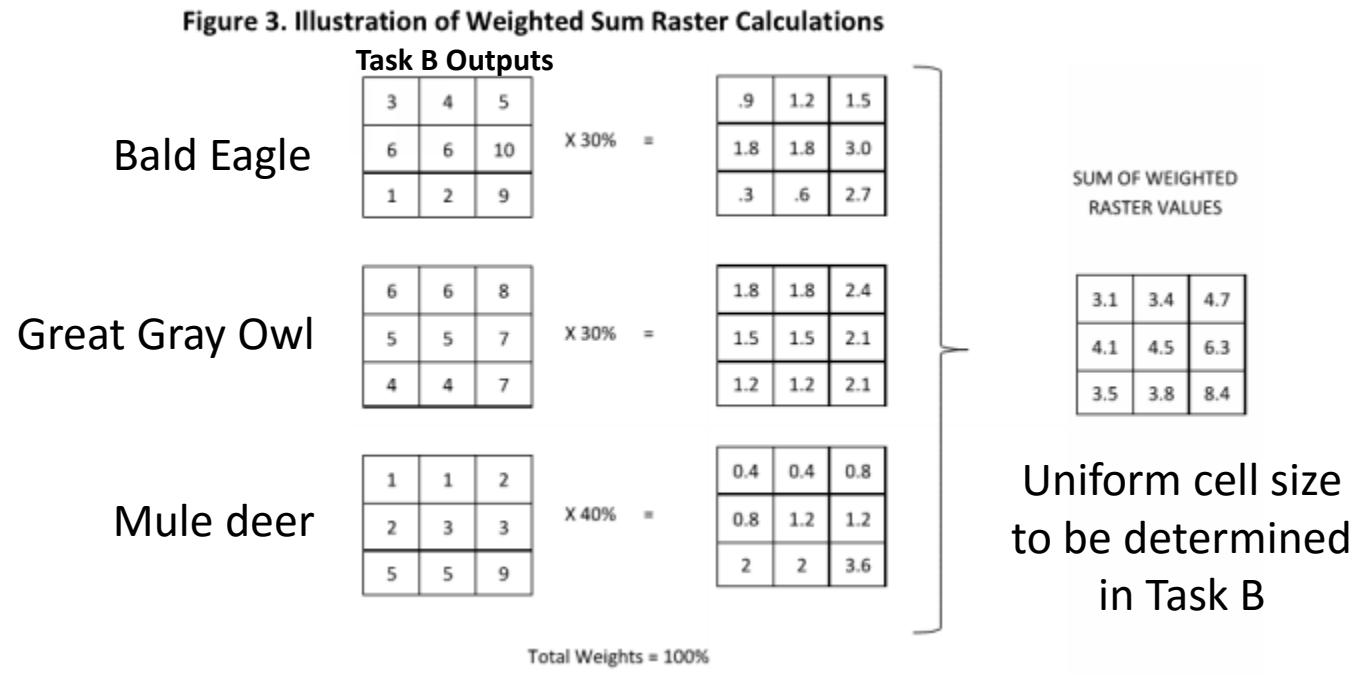
In both cases, primary or secondary research based habitat layers, local observational point data will be employed as a verification of the habitat map's results. The observational data (queried by season) will be overlaid on the habitat layer(s) and a select by location function will be used to assess the percentage of observations that positively correlate with the habitat layer. If the percentage of observations is low, then further evaluation of that habitat layer will be needed. Observational point data to be used will include Nature Mapping Jackson Hole and WGFD Wildlife Observation System (WOS) data. It is important to note that these observational data sets will not be employed in the creation of the habitat layers but rather used as a verification of the habitat identification process.

**<u>Observational Point Data</u>**

For species layers that are based on peer-reviewed habitat information as described in Fig 1, *VERIFICATION* is the only step where observational data is used. Binary cell values, based on presence/ absence, are not currently part of this process at any other step.

# Processing of Task B Outputs

Species Habitat Layers can be combined as displayed in Fig 3




This figure was included in the proposal as a generic explanation of raster math for those that needed an explanation. It is *not* intended to display any philosophical methodology but merely to display how the GIS tool works.

# Task C

**TASK C. ASSESSMENT OF RELATIVE VALUE OF IMPORTANT HABITAT SPECIES**

The role of Task C in this project is to use the research collected and created in Task A and B to transfer the project from the context of individual focal species and their habitats to the landscape context of important habitats, ecological function and connectivity throughout the County. Within this broad, landscape context, the critical assessment that Task C will make is to determine the relative values of habitats and movement corridors through the valley not only for the focal species identified but also for all wildlife species within the system.

As with all projects, there comes a point where subjective decisions and scientifically based interpretations of results must be made. The key to these subjective decisions and interpretations is to base them in ecological understanding of system and to address the question at hand in a manner that is accessible to the intended audience. It is Alder's Team's approach that these decisions and interpretations are best made through a collaborative approach of knowledgeable people (our Team, NRTAB, WGFD and TC Planning Staff) rather then in isolation by a few. Furthermore, the goal of Task C is to produce an assessment (GIS map and narrative) of the relative value of important habitats in Teton County. The audience for these products will be the Teton County Planning staff and the Board of County Commissioners to use in their work amending and developing land development regulations.

This is where ***a priori*** is used in our proposed methodology – to define the inputs to Task C before the raster is created thereby assuring that the hunt and pick method is ***not*** used. The output will be what the output is unless there is a sound, defensible reason to adjust the inputs.

***Methods***

A weighted system will be designed to describe the relative critical value of different habitat types within the system using the Spatial Analysis Overlay toolset in ArcGIS. The GIS data input for this weighted system will be the Focal Species Important Habitat layers created in Task B. This weighted system will be described *a priori* and will assign ranking values to critical components of the landscape and species use of the landscape. These critical components will be identified through the answering of intermediate questions. The results of Task A and B will be used to answer these important, intermediate questions. The results of these questions will not only be used to inform the relative value of important habitats but could also assist Teton County Planning staff in their prioritization and development of land use regulations. Example questions could include:

The results of the intermediary *EXAMPLE* questions will <u>not</u> all be used as inputs for Task C's raster output.

# Intermediate Question Inform Future Steps

Utility of Intermediary Question Results *Could* Include*:*
informing relative weights, assist TC Planning in their future work or verifying the GIS output from Task C

## Inform Relative Weights Process

- Is there a particular species of concern that should be prioritized?

If yes, then should they receive a higher relative weight? Informing the a priori decision of relative weights

- Are there habitat types that are particularly critical to wildlife species?

If yes, then should they receive a higher relative weight? Informing the a priori decision of relative weights

- Are there important species habitats or vegetation cover types that are in decline?

This is a question for experts who have historic, local knowledge. How are these vegetative cover types represented in the inputs? Is it sufficient? Should they receive higher relative weights?

- Are there movement corridors through the County that are of high importance?
- Are there movement corridors through the County that appear at risk and could be restored through future land regulations and management decisions?

If yes, then should there be an input raster of movement corridors as a means of mathematically emphasizing these areas or are the corridors adequately represented in the Task B outputs. These areas should also be incorporated into the rewrite of Division 5 LDRs as they pertain to fencing regulations and setbacks.

## Verify Outputs

- Are there areas where multiple Focal Species Important Habitats overlap?

This question was included because it is frequently mentioned as a simple metric of important areas in the valley. The reality is that it is a direct output of the inputs. This is to say that if the inputs are limited or not evenly balance by variable (e.g. habitat) then this is not a good metric to use. For instance, if 5 sagebrush species and no riparian species are input, then riparian will not rise to the top as important. Once the species list is generated, this question should again be assessed for its value. If used, the output may function better as a validation check of the Task C output rather than as an input to Task C.

## Assist TC Planning with Division 5 Revisions

- Are there habitat types within the County that are particularly abundant or scarce?

The answer to this question should be generated through an analysis of vegetation cover and aspect (at a minimum) on private lands without regard to species. If there are scarce resources, this can inform both the decision of relative weights as well as the rewrite of Division 5 LDRs.

- Is there a particular habitat patch size, habitat associations or edge effects that are particularly beneficial or have a negative effect on wildlife's habitats (either groups of species or specific species)?
- Are there particular habitats or habitat associations that would benefit from a development buffer to maintain ecological integrity of the system? Are these habitat types threatened by development?

If so, this should inform the rewrite of Division 5 LDRs. Do these habitat types need a setback from development to sustain ecologic function?

# Developing A Framework/ Managing the Task C Conversation

I. Alder's team, WGFD and 1 NRTAB representative (if inclined to be included) will revisit intermediate questions and discuss which are appropriate to ask and if additional questions are needed

II. Alder's team will generate answers to the intermediate questions through GIS analysis, research and gathering expert opinion as appropriate by question

III. Alder's team, WGFD and 1 NRTAB representative will meet to have a structured conversation analyzing the GIS Outputs of Task B and answers to intermediary questions. The group will generate a draft set of defensible, relative weights by GIS raster input layers (all layers will have a standardized cell size and values scheme)

IV. Draft relative weights scheme will be presented to NRTAB full board and TC Planning for feedback

V. Alder's Team will generate GIS output for Task C with standardized symbology

VI. Subgroup from step I & III above with the addition of a representative from TC Planning will analyze output, generate list of concerns/ thoughts and then present to the full NRTAB

Attachment 4

JACKSON HOLE CONSERVATION ALLIANCE

Dear Teton County Board of Commissioners,

The Jackson Hole Conservation Alliance believes that we have a responsibility to craft and enforce land use rules that promote walkable neighborhoods surrounded by protected open space, working agricultural lands, and connected wildlife habitat.

The upcoming update to our community's natural resources regulations provides an opportunity to advance this vision. In order to seize this opportunity and craft robust natural resource regulations based on facts and data, it's important to accurately assess and map habitats in our county that are important to species conservation.

County planning staff's proposed action to call for a proposal to create a transparent, science-based framework to identify, describe and map important wildlife habitat and migration corridors is a necessary step toward developing our natural resource regulations.

This Focal Habitat Feature project will help us understand what habitats are important and where they are located in our private lands. We understand that staff have taken this approach with significant consultation from our local Wyoming Game & Fish agency biologists. This will help ensure that good data and science are incorporated into this request for proposal.

Further, we understand that this proposal will also include ideas for how this framework may be updated as new data become available.

The Alliance supports this request from planning staff and kindly asks that you instruct and allow staff to move ahead on this project. This project when complete will represent an important resource that helps our planners develop robust natural resource regulations.

Thank you for your consideration of this request and please let us know if we can be of any help with this matter moving forward,

Craig M. Benjamin

Craig M. Benjamin
Executive Director

Attachment 5

# REQUEST FOR PROPOSALS

# Focal Species Habitat Mapping Project for Teton County, Wyoming

**June 24, 2016**

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## Contents

## I. Purpose

The objective of this project is to create a transparent, and replicable framework to identify, describe, rank and map important wildlife habitats and movement corridors, which will inform Teton County Commissioners and planners as they amend and apply land development regulations. The approach will reflect the relative values of important habitat types for focal species using objectively collected observational data, and the best available science. The methodology will be able to incorporate new data that meets established standards as it is developed, to refine the species maps. The analytical, decision-informing system and maps will allow Teton County to fulfill its stewardship obligation to best protect important wildlife habitat and movement corridors as set forth in the Teton County Comprehensive Plan.

Teton County intends to enter into a contract with a professional consultant to develop a GIS map and description of the relative value of different important habitat types for identified focal species in Teton County (Appendix I). The final product will inform a future Natural Resources Overlay (NRO) map and natural resource protection standards.

## II. Background

The Jackson/Teton County Comprehensive Plan (Comprehensive Plan) calls for the protection of native species populations through a system of regulations and requirements that are based on relative value of habitat. Teton County has completed a Geographic Information System (GIS) digital layer of designated vegetation and non-vegetation cover-types on all lands in Teton County, Wyoming, excluding most large acreages under federal ownership. Teton County intends to use the work produced out of this proposal in a broader effort to update the Town and County Land Development Regulations regarding habitat protection. Policy 1.1.a of the Comprehensive Plan states the following:

> *"Protecting wildlife requires protecting wildlife habitat and wildlife movement corridors. Our Natural Resource Overlay (NRO) that protects wildlife habitat and wildlife movement corridors will consider the importance and abundance of habitat types and be based on a set of focal species that indicate the health of all native species and includes culturally and economically significant species. The most abundant and visible wildlife species are not necessarily indicative of overall ecosystem health. Likewise, while a habitat may be important, it may also be abundant and therefore only relatively critical, while another important habitat may be declining and/or disappearing due to development and climate change and therefore absolutely critical. As our NRO and other programs to protect wildlife habitat from the impacts of development and transportation evolve, they should be updated to reflect the best available data on the relative critical value of different habitat types for identified focal species."*

Peer review is requested throughout each of the three significant phases of this study as identified by Tasks. For the purposes of consistency where indicated in the procedural steps outlined in this RFP peer review shall include Teton County Planning Department (TCPD) staff, the Natural Resources Technical Advisory Board (NRTAB), Wyoming Game and Fish Department (WGFD), and other academic and scientific professionals as determined by TCPD staff.

## III. Scope of Work and Services

### Task A. Identify Important Habitat Characteristics of Focal Species

1. Using the provided list of focal species (Appendix I), the Consultant will confirm the ability to work with the preliminary list, and identify any important changes to the list designated in the RFP. The Consultant will identify focal species important habitat through referenced published literature, referenced expert knowledge, or derived correlations from available datasets. Where sufficient data is readily available, the consultant will analyze the data in a scientific, statistical, repeatable manner. Results will first be validated using proven, accepted statistical validation techniques, only secondarily or when rigorous scientific analysis is not possible due to the lack of available data, will identified important habitat be validated by expert opinion. Habitat descriptors will be a function of vegetative covertype associations and abiotic factors including but not limited to slope, aspect, or elevation. Important habitat will capture a variety of essential natural history requirements for a given species or suite of species, including but not limited to reproductive habitat, migration corridors, and crucial winter range. The consultant will develop text and a spreadsheet table describing the ecological function of the important habitat described for each focal species habitat overlay.
2. **Task A** Deliverable is a narrative for each of the identified focal species describing important habitat and associated habitat descriptor variables, such that important habitat distribution maps can be generated in a

GIS format as described in Task B. The spreadsheet table describing ecological function of important habitat for each focal species will be included as GIS metadata. This information will be peer reviewed.

## Task B. Map Important Habitat for each identified focal species

1. The consultant will develop a GIS layer of critical habitat distribution within Teton County for each identified focal species, using clearly defined methods with reference to source literature supporting the chosen methodology.
2. **Task B** Deliverables will be a GIS layer illustrating important habitat distribution within Teton County for each focal species, and a spreadsheet table describing important habitat ecological function by species.
    a. All GIS layers will include thorough metadata documentation.
    b. Where point data is available, distribution of focal species important habitat will be determined using that point data and an assessment of important habitat map accuracy.

**Task B** deliverable products will be submitted to the TCPD for peer review. Individual GIS layers will be utilized in Task C only after approval through this internal review process.

## Task C. Assessment of Relative Value of Important Habitat

There is a broad, landscape context within which focal species persist in Teton County. The abundance, connectivity and ecological health of discrete important habitat types are important factors that inform the relative value of important habitats. Task C of this project requires the Consultant to evaluate species-specific important habitat in a broader context of habitat availability, threats to habitat sustainability, and habitat connectivity.

1. The Consultant shall develop a framework to determine relative value of important habitat. A methodology for this component of the study will be presented in the proposal. The project final output is envisioned to utilize the consolidation of all focal species habitat map layers for illustration of the relative critical value of different habitat types. A weighting system will be described *a priori* in order to assign ranking values to special factors that influence focal species use of the landscape. Examples of focal species important habitat attributes to incorporate into the weighting schema include:
    a. Overlapping important habitat for multiple focal species
    b. A habitat or habitat feature for a single species of concern
    c. A crucial migration corridor
    d. Rare or declining vegetation type associated with focal species' distribution
    e. Landscape metrics such as habitat patch size, proximity, edge/ecotone abundance

2. **Task C** Deliverables include:

    a. GIS map layer(s) illustrating the consolidated focal species important habitats, as attributed through the application of weighting schema as described in the Task C methodology to represent the relative habitat value.
    b. Seven (7) copies of the Draft final report to the Teton County Planning Department that compiles and presents focal species relative habitat analysis, methodologies, along with attendant GIS map layer(s), text, and if applicable tabular information in spreadsheet format defining selection methodology and delineating important habitat relative values. This report Draft will be peer reviewed.
    c. Draft Final Report findings, following peer review and incorporation of peer review edits, will be presented to County Elected Officials.
    d. Seven (7) copies of the Final Report will be submitted, and will include comprehensive description of methods, results and discussions for each of the Tasks outlined in this RFP. Final reports will be provided in both digital and hard copy to the Planning Department. The digital delivery will include all GIS layers in either Shapefile or MapInfo Table format, with associated metadata.
    e. The final report will include a description of how additional important habitat layers or revisions to the Final Report layers can be improved or updated in the future. The vision of this study is to achieve a GIS platform that can be refined and improved with time, in iterative steps within a pre-established framework.

### Term/Project Timeline and Correspondence

The applicant shall include a project timeline for completion of Tasks A, B, and C with their submittal. The Board of County Commissioners expects the Focal Species Habitat Mapping Study to be completed in six (6) months, or sooner, from the date the contract is awarded. Any extensions to complete all Tasks are not anticipated in the six (6) month timeframe, and further any requests for extensions to complete the Project may not be recommended.

The Consultant shall provide monthly written progress reports to the TCPD project manager, which will be required related to completion of Task Deliverables, and general progress.

## IV. Estimated Cost of Services

The County has budgeted $45,000.00 for this Project. The applicant shall provide a detailed breakdown of services by task with hours, personnel, and cost of each task, including a total estimated cost of services. If cost of project proposed exceeds the budget amount, the consultant shall provide both a rationale for why it exceeds the budget and a revised scope that would meet the allotted budget specifying what would be eliminated from the scope of work and services described above. The Consultant who is selected shall invoice the TCPD for each deliverable and the County shall remit payment to the Consultant upon each Task being delivered to the Planning Department and found sufficient.

## V. Insurance Requirements

### A. Insurance

The Consultant shall provide at its own expense the following insurance for its business entity and its employees in connection with the work required under this contract:

1. Worker's Compensation: Statutory.
2. General Public and Auto Liability: $1,000,000.00 each occurrence and aggregate.

### B. Liability

The Consultant shall indemnify and hold harmless the County against all forms of liability, claims, damages, and demands, including attorney's fees and litigation expenses, of every kind and nature and that which results from or in any manner arises out of, or in connection with, the performance of work under this contract.

## VI. Employment Discrimination Prohibited

During the performance of a contract awarded pursuant to this "Request for Proposals," the Consultant agrees to not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Consultant agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause. The Consultant, in all solicitations or advertisements for employees placed by or on behalf of the Consultant, will state that the Consultant is an equal opportunity employer. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for meeting these requirements.

## VII. Proposal Content

At a minimum, the Applicant's proposals shall contain the following information:

**A.** **Understanding**: Consultant's understanding of project intent and scope, required services and work product;

**B.** **Consultant Qualifications**: Qualifications of the Consultant, including a current company profile, qualifications of specific individuals who will provide the services and work product required for this project, conservation ecology and corridor ecology credentials, their availability and time commitment, and examples of similar completed work and client references;

**C.** **Demonstrated Relative Experience:** Information regarding preparation of comparable work projects, including a list of at least 3 references/clients from previous similar work projects, which will be contacted;

**D.** **Insurance**: Required coverage (Workers' compensation, General public and auto liability);

**E.** **Timeline**: for completion of work including key milestones;

**F.** **Fee for Services**: with breakdown by tasks, budget time and cost per task/deliverable, and including all expenses including costs related to meetings with Planning Staff, NRTAB and the Board of County Commissioners;

**G.** **Conditions and Additional Services**: Specific contract and performance conditions, including hourly rates for additional services; and,

**H.** **Exceptions**: Any exceptions, which the Applicant is requesting to the requirements of this Request for Proposals.

**I.** **Contact:** Name, address, phone numbers, and email of firm, with contact person and title.

## VIII. Special Provisions

A. **Fee for Services and Payments**: Invoicing and Payment terms shall be in accordance with the provisions of the Teton County Policies Manual and Handbook (2011 Edition) and Bid/Contract, Services – Contracting and applicable Wyoming State Statutes.

B. **Award of Contract**: The TCPD in consultation with the NRTAB shall review the bid proposals and the Teton County Planning Director shall make his recommendations to the Board of County Commissioners for Notice of Award and contract to the preferred Applicant who meets the criteria. The County shall select a Consultant and award a contract based upon criteria and evidence of capabilities including, but not limited to, the following areas:

1. Demonstrated understanding of project scope and scope of Consultant services;
2. Qualifications to perform required services;
3. Cost basis, fee for services, and terms of payment;
4. References of provider, and years in business;
5. Ability to meet time requirements and proposed work plan; and
6. Adequate insurance (verified with insurance required in bid specification);
7. Defensible and reproducible product;
8. Preference in the selection will be given to applicants with expertise in Teton County, Wyoming.

The County may negotiate with two or more respondents. After negotiation with selected respondents, the County shall select the one that, in its opinion, has made the best overall presentation and cost projections. If the County determines that only one respondent meets the qualifications, it may enter into negotiations with that respondent.

C. **Reservation of Rights**: Teton County reserves the right to reject any and all proposals, to waive informalities and irregularities in proposals received, to reject non-conforming, non-responsive or conditional proposals, and to accept the proposal that in the County's sole judgment best serves the interests of Teton County, Wyoming.

D. **Method of Submittal of Proposals**: Sealed bid proposals must be received at the Teton County Planning & development Department, 200 S. Willow, 2nd Floor, Jackson, Wyoming, by

**4:00 pm, July 15, 2016**

Proposals received after this time and date will be returned unopened. It is the responsibility of the respondent to ensure the bid proposal arrives on time. Please provide seven bound copies and one electronic copy of the proposal. Mail or hand deliver proposals to the attention of:

Hamilton Smith
Teton County Planning & Development Department
P.O. Box 1727
200 S. Willow
Jackson, WY 83001

Fees for Services as stated in the bid proposal shall be firm for 6 months, beginning TBD, 2016. No faxes or electronic submittals will be accepted. All proposals shall be the property of the TCPD and the County and will become a public record.

**E. Schedule**

| | | |
|---|---|---|
| 1. | RFP Issued | June 24, 2016 |
| 2. | Proposals Due | July 15, 2016 |
| 3. | Notification of Award | August 2, 2016 |
| 4. | Contract Review/Approval | August 9, 2016 |

F. **Required Compliance**: The Applicant who is awarded the contract shall be required to comply with all Teton County, State of Wyoming, and Federal requirements related to the contract.

Please direct any questions or requests for additional information regarding this Request for Proposals to Hamilton Smith at the Teton County Planning & Development Department, (307) 733-3959.

## Appendix I. Focal Species List

Moose
Mule deer
Elk
Snake River fine-spotted cutthroat trout
Western toad
Great blue heron
Trumpeter swan
Northern goshawk
Northern harrier
Bald eagle
Great gray owl
Greater sage-grouse
Willow flycatcher
Common yellowthroat
Brewer's sparrow
Sage thrasher
Western Meadowlark