Data Management Plan

Name of Contractor	**Teton Science Schools, Inc**
Name of project	**Planning-Support for Mitigation of Wildlife Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming**
Project Duration	**Start date: January 2015** **End: August 2016**
DMP Version	**2**
Date Amended, if any	
Name of all authors, and ORCID number for each author	**Corinna Riginos: 0000-0001-9082-5206** **Chauncey Smith: 0000-0001-8861-6763** **Holly Copeland: 0000-0001-8613-2650** **Hall Sawyer: 0000-0002-3789-7558** **Kevin Krasnow: 0000-0002-0887-2503** **Thomas Hart: 0000-0002-3246-7049**
WYDOT Project Number	**RS03215**
Any Digital Object Identifier (DOI), including any CROSSREF number, which has been assigned to any peer reviewed publication or data generated by this project	**Not yet assigned.**
Name of all peer reviewed publications which have been generated using data from this project	**None yet**
URLs for all peer reviewed publications which have been generated using data from this project	**None yet**
RiP RH Display ID Number	**05166467**
Dataset URL, if available	**None yet**

What constitutes such data will be determined by the Principle Investigator, Project Champion, and the Research Manager. In general, your plan should address final research data. This includes recorded factual material commonly accepted in the scientific community as necessary to validate research findings. Final research data do not include laboratory notebooks, partial datasets, preliminary analyses, drafts of scientific papers, plans for future research, peer review reports, communications with colleagues, or physical objects, such as gels or laboratory specimens. As part of your research, you may also generate unique data, which are data that cannot be readily replicated. Your DMP should also address unique data that may arise from your research.

WYDOT expects the timely release and sharing of data to be no later than the acceptance for publication of the main findings from the final dataset, unless the Principle Investigator will be embargoing the data. In such a case, the data cannot be embargoed for a period longer than twelve (12) months.

1. Introduction

The purpose of this research project is to:

The purpose of this project was to analyze patterns of deer-vehicle collisions across Wyoming in order to provide valuable information to WYDOT about cost-effective mitigations for wildlife-vehicle collisions. This project consists of five outcomes: (1) An analysis of the placement of deer road crossing signs relative to areas with high and low deer-vehicle collision rates, with recommendations for modification of sign placement; (2) identification of the migration and movement routes most vulnerable to deer-vehicle collisions; (3) an analysis of the variables associated with high deer-vehicle collision rates across the state; (4) identification of the "hotspots" of deer-vehicle collisions in the state and the biological patterns driving them, leading to (5) Specific recommendations for suitable mitigations at each of these sites.

2. Definitions

a.   Code or scripts include code used in the collection, manipulation, processing, analysis or visualization of data, but may also include software developed for other purposes.

b.   Copyright is a set of legal rights extended to copyright owners that govern such activities as reproducing, distributing, adapting, or exhibiting original works fixed in tangible forms.

c.   Data means the recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, communications with colleagues. Recorded material excludes physical objects (e.g. laboratory samples). Research data also does not include trade secrets, commercial information, materials necessary to be held confidential; and personnel and medical

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information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy.

     d.   Data Archive is a site where machine readable materials are stored, preserved or possibly redistributed to individuals interested in the materials.

     e.   Data Management Plan is a document that specifies your plans for managing your data and files for a research project.

     f.   Dataset means collection of data.

     g.   Metadata refers to structured data about data which helps define administrative, technical, or structural characteristics of the digital content.

3. Data Types and Storage

The types of data and/or datasets generated and/or used in this project include …

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1. ArcGIS geodatabase ($gdb\ v10$) including:
   a. Point feature class with location of all wildlife crossing signs
   b. Point feature class of all wildlife-vehicle collision records 1990-2014 in the state of Wyoming, with duplication removed between records obtained from WYDOT's crash and carcass databases
   c. Feature class with 1-mile increments of WYDOT's LRS route network
   d. Feature class with 3.2-mile increments of WYDOT's LRS route network
   e. Feature class with 27 hotspots of deer-vehicle collisions around Wyoming
   f. Raster file with kernel density of all deer collisions, 2008-2013
   g. Raster file of deer collisions in each year, 2008-2013
   h. Raster file of deer collisions in each season (winter, fall, spring, summer)
2. Excel spreadsheet (.csv files) summarizing: deer-vehicle collision counts per 3-miles of Wyoming road network (by year and by season) and data on numerous habitat and road variables for each 3.2 mile increment including traffic volume, speed limit, land cover, deer winter use areas, and deer migration habitat. These data were used for analysis of variables associated with high deer-vehicle collision rates.

Please see the accompanying file "RS03215_062016_Metadata.pdf" for details on the data included.

Data collection protocols are documented fully in the project final report. All data are reproducible.

Data are housed on computers and external hard drives maintained by project PIs.

Provide a description of the data that you will be gathering in the course of your project. You should address the nature, scope, and scale of the data that will be collected. Describe the characteristics of the data, their relationship to other data, and provide sufficient detail so that reviewers will understand any disclosure risks that may apply. Discuss value of the data over the long-term. Please provide the name of all repositories where the data will be housed during the lifetime of the project.

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Checklist

o What type of data will be produced?

o How will data be collected? In what formats?

o How will the data collection be documented?

o Will it be reproducible? What would happen if it got lost or became unusable later?

o How much data will it be, and at what growth rate? How often will it change?

o Are there tools or software needed to create/process/visualize the data?

o Will you use pre-existing data? From where?

o Storage and backup strategy?

3. Data Organization, Documentation and Metadata

The plan for organizing, documenting, and using descriptive metadata to assure quality control and reproducibility of these data include …

All GIS data (in the geodatabase) have embedded metadata adhering to standards of the Federal Geographic Data Committee (FGDC). Naming conventions have been used to maximize clarity and efficient access to data.

The .csv files accompanied by a metadata text file explaining each column of the spreadsheet and how it was derived.

Data identifiers will be assigned upon upload to a public access website after the embargo period has ended.

Your DMP should describe the anticipated formats that your data and related files will use. To the maximum extent practicable, and in accordance with generally accepted practices in your field, your DMP should address how you will use platform-independent and non-proprietary formats to ensure maximum utility of the data in the future. If you are unable to use platform-independent and non-proprietary formats, you should specify the standards and formats that will be used and the rationale for using those standards and formats.

NOTE: Attach the Metadata transmittal form or URL for data generated or peer reviewed publications from this project.

Checklist

o What standards will be used for documentation and metadata?

o Is there good project and data documentation format/standard?

o What directory and file naming convention will be used?

o What project and data identifiers will be assigned?

o Is there a community standard for metadata sharing/integration?

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4. Data and/or Database Access and Intellectual Property

What access and ownership concerns are there…

> There are no privacy or confidentiality concerns.
>
> All derived data will be handed over to WYDOT on completion of the project and will be made publically available after a 12-month embargo period. Derived data includes, for example, presence vs. absence of a known deer migration route, based on GPS collar data. Original GPS collar data remains the property of its original owners, which include WEST, Inc., and the University of Wyoming.
>
> After the embargo period, data will be publicly accessible. Data archiving and any updates will be controlled by the PIs.

Protecting research participants and guarding against the disclosure of identities and/or confidential business information is an essential norm in scientific research. Your DMP should address these issues and outline the efforts you will take to provide informed consent statements to participants, the steps you will take the protect privacy and confidentiality prior to archiving your data, and any additional concerns. If necessary, describe any division of responsibilities for stewarding and protecting the data among Principal Investigators.

If you will not be able to deidentify the data in a manner that protects privacy and confidentiality while maintaining the utility of the dataset, you should describe the necessary restrictions on access and use. In general, in matters of human subject research, your DMP should describe how your informed consent forms will permit sharing with the research community and whether additional steps, such as an Institutional Review Board (IRB), may be used to protect privacy and confidentiality.

Checklist

o What steps will be taken to protect privacy, security, confidentiality, intellectual property or other rights?
o Does your data have any access concerns? Describe the process someone would take to access your data.
o Who controls it (e.g., PI, student, lab, University, funder) ?
o Any special privacy or security requirements (e.g., personal data, high-security data) ?
o Any embargo periods to uphold?

5. Data Sharing and Reuse

The data will be released for sharing in the following way …

Intellectual property rights will be held by the lead PI (Corinna Riginos), Teton Science Schools, WYDOT, and the State of Wyoming. Data will be made available via the Wyoming State Archives. Anybody wishing to re-use the data should submit a request in writing to the PI with a clear explanation of what the data will be used for an agreement to acknowledge the PIs appropriately.

We are preparing a manuscript detailing study findings for peer-reviewed publication.

Describe who will hold the intellectual property rights for the data created by your project. Describe whether you will transfer those rights to a data archive, if appropriate. Identify whether any copyrights apply to the data, as might be the case when using copyrighted instruments. If you will be enforcing terms of use or a requirement for data citation through a license, indicate as much in your DMP. Describe any other legal requirements that might need to be addressed.

Checklist

o If you allow others to reuse your data, how will the data be discovered
and shared?
o Any sharing requirements (e.g., funder data sharing policy) ?
o Audience for reuse? Who will use it now? Who will use it later?
o When will I publish it and where?
o Tools/software needed to work with data?

6. Data Preservation and Archiving

The data will be preserved and archived in the following ways …

Data will be archived with the Wyoming State Archives. Each dataset will be assigned a Digital Object Identifier (DOI).
Data will be retained there indefinitely.

Describe how you intend to archive your data and why you have chosen that particular option. You may select from a variety of options including, but not limited to:
- Use of an institutional repository
- Use of an archive or other community-accepted data storage facility
- Self-dissemination

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You must describe the dataset that is being archived with a minimum amount of metadata that ensures its discoverability. Whatever archive option you choose, that archive must support the capture and provision of the US Federal Government "Common Core" metadata. In addition, the archive you choose must support the creation and maintenance of persistent identifiers and must provide for maintenance of those identifiers throughout the preservation lifecycle of the data. Your plan should address how your archiving and preservation choices meet these requirements.

Checklist
o How will the data be archived for preservation and long-term access?
o How long should it be retained (e.g., 3-5 years, 10-20 years, permanently) ?
o What file formats? Are they long-lived?
o Are there data archives that my data is appropriate for (subject-based? Or institutional)?
o Who will maintain my data for the long-term?

NOTE:

Researchers evaluating data repositories as the option(s) for storing and preserving their data should examine evidence demonstrating that the repository:
   a. Promotes an explicit mission of digital data archiving;
   b. Ensures compliance with legal regulations, and maintains all applicable licenses covering data access and use, including, if applicable, mechanisms
        to protect privacy rights and maintain the confidentiality of respondents;
   c. Has a documented plan for long-term preservation of its holdings;
   d. Applies documented processes and procedures in managing data storage;
   e. Performs archiving according to explicit work flows across the data life cycle;
   f. Enables the users to discover and use the data, and refer to them in a persistent way through proper citation;
   g. Enables reuse of data, ensuring appropriate formats and application of metadata;
   h. Ensures the integrity and authenticity of the data;
   i. Is adequately funded and staffed, and has a system of governance in place to support its mission; and
   j. Possesses a technical infrastructure that explicitly supports the tasks and functions described in internationally accepted archival standards like Open Archival Information System (OAIS).
        **These guidelines are based on the Data Seal of Approval.

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METADATA TRANSMITTAL FORM

Title[1]	Planning-Support for Mitigation of Wildlife-Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming
Creator	Corinna Riginos (ORCID 0000-0001-9082-5206), Holly Copeland (ORCID 0000-0001-8613-2650), Chauncey Smith (ORCID 0000-0001-8861-6763), Hall Sawyer (ORCID 0000-0002-3789-7558), Kevin Krasnow (ORCID 0000-0002-0887-2503), and Thomas Hart (ORCID 0000-0002-3246-7049)
Publication Date(s)	August, 2016
Description	The object of the research project was to provide transportation planners, conservation planners, and wildlife managers with statewide information that will help them evaluate the placement of current and future wildlife vehicle mitigation measures.
Keywords	Road Kill, Wildlife-Vehicle Collisions, TSS, Wyoming Department of Transportation, WYDOT, NRCC, Northern Rockies Conservation Cooperative.
Subject	Wildlife-vehicle collision factors.
Identifier[2]	Grant No. RS03215. FHWA-WY-1610F
Edition	08/23/2016
Abstract	Wyoming is home to abundant big game, including long-distance migratory species such as mule deer, elk, and pronghorn. Where these animals' movement patterns intersect with roads, vehicles often hit animals. This poses a threat both to highway safety and to wildlife populations. Here, we used carcass and collision records from 2008 to 2013 to identify the areas in Wyoming with the highest rates of wildlife-vehicle collisions (focusing primarily on deer, which make up the majority of wildlife-related collisions). We identified 27 deer-vehicle collision "hotspots" in the state. We then analyzed the ecological and road characteristics that are associated with areas of high deer-vehicle collision (DVC) rates. Results showed that DVC spatial patterns are consistent across multiple years and seasons. Across the state, high rates of DVC are most strongly associated with high traffic volumes, high speed limits, deer migration habitat, deer winter-use areas, irrigated agriculture, and wetlands. We then examined the spatial and temporal patterns of DVC for each hotspot in relation to known deer migration routes and winter-use areas. This enabled us to assess where DVC hotspots are associated with migration

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[1] *To include alternate title; conference title; and journal title if they are different.*

[2] *To include record numbers; report numbers; NTIS number; TRIS Accession Number; OCLC Number; ISBN; ISSN; contract number; and DOI if available.*

	times only, winter-use areas only, migration and winter-use, summer-use, or year-long deer presence. Using these results, we suggest mitigation measures that are most suitable for each of the 27 collision hotspots.
Geographic Coverage	State of Wyoming.
Language	English
Publisher	Wyoming Department of Transportation
Contact Point	Corinna Riginos Northern Rockies Conservation Cooperative P.O. Box 2705 Jackson, WY 83001 Email: criginos@gmail.com WYDOT Sponsor: Thomas Hart, Wildlife Specialist, Wyoming Department of Transportation 5300 Bishop Blvd. Cheyenne WY 82009-3340
Funding agency	WYDOT and FHWA
Access Restrictions	Public
Intellectual Property and Other Rights	Copyright © 2016. All rights reserved, State of Wyoming, Wyoming Department of Transportation, Teton Science Schools, and Corinna Riginos.
License	None
Format	Data is formatted in .gdb ArcGIS format
Collection	There are 2 subject datasets
Related Documents	http://www.corinnariginos.com/resources/MD_Final_Report_RS03210.pdf http://www.corinnariginos.com/resources/WVC_and_migration_final_report.pdf Data: RS03215_062016_Metadata.pdf
Data Organization	WYDOT, Teton Science Schools
Size of file	Dataset size: 55.3 MB

Title[3]	Master Data Table 062016 Master_Data_062016.xls
Creator	Corinna Riginos Northern Rockies Conservation Cooperative P.O. Box 2705 Jackson, WY 83001 Email: criginos@gmail.com
Publication Date(s)	June 20, 2016
Description	This data table contains all associated data referenced in the report "Planning-Support for Mitigation of Wildlife-Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming". This data table can be joined to the feature class CID_32mi_1531 to be viewed spatially. For more information read: RS03215_062016_Metadata.pdf
Keywords	Road Kill, Wildlife-Vehicle Collisions, TSS, Wyoming Department of Transportation, WYDOT, NRCC, Northern Rockies Conservation Cooperative.
Subject	Wildlife-vehicle collision factors.
Identifier[4]	Grant No. RS03215
Edition	08/23/2016
Abstract	Wyoming is home to abundant big game, including long-distance migratory species such as mule deer, elk, and pronghorn. Where these animals' movement patterns intersect with roads, vehicles often hit animals. This poses a threat both to highway safety and to wildlife populations. Here, we used carcass and collision records from 2008 to 2013 to identify the areas in Wyoming with the highest rates of wildlife-vehicle collisions (focusing primarily on deer, which make up the majority of wildlife-related collisions). We identified 27 deer-vehicle collision "hotspots" in the state. We then analyzed the ecological and road characteristics that are associated with areas of high deer-vehicle collision

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	(DVC) rates. Results showed that DVC spatial patterns are consistent across multiple years and seasons. Across the state, high rates of DVC are most strongly associated with high traffic volumes, high speed limits, deer migration habitat, deer winter-use areas, irrigated agriculture, and wetlands. We then examined the spatial and temporal patterns of DVC for each hotspot in relation to known deer migration routes and winter-use areas. This enabled us to assess where DVC hotspots are associated with migration times only, winter-use areas only, migration and winter-use, summer-use, or year-long deer presence. Using these results, we suggest mitigation measures that are most suitable for each of the 27 collision hotspots.
Geographic Coverage	State of Wyoming.
Language	English
Publisher	None Yet.
Contact Point	Corinna Riginos Northern Rockies Conservation Cooperative P.O. Box 2705 Jackson, WY 83001 Email: criginos@gmail.com WYDOT Sponsor: Thomas Hart, Wildlife Specialist
Funding agency	WYDOT
Access Restrictions	Public
Intellectual Property and Other Rights	Copyright © 2016. All rights reserved, State of Wyoming, Wyoming Department of Transportation, Teton Science Schools, and Corinna Riginos
License	The license or non-license (i.e. Public Domain) status with which the dataset or API has been published.
Format	.xls. Excel file
Collection	The collection of which the dataset is a subset.
Related Documents	RS03215_062016_Metadata.pdf
Data Organization	WYDOT, Teton Science Schools
Size of file	883 KB

Title[5]	WVC Highway Impacts geodatabase WVC_Highway_Impacts.gdb (can only be viewed with ArcGIS)
Creator	Corinna Riginos
Publication Date(s)	July 30, 2016

Description	This geodatabase contains all spatial data files referenced in the report "Planning-Support for Mitigation of Wildlife-Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming".
	
	Feature Classes Contained:
	    CID_32mi_1531
	    DVC_Circles_1mi
	    Identified_Hotspots_27
	    Statewide_WVC_1987_2014
	
	Raster Data Contained:
	    Kernel Density raster file of All DVC 2008 – 2013
	    Kernel Density raster file per year for DVC 2008 – 2013
	    Kernel Density raster file for each season (Winter, Fall, Spring, Summer)
	
	For more information read RS03215_062016_Metadata.pdf

Keywords	Road Kill, Wildlife-Vehicle Collisions, TSS, Wyoming Department of Transportation, WYDOT, NRCC, Northern Rockies Conservation Cooperative.
Subject	Wildlife-vehicle collision factors.
Identifier[6]	Grant No. RS03215
Edition	08/23/2016
Abstract	Wyoming is home to abundant big game, including long-distance migratory species such as mule deer, elk, and pronghorn. Where these animals' movement patterns intersect with roads, vehicles often hit animals. This poses a threat both to highway safety and to wildlife populations. Here, we used carcass and collision records from 2008 to

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	2013 to identify the areas in Wyoming with the highest rates of wildlife-vehicle collisions (focusing primarily on deer, which make up the majority of wildlife-related collisions). We identified 27 deer-vehicle collision "hotspots" in the state. We then analyzed the ecological and road characteristics that are associated with areas of high deer-vehicle collision (DVC) rates. Results showed that DVC spatial patterns are consistent across multiple years and seasons. Across the state, high rates of DVC are most strongly associated with high traffic volumes, high speed limits, deer migration habitat, deer winter-use areas, irrigated agriculture, and wetlands. We then examined the spatial and temporal patterns of DVC for each hotspot in relation to known deer migration routes and winter-use areas. This enabled us to assess where DVC hotspots are associated with migration times only, winter-use areas only, migration and winter-use, summer-use, or year-long deer presence. Using these results, we suggest mitigation measures that are most suitable for each of the 27 collision hotspots.
Geographic Coverage	State of Wyoming.
Language	English
Publisher	None Yet.
Contact Point	Corinna Riginos Northern Rockies Conservation Cooperative P.O. Box 2705 Jackson, WY 83001 Email: criginos@gmail.com WYDOT Sponsor: Thomas Hart, Wildlife Specialist
Funding agency	WYDOT
Access Restrictions	Public
Intellectual Property and Other Rights	
License	The license or non-license (i.e. Public Domain) status with which the dataset or API has been published.
Format	.gdb ArcGIS format
Collection	The collection of which the dataset is a subset.
Related Documents	RS03215_062016_Metadata.pdf
Data Organization	WYDOT, Teton Science Schools
Size of file	55.3 MB