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# A pre-emptive rangeland restoration approach to improving biodiversity and provision of ecosystem services

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## Data Management Plan

### *a. Expected Data Type*

Field experiment data will include: 1) field measurements (e.g., survival, height, basal circumference, tiller production, flowering) of planted seedlings collected at time of planting and in subsequent springs/summers, 2) site descriptive data (e.g., plant cover, shrub densities, and interplant gap sizes), and 3) microsite soil surface classification. All data will be entered and stored in an Access database.

Social data primarily will be obtained via interviews and surveys. Data will consist of transcripts of land manager interviews (with identity of interviewees removed), and numerically coded responses to questions in an online survey. To further understand the social and economic contexts, additional secondary data (e.g., demographic information from the U.S. Census Bureau) will be obtained from publicly available, primarily online sources.

The computational models will be coded in netlogo, and detailed documentation will be provided in Microsoft Word and/or PDF format.

All are primary data.

### *b. Data Format*

For field data, senior project personnel will train field technicians and supervise data collection. Data will be entered in Microsoft Access forms that impose limits on the types and values of data that can be entered in a given cell. After initial data entry, data will be checked for errors by the PI, and data will be examined for outliers indicative of data entry errors. A log of any corrections to the data, as well as archives of previous data versions will be maintained. Meta-data will be created for all data. We will use a metadata documentation tool (e.g., Metavist; <http://nrs.fs.fed.us/pubs/2737>) and use Ecological Metadata Language to create metadata that follows KNB (Knowledge Network for Biocomplexity) standards: <https://knb.ecoinformatics.org/#external//emlparser/docs/index.html>.

Interview data will be digitally recorded, then transcribed verbatim into a Microsoft Word file. Online survey data are automatically entered into a database by Qualtrics.com, then stored on a cloud server.

Code for the computational models that are built will be in .nlogo format, and model documentation will be either in Microsoft Word or PDF.

### *c. Data Storage and Preservation*

All field experiment data will be stored locally on PI Veblen's hard drive, which syncs instantaneously to a cloud server and daily to an external hard drive. Original datasheets will be stored at USU and scanned into pdf form to be stored electronically by each PI separately.

Short-term storage of social science data will be in laboratory facilities maintained by co-PI Brunson at USU according to standards set by the USU IRB. Original survey data will be imported into the SPSS statistics software package, where the codebook (metadata) also will be stored, and will also remain on USU's Qualtrics server. A separate Word file of the metadata will be stored on the Socio-Ecological Systems Lab computer. Word files will be backed up to USU's file-storage server (Box).

We will publish the code and documentation of our computational models on the OpenABM website: [www.openabm.org](http://www.openabm.org).

*d. Data Sharing and Public Access*

Field experiment data will be entered by technicians and after QA/QC will be added to a permanent database accessible to only the PI's. Raw social data will be available only to the researchers for the duration of the project according to the terms of a pending IRB protocol application. Interviews and surveys will be marked with a numeric code that corresponds to the interviewee/survey recipient. To maintain confidentiality, the actual list of interviewees and survey recipients will be maintained in a separate password-protected file kept on a different computer in the Socio-Ecological Systems Lab.

After two years following project completion, or upon publication of project results in peer-reviewed journals (whichever comes first), field experiment and social science data will be made publicly available in the data repository. Prior to public availability the data will be available upon request to land managers and scientists with some restrictions on publication for the latter. The social science data, because they involve human subjects, are subject to additional data-sharing obligations with important qualifications. Interview data release will require de-identification by removing direct identity information as well as indirect identifiers that could be used to deduce participant identities. Because some respondents will be the only individual with their particular job in an office, we cannot publish certain survey items related to respondent characteristics without creating a risk of deducing respondent identities. In such cases, an objective statistical or narrative summary of the data will be developed and released.

We will publish the code and documentation of our computational models on the OpenABM website: [www.openabm.org](http://www.openabm.org), a publicly available repository for computational models.

*e. Roles and Responsibilities*

PI Veblen will be in charge of data management for the field data portion of the project; in the event that PI Veblen leaves the project, co-PI Pyke will take over this responsibility. Co-PI Brunson will be in charge of data management for social science data, and co-PI Baggio for the modeling data; in the event that either Brunson or Baggio leave the project, the other will take over data management for both the social science and modeling portion. Veblen will oversee implementation of the DMP for the entire project; in the event Veblen leaves the project, responsibility will be turned over to the next available PI in the following order: Brunson, Pyke, Baggio.