**DRAFT**

**Analysis Methods for Prairie Vegetation Monitoring Data**

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**Analysis Methods for Objective 1**

Detect change in the extent of physiognomic cover types in American Camp (AC) at San Juan Island National Historical Park (SJINHP) over years 2007-2015.

**Metric 1.1: Percent Cover H Herbaceous**

**Metric Type:** Landscape Structure.

**Denominator:** For a given transect, the sum of the straightened lengths of herbaceous H, shrub S, and tree T physiognomic cover types. Alternatively, the length of the straightened transect, in meters, allowing for temporal variation in end points, minus the sum of the length of developed D and unvegetated U physiognomic cover types.

**Numerator:** The length of the straightened transect, in meters, restricted to the physiognomic cover type herbaceous H.

**Metric Calculation**

**Example Calculation:** Utilizing Table 1 of recorded 2015 physiognomic cover types in transect 1-14, calculate the value of Metric 1.1 (M1.1) as

**Database Considerations**

The physiognomic cover type in the NPS database is VegType. Straightened transect lengths utilized in the calculation of metrics derive from UTM-10N eastings and northings (UTME and UTMN, respectively) collected at the time of data collection.

These variables correspond to VegType, UTME, and UTMN in the WEST-derived shapefiles.

**Metric 1.2: Percent Cover S Shrub**

**Metric Type:** Landscape Structure.

**Denominator:** For a given transect, the sum of the straightened lengths of herbaceous H, shrub S, and tree T physiognomic cover types. Alternatively, the length of the straightened transect, in meters, allowing for temporal variation in end points, minus the sum of the length of developed D and unvegetated U physiognomic cover types.

**Numerator:** The length of the straightened transect, in meters, restricted to the physiognomic cover type shrub S.

**Metric Calculation**

**Example Calculation:** Utilizing Table 1 of recorded 2015 physiognomic cover types in transect 1-14, calculate the value of Metric 1.2 (M1.2) as

**Database Considerations**

The physiognomic cover type in the NPS database is VegType. Straightened transect lengths utilized in the calculation of metrics derive from UTM-10N eastings and northings (UTME and UTMN, respectively) collected at the time of data collection.

These variables correspond to VegType, UTME, and UTMN in the WEST-derived shapefiles.

**Metric 1.3: Percent Cover T Tree**

**Metric Type:** Landscape Structure.

**Denominator:** For a given transect, the sum of the straightened lengths of herbaceous H, shrub S, and tree T physiognomic cover types. Alternatively, the length of the straightened transect, in meters, allowing for temporal variation in end points, minus the sum of the length of developed D and unvegetated U physiognomic cover types.

**Numerator:** The length of the straightened transect, in meters, restricted to the physiognomic cover type tree T.

**Metric Calculation**

**Example Calculation:** Utilizing Table 1 of recorded 2015 physiognomic cover types in transect 1-14, calculate the value of Metric 1.3 (M1.3) as

**Database Considerations**

The physiognomic cover type in the NPS database is VegType. Straightened transect lengths utilized in the calculation of metrics derive from UTM-10N eastings and northings (UTME and UTMN, respectively) collected at the time of data collection.

These variables correspond to VegType, UTME, and UTMN in the WEST-derived shapefiles.

**Models**

Three separate linear statistical mixed models [Piepho and Ogutu, 2002] were considered in modeling percent cover of each of the three physiognomic cover types over all transects *i* and years *j*. Each of the logit and arc-sine transformations aid in model-fitting when proportionality data are either less than 20% or greater than 80%. The arc-sine transformation has the added benefit of helping to stabilize variance.

1. Untransformed:

2. Logit:

3. Arc-Sine:

**Model Parameters of Interest**

1. : The overall American Camp linear temporal estimate of trend of percent cover of trees T, years2007-2015. For the Untransformed Model, estimate interprets as the average one-year percent change in the T Tree cover-type, over the whole of American Camp.

2. : The individual *i*th transect linear temporal prediction of trend of percent cover of trees T,over 2007-2015. For the Untransformed Model, prediction interprets as the average one-year percent change in the tree cover-type, for the individual *i*th transect.

3. : The variability in linear deviations of percent cover of trees T, over individual transects as a whole, 2007-2015. The value of will probably be relatively high, given that some transects are dominated by one physiognomic cover-type, while others have a prevalence of something different.

4. : The variability in linear deviations of percent cover of trees T, over individual time points as a whole, 2007-2015. The value of will hopefully be relatively low, assuming consistency of year-to-year weather patterns and data collection.

5. : The variability in slope deviations of percent cover of trees T, over individual transects as a whole, 2007-2015. The value of will hopefully be relatively low, assuming a lack of spatial variability, the relatively small sampling frame, and a consistent lack of disturbance throughout the park.

6. : The residual variability of individual observations. These provide assistance with assessing the quality of model fit.

**Objective 1 Analysis Plan**

To investigate and model the three metrics (Herbaceous, Shrubs, and Trees Percent Cover) associated with Objective 1, the following will occur.

1. Plot temporally individual transect-observed percent cover for each individual transect *i* with at least two data points, for each of the three cover types. Utilize each transect's baseline to calculate and plot cut-points depicting each of “Good,” “Caution,” and “Significant Concern.”

2. Plot temporally American-Camp observed percent cover for each of the three cover types. Utilize the weighted-average overall baseline to calculate and plot cut-points depicting each of “Good,” “Caution,” and “Significant Concern.”

3. Create histograms of percent cover, for each of the three cover types, for each year.

4. Fit the Piepho and Ogutu linear mixed model, and plot the resulting fit, for both the overall trend and individual transect-level predictions .

5. Do each of three above items utilizing an untransformed outcome, a logit-transformed outcome, and an arc-sine-transformed outcome. In this way, obtain 9 sets of models and plots.

6. Plot resulting model residuals , as detailed within [Starcevich, 2013] and [Pinheiro and Bates, 2004].

7. Conduct all other plots to ascertain quality of model fit, as detailed within [Starcevich, 2013] and [Pinheiro and Bates, 2004].

8. Based on included observed transect eastings and northings, construct linear shapefiles for each transect *i* and year *j*.

9. Plot resulting transect-specific residuals spatially, for each individual year *j*, so as to identify any possibly unaccounted spatial trends.

10. Tabulate all results, ensuring all parameter estimates are back-transformed, where appropriate.

**References**

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