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ECOLOGICAL EFFECTIVENESS OF CONIFER REMOVAL IN MEADOWS

USDA Forest Service
Region 5 Ecology Program
Central Sierra Province

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Background

This protocol was developed to be used in conjunction with the Aspen effectiveness monitoring that was originally adapted from: Jones, B.E., D. Burton, and K.W. Tate. 2005. Effectiveness Monitoring of Aspen Regeneration on Managed Rangelands. A monitoring method for determining if management objectives are being met in aspen communities. USDA Forest Service, PSW Region. These two protocols can then be used to monitor both the effectiveness of conifer removal from Aspen and Meadows.

Key Questions

How long does the conifer removal treatment effectiveness last? Do conifer seedlings continue to establish after restoration activities? Do follow up treatments need to be conducted in order to maintain low cover of conifers?

Does large scale burning of meadows change vegetation community structure (i.e. changing community from graminoid dominate to herbaceous dominate)?

Additional questions depending on the intensity of data collection:
Does removal of conifers and/or introduction of fire change the ratio of wetland species (i.e. obligate, facultative, upland, etc)?
Will removal of lodgepole pine in meadows increase groundwater level and meadow wetness?

Equipment

50 m tape measure
2 Chaining Pins
8 Pin Flags
1 meter PVC square
DBH tape
2 meter distance measuring pole, tape measure or Biltmore stick
Rebar (two for each transect, for a total of up to 20 per treatment area) and 2 plus rebar caps (write plot number on cap)
Sharpie
Two tree tags and two nails for witness trees
GPS
Camera
Compass
Data Sheets/Data recorder
Metal detector for post effectiveness monitoring
Trimble when installing piezometer

Methods

Monitoring Plots

Ten permanent plots will be established in each meadow (a plot consists of 40 meter belt transect and 1-2 8-m radius circular plots with a 4.37-m radius circular sub plot within the 8-m radius circular plot). If the meadow will have more than 1 treatment type separated spatially then it would be ideal to have 10 plots per treatment type.

Repeated measurements will be taken at the following intervals: 1 year post treatment, 3 years post treatment, 5 years, and 10 years post treatment. After 10 years future monitoring will be reevaluated, in order to evaluate the effectiveness of treatments long term monitoring is ideal. Data will be collected in summer to early fall to capture the peak growing season for herbaceous cover component.

Plot Design

Plot locations will be selected in GIS. Twenty plot locations will be identified around the meadow at equal spacing. Ten of these will be identified randomly as priority, if one of the locations does not work than a secondary plot will be selected. Transects should run through areas where conifer removal will occur. Transects should avoid running through dense willow stands.

Transects will run perpendicular to meadow edge (be sure to record the azmuth). The objective of each transect is to capture areas that will be treated, if a plot does not fall in an area that will noticeably receive treatment then it should be dropped. Belt transects will be established with 1 to 2 8-m radius plots. Starting points will extend 30 meters into the meadow and 10 meters into the surrounding forest. If the transect crosses a channel, extend the transect to accommodate the distance of the channel (e.g. if the transect crosses from meter 23 to meter 25, extend the transect to 42 meters total). Meter 0 will start on the forest end (0-10 meters transect through forest, 10-40 m plot through the meadow). An 8-m radius plot will be established at meter 0 and occasionally at an additional transect location along the transect. The intent of the meter 0 radius plot will be to evaluate how surrounding forest structure influences the effectiveness of conifer removal (e.g. do denser forests reduce effectiveness of treatments). The intent of the other radius plot (which will sometimes be the same as the meter 0 plot) will be to pair the data with piezometer measurements of ground water/evapotranspiration.

Transect Design

Transects will be 40m belt transects with 1 meter on each side of the center line (2 meters wide). The transect start location will be 10 meters from the edge of meadow in the forest ecotone and move towards the meadow.

At each transect location, place a piece of rebar with a cap at each end of the transect, the rebar should be 40 meters apart. Label cap with transect number. Stretch a meter tape from end to the other so that the tape is tight and straight, secure with range stakes.

Plot Data

Record the plot number: The plot number will be meadow unit number sequential plot numbers (e.g. BW_1_P1).
Transect bearing
Slope
Transect distance
Length of Channel (if applicable)
Location of piezometer plot if one is established in a location different than meter 0
GPS location (this is a backup in case the Javad point does not process)
In addition, on the closest leave tree at both ends of the transect, nail an aluminum tag at the base identifying the plot number. Record the tree species, azimuth, diameter, determine if it is cut or not cut yet, and distance from this tag to meter 0 or 40 respectively.

Javad GPS Coordinates

The Javad receiver should be used to measure a point at each end of the transect. Each point should be recorded at 5 sec intervals for 15 minutes.

Photo Documentation

Take 5 photos of the plot:
Photo of plot number
Photo from 1 meter behind meter 0 to meter 40
Photo meter 0 towards the forest – looking towards circular plot away from transect
Photo from 1 meter behind meter 40 to meter 0
Photo meter 40 towards the meadow – looking away from transect
Each photo should be renamed as follows: Plot number (for each photo) followed by: _0m (for meter 0 to meter 40), _Forest (for meter 0 towards the forest), _40m (for meter 40 to meter 0), and _Meadow (for meter 40 towards the meadow). For example: BW_1_0m.

Conifer Density

All conifers stems within 1 meter of each side of the transect are counted and recorded by live or dead and by species in the following size classes: 1 (seedling <1.37 m tall), 2 (sapling >1.37 m tall and ≤7.6 cm dbh), 3 (tree >7.6-25.4 cm dbh (3.0-10")), 4 (tree >25.5-45.7 cm dbh (>10-18")), 5 (tree >45.8 cm dbh). Use a measuring pole at ground level to determine if each conifer stem is in or out of the 2 meter belt. A tree is considered in if the pith is within the transect belt. The number of stems by size class is recorded in 4m segments along the transect. At each 4 meter segment identify if you are in the Meadow, Forest, or a Transition zone.

Cover Data

A one meter square quadrat will be placed every 4 meters starting at 0 meters. The plot at 0 meters should be read on the right side of the transect (as look towards 40 meters) and then the plots should be alternated left-right-left. You should have a minimum of 10 plots per conifer treated area. A 10cm x 10cm square is 1% cover. Within the 1 m^2 plot frame, estimate total cover of vegetation. Estimate the cover for the following growth forms: forbs, graminoids (grasses, sedges, rushes), cryptograms, shrubs,

conifers, hardwood, and invasive species. Only include canopy cover of trees rooted in the plot under conifers. If there is canopy cover in the plot from a tree not rooted in the plot, record the cover in the notes. The sum of all the individual growth form cover in the plot may be greater than the total cover because of overlapping values but should not add to less than the total cover. Record the dominant shrub species. If invasive species are identified note the species found. Record if plot is dominated by upland or riparian vegetation or in a transition.

Estimate percent ground cover (below vegetation) which will add to 100%. Ground cover categories include: bare ground, rock, woody debris split into fine woody debris, course woody debris, litter, basal vegetation, dead basal vegetation, and water. Basal vegetation is the estimate of how much cover is taken up by the base of the plant as if everything in the plot was cut where the stem meets the soil, this is usually a small percentage. A 10cm x 10cm stem of a tree would be 1% Basal Veg.

Wetland Vegetation Cover

This component will only be evaluated if the following question is being addressed: Does removal of conifers and/or introduction of fire change the ratio of wetland species (i.e. obligate, facultative, upland, etc)? Due to time constraints this metric is not currently being evaluated. If desired the methods should be evaluated. Identify and record cover of each individual species in the 1 m square plots.

Eight Meter Radius Plots

Both tree and cover data will be collected in the radius plots.
The center of the forested plot should be at meter 0 and will be called A (e.g. BW_1_P1A).
Set the 8-m radius transects along the cardinal directions. Place pin flags at 8-m (for the full size plot), and 4.37-m (for smaller seedling regen plot).
The piezometer plots will be targeted in areas specifically where there is noticeable conifer removal that will occur – these can be established along the transect or 8 meters from end of the transect. These do not need to be random because the key is to evaluate the response of conifer removal on ET trends. Plots should be established where:
There is a noticeable stand where removal activities will remove a large portion of the stand.
The stand is at least 10 meters from flowing water and ideally does not have standing water in the stand during peak growing season.
The cover data will be collected as noted above but for the full 8-m radius plot rather than 1-m plot. In addition, cover of conifer seedlings will be separated from conifer tree and sapling cover.
Count saplings by status (live/dead) and species (all tree species not just conifers)
For each tree (all tree species not just conifers) record: *Species, Status (Live/dead),* and *DBH.*
When a piezometer is installed a polygon will be drawn around the stand that the piezometer is in. The stand will be identified as the area with similar vegetation/topography. (See appendix B.)

Appendix A. Detailed Instructions ArcGIS for selecting meadow plots

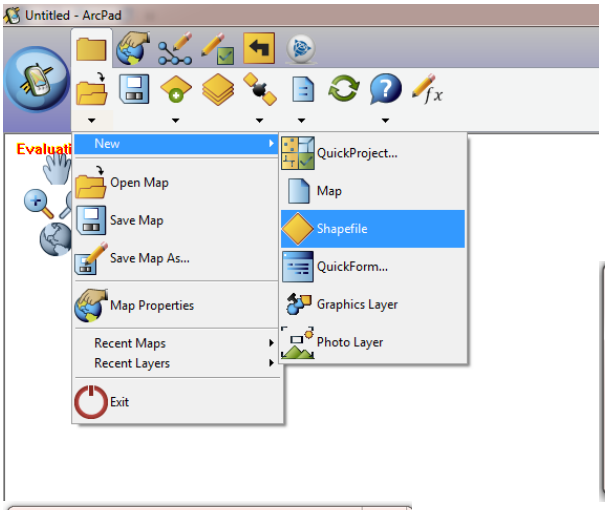
Turn polygon into line feature:
Toolbox -> Data Management Tools -> Features -> Polygon to Line -> uncheck box
Make new point feature to store points in
Evenly space points along meadow edge – aka line feature
Click the **Edit** tool on the **Editor** toolbar – edit point file
Click the line feature using along which you want to generate points.
Click the **Editor** menu and click **Construct Points**.
Choose the target in which the new feature will be created.
If you have feature templates for the layers in your map, click the **Template** button and click the template to use to create the new feature. You can also double-click the preview of the template to choose a different template.
If you do not have feature templates, click the layer in which to create the feature.
Choose how you want the points to be created.

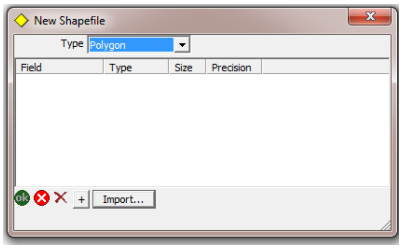
Number of points	Creates a specific number of points that are spaced evenly along the line. Click this option and type the number of points to create.
Distance	Creates points at a specific interval in map units. Click this option, type the interval, then click whether the points should originate from the start or end of the line. Arrows are drawn on the map to indicate the direction of the line.
By measures (m-values)	Creates points at a specific interval based on m-values along the line. Click this option, type the interval, then click whether the points should originate from the start or end of the line. Arrows are drawn on the map to indicate the direction of the line.

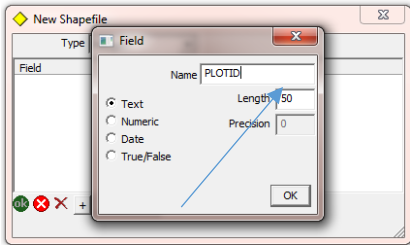
Choose whether to place additional points at the start and end of the line.
Click **OK**

Appendix B. Detailed Instructions – Collect Piezometer Polygons

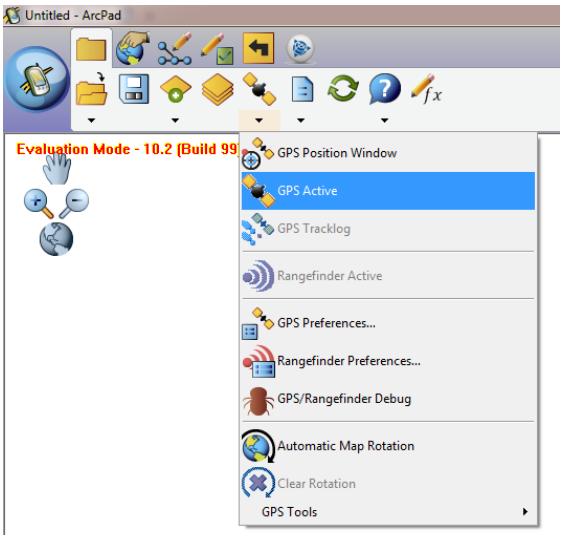
Either you can create one shapefile for each meadow or have one shapefile that you can collect all of the meadow data in and enter the Meadow name in the Plot ID attribute. Make sure to set it up as a polygon file and add an attribute called PlotID (text file). When it asks if you want to create a Quickform say no.



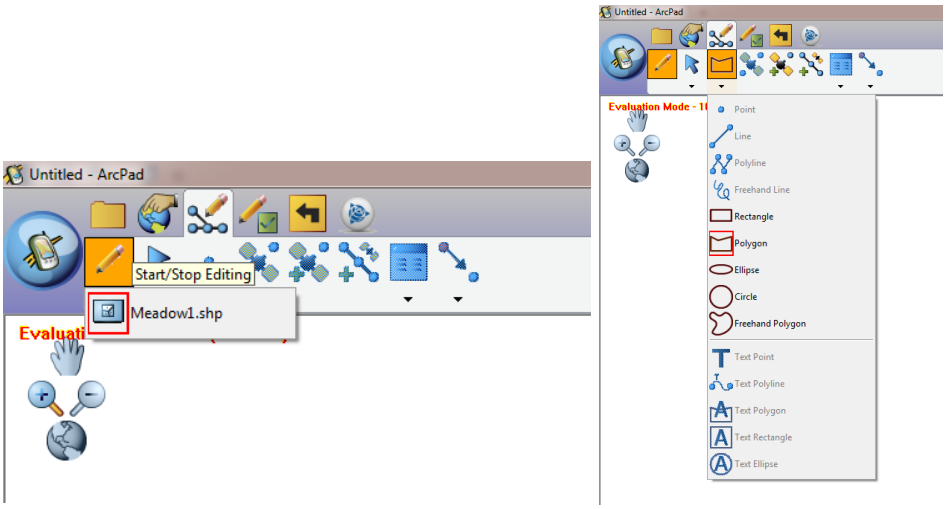




Make sure you activate your GPS. When it is highlighted in red that means it is active. You can also check to make sure you have a position using the GPS position window.

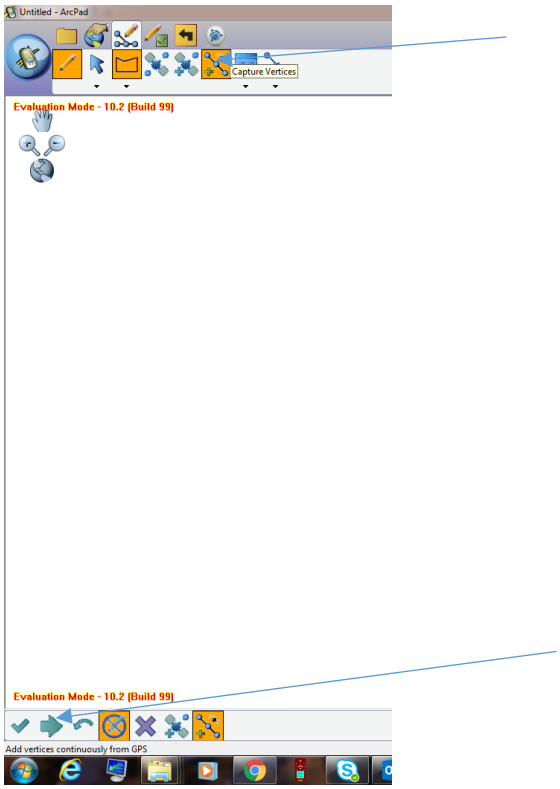


Make sure that the file that you are interested in is in the edit mode. If the filename is highlighted in red then you are in business. Also make sure that polygon is selected. You will only be able to select the options for a polygon.



Before you start the GPS process, make sure you have a good idea of where the vegetation changes around the piezometer so that you will only have to collect the data once.

To activate the polygon, click the capture vertices button and begin to walk around the piezometer. Once you have completed the polygon, then click the left green arrow. This will bring up the popup screen where you will enter the Plot ID. Make sure to include transect and point name along with the meadow name.



Once the data has been collected make sure to close ArcPad and save the map. This data can easily be transferred from the Trimble to the computer. Make sure when you copy the file copy the entire folder so that you make sure you have all the shapefile pieces.