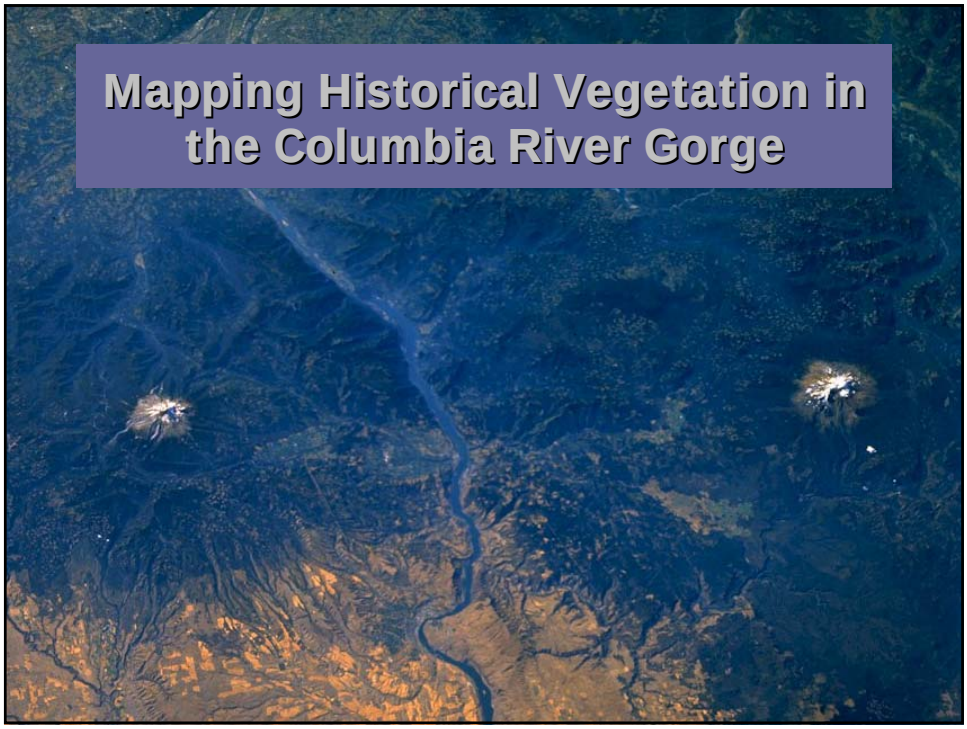
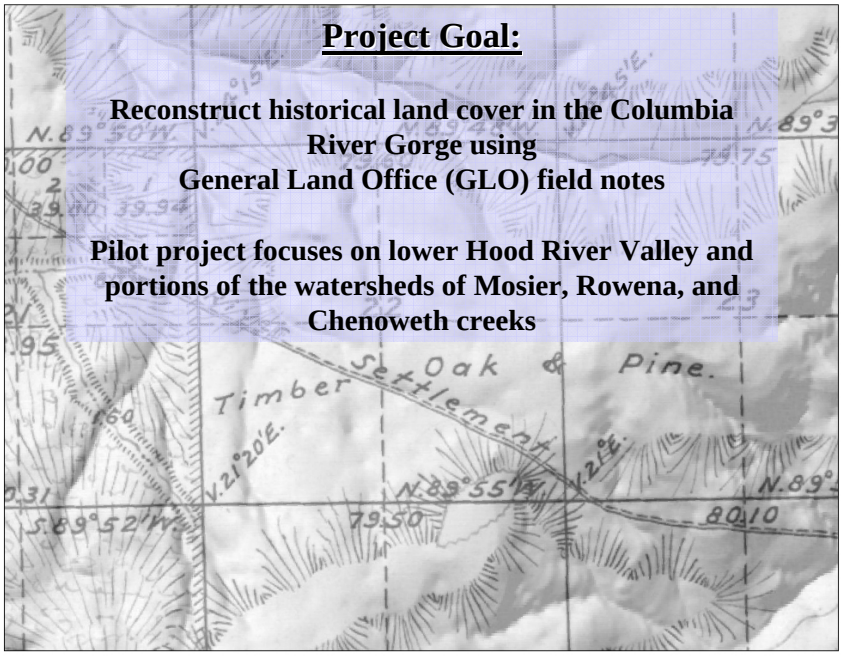
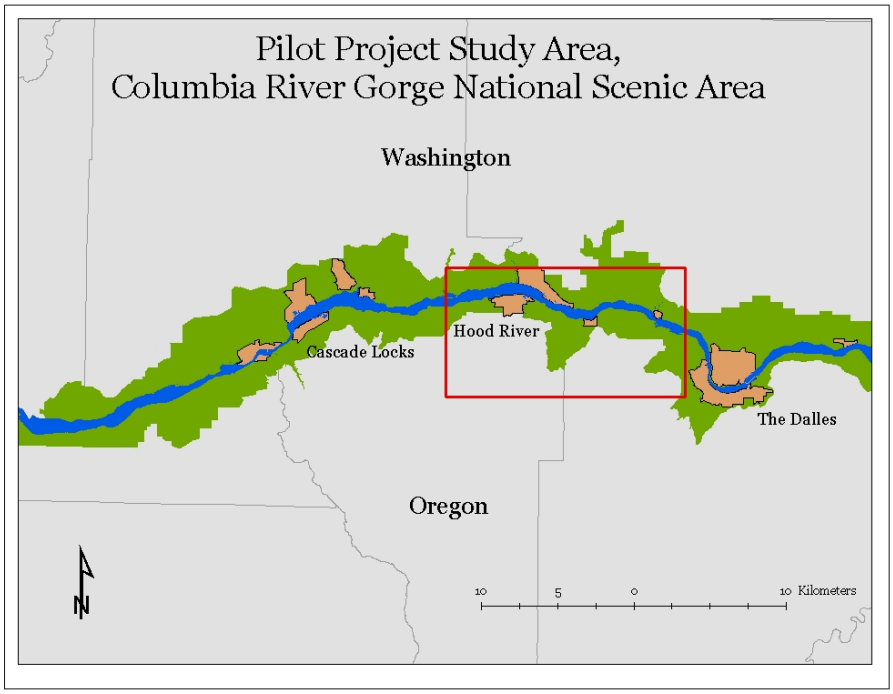

Mapping Historical Vegetation in the Columbia River Gorge


Project Goal:
Reconstruct historical land cover in the Columbia River Gorge using General Land Office (GLO) field notes
Pilot project focuses on lower Hood River Valley and portions of the watersheds of Mosier, Rowena, and Chenoweth creeks
Timber
Settlement
Oak & Pine.
N.89°55'W.
S.89°52'W.
79.50
80.10



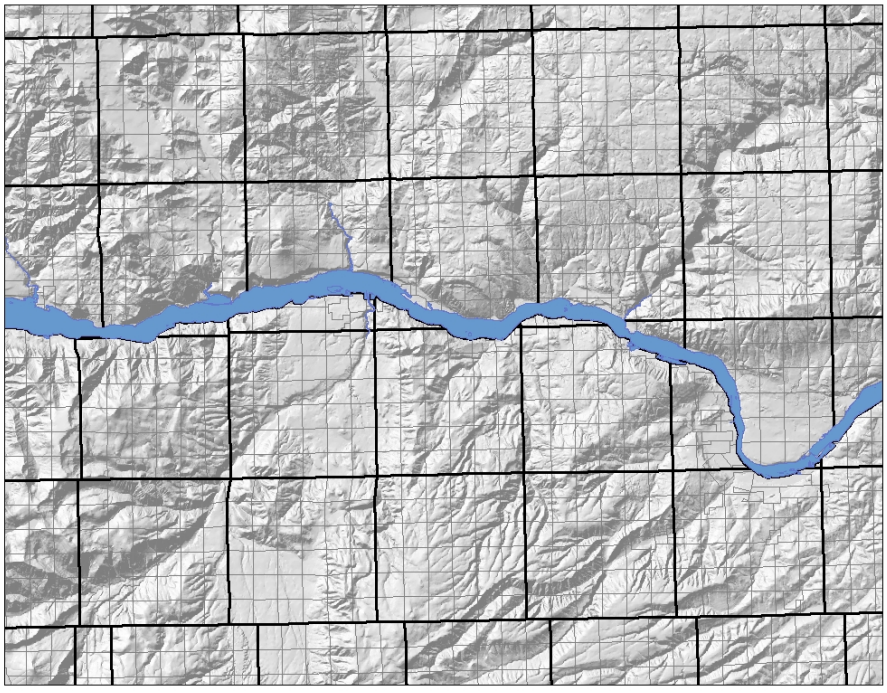
Datasets:

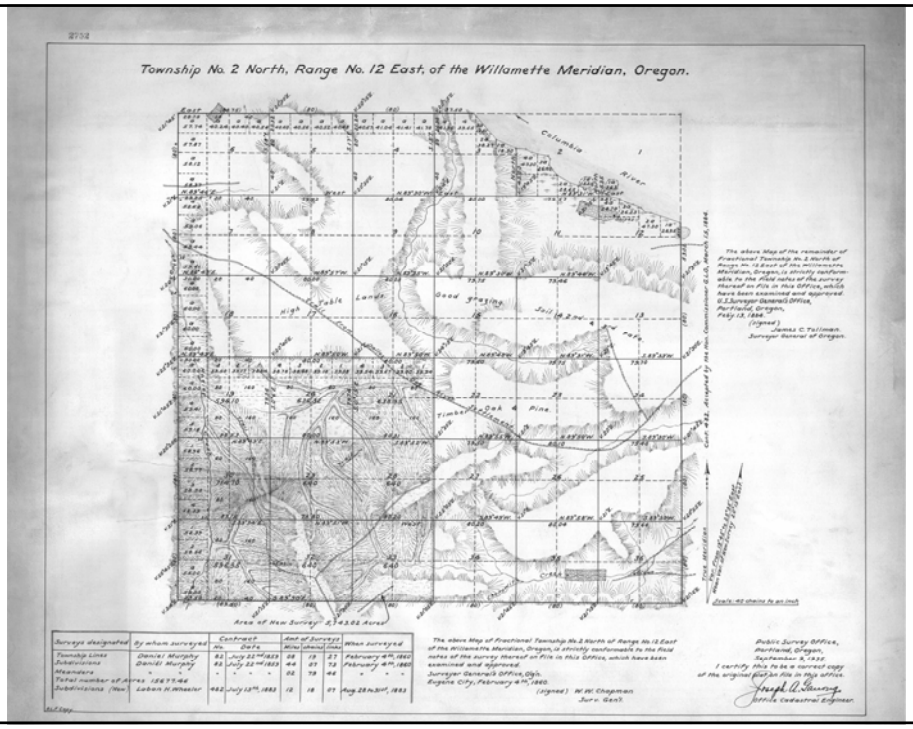
- DEM from USGS—mosaicked, then transformed into hillshade model using Spatial Analyst
- Streams shapefile from Streamnet—clipped to study area
- Manually digitized pre-dam Columbia River polygon feature class
- Precipitation shapefile from Natural Resources Conservation Service—clipped to study area, rasterized, then made into contour lines (2” contour interval) using Spatial Analyst
- Public Land Survey System shapefiles from Oregon Geospatial Data Clearinghouse—clipped to study area
- Vegetation data from GLO field notes, on microfiche at BLM library in downtown Portland—plats available online

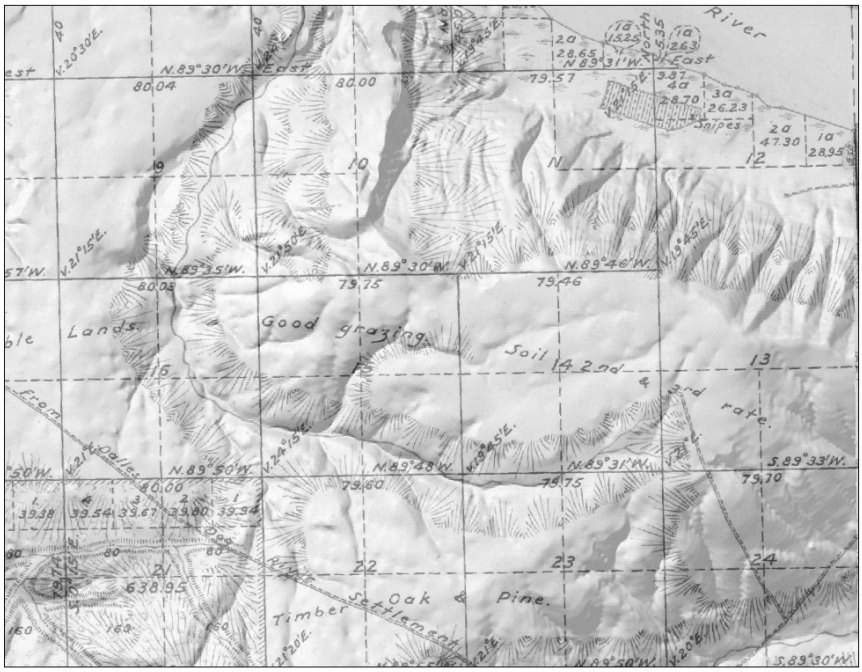
The Public Land Survey System is a coordinate system developed in the early 19th century to rationalize the disposal of the public domain.

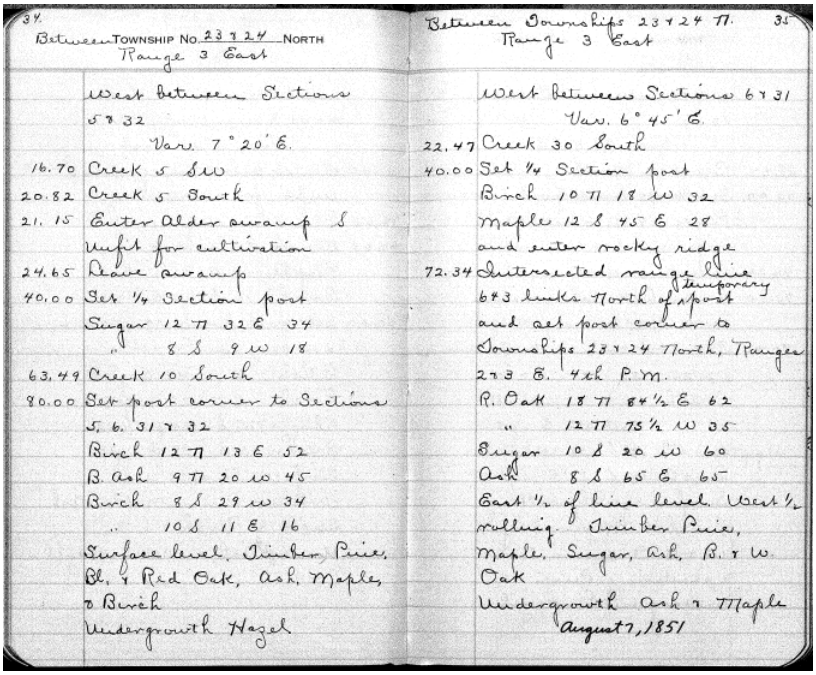
In forested areas, General Land Office surveyors used bearing trees to mark township and section lines. Bearing trees represent a spatially systematic sample of vegetation.

Most of the Gorge was surveyed from 1860s to the 1880s.




Township No. 2 North, Range No. 12 East, of the Willamette Meridian, Oregon.
Columbia River
Good grazing Soil
Timber Oak & Pine.
Area of New Survey 2,143.01 Acres
Public Survey Office, Portland, Oregon, September 8, 1932.
I certify this to be a correct copy of the original plat on file in this office.
Joseph P. Dunning
Public Cadastral Engineer.


Columbia River
Good grazing.
Soil
Timber
Oak & Pine.
Settlement
N.89°30'W.
N.89°46'W.
N.89°48'W.
N.89°31'W.
S.89°33'W.
N.89°50'W.
S.89°30'W.
79.75
79.46
79.60
79.70
638.95



34.
Between Township No. 23 & 24 North
Range 3 East

West between Sections
5 & 32
Var. 7° 20' E.
16.70 Creek S SW
20.82 Creek S South
21.15 Enter Alder swamp S
unfit for cultivation
24.65 Leave swamp
40.00 Set 1/4 Section post
Sugar 12 in 32 E 34
" 8 L 9 W 18
63.49 Creek 10 South
80.00 Set post corner to Sections
5, 6, 31 & 32
Birch 12 in 13 E 52
B. Ash 9 in 20 W 45
Birch 8 L 29 W 34
" 10 L 11 E 16
Surface level. Timber Pine,
Bl. & Red Oak, Ash, Maple,
& Birch
Undergrowth Hazel

Between Townships 23 & 24 N. 35
Range 3 East

West between Sections 6 & 31
Var. 6° 45' E.
22.47 Creek 30 South
40.00 Set 1/4 Section post
Birch 10 in 18 W 32
Maple 12 L 45 E 28
and enter rocky ridge
72.34 Intersected range line temporary
643 links North of post
and set post corner to
Townships 23 & 24 North, Ranges
2 & 3 E. 4th P. M.
R. Oak 18 in 84 1/2 E 62
" 12 in 75 1/2 W 35
Sugar 10 L 20 W 60
Ash 8 L 65 E 65
East 1/2 of line level. West 1/2
rolling. Timber Pine,
Maple, Sugar, Ash, B. & W.
Oak
Undergrowth Ash & Maple
August 7, 1851

Analysis of GLO vegetation data:

(1) Calculate absolute density using modified point-centered quarter method

(2) Surface interpolation based on density points

(3) Classify dominant overstory based on bearing tree species and qualitative descriptions

(4) Proximity polygons to create continuous surface based on overstory points

(5) Overlay density raster and overstory polygon feature class

Calculating Absolute Density:

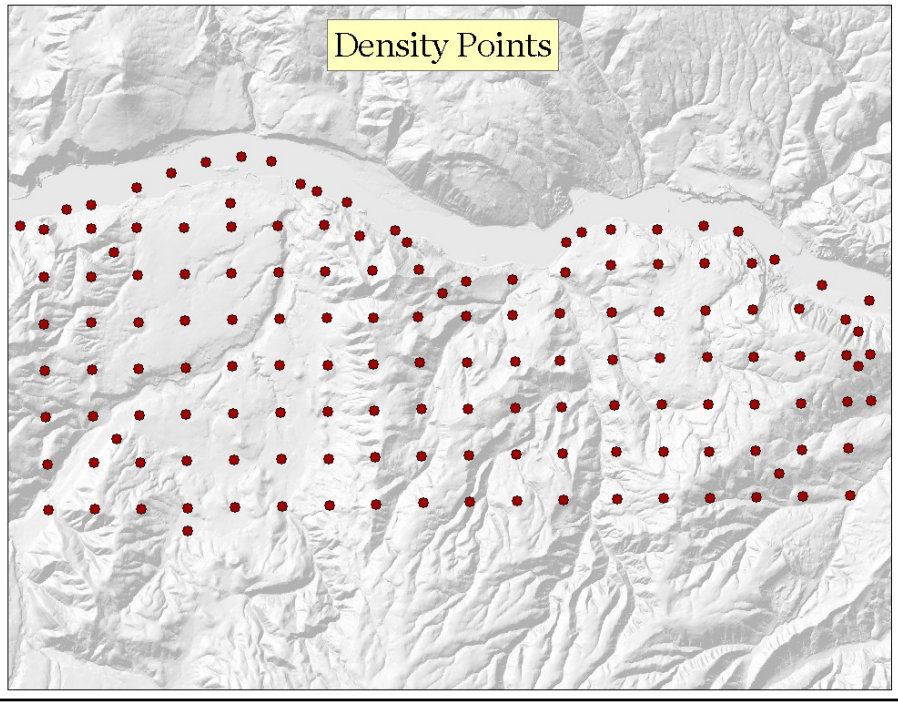
$$\bar{d} = \frac{\sum d}{n}$$

Mean distance of bearing tree from corner (aggregated by section)

$$D = \frac{1}{\bar{d}^2}$$

Density (trees/ha)

Prairie	= <0.5 trees/ha
Savannah	= 0.5-46 trees /ha
Woodland	= 47-98 trees/ha
Forest	= 99+ trees/ha



Explored density values with Spatial Statistics tool:

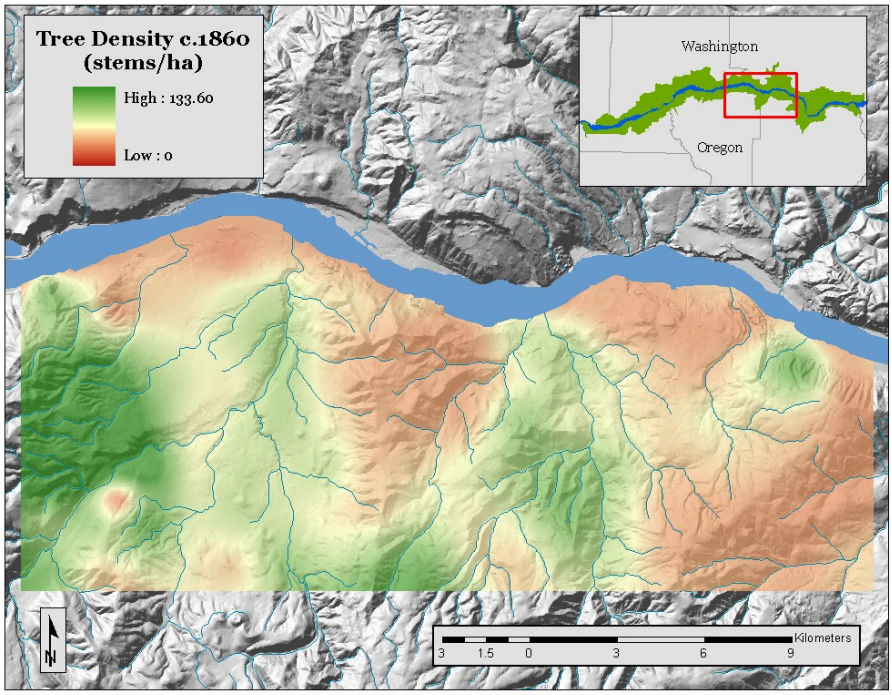
--Moran's I

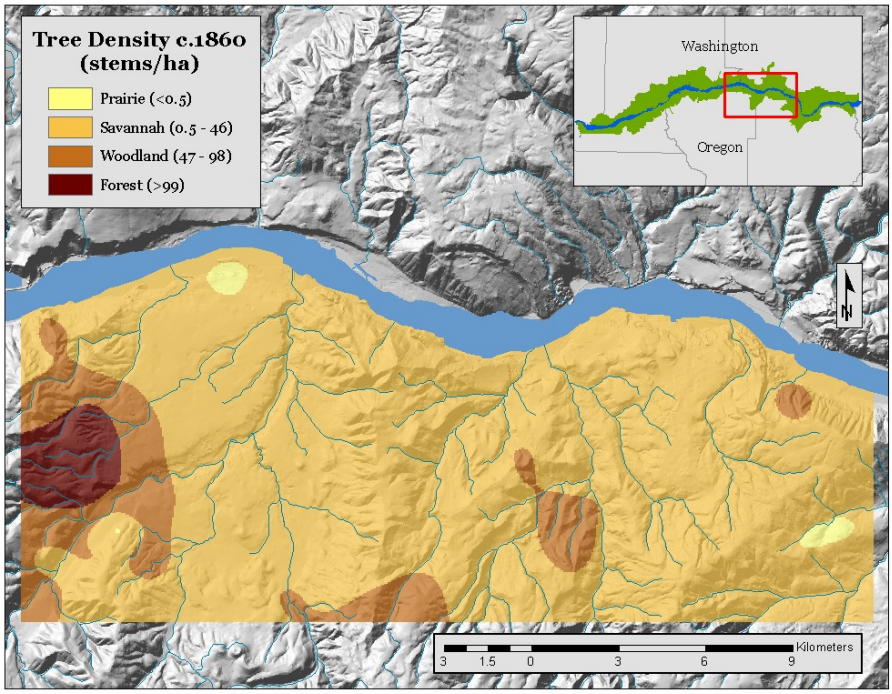
- Moran's Index = 0.158
- Expected Index = -0.007
- Variance = 8.222e-005
- Z Score = 18.197
- Less than 1% likelihood that this clustered pattern could be the result of random chance

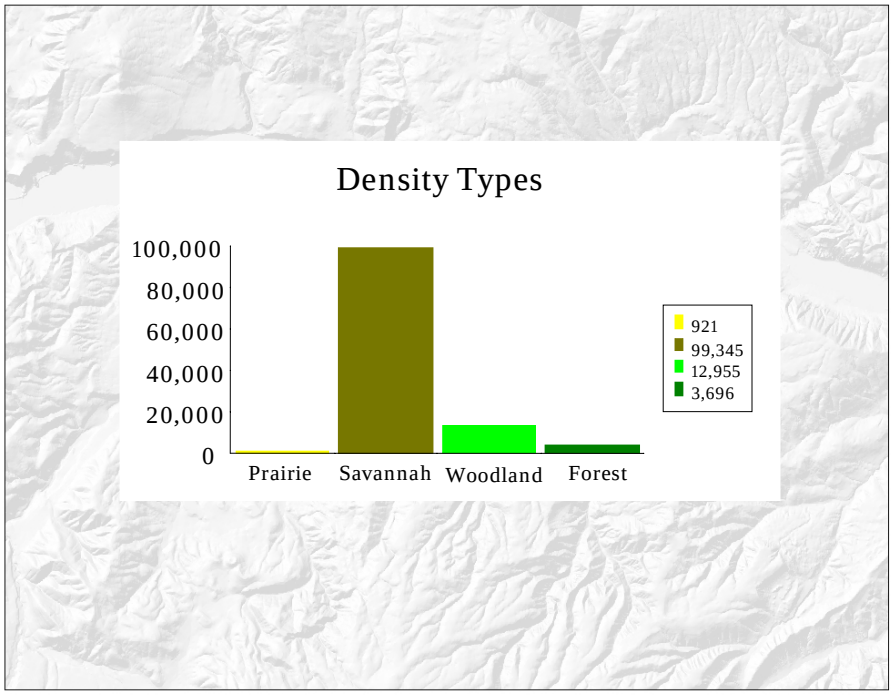
--Getis-Ord General G

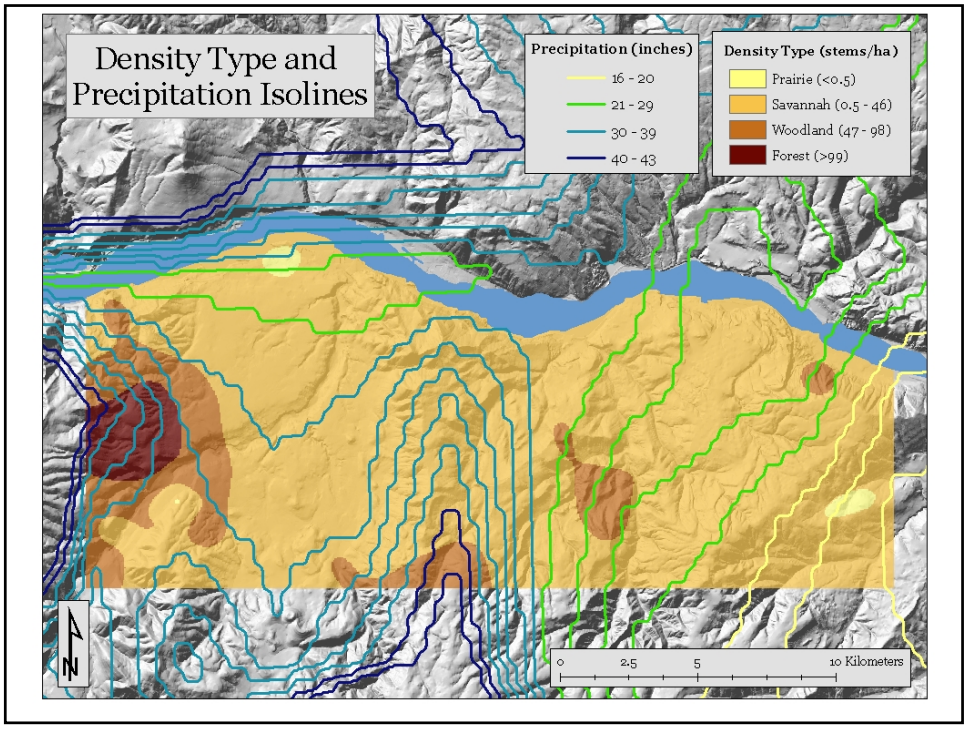
- Observed General G = 0.0001596
- Expected General G = 0.0001373
- General G Variance = 8.212e-012
- Z Score = 7.792 Standard Deviations
- Less than 1% likelihood that this clustering of high values could be the result of random chance

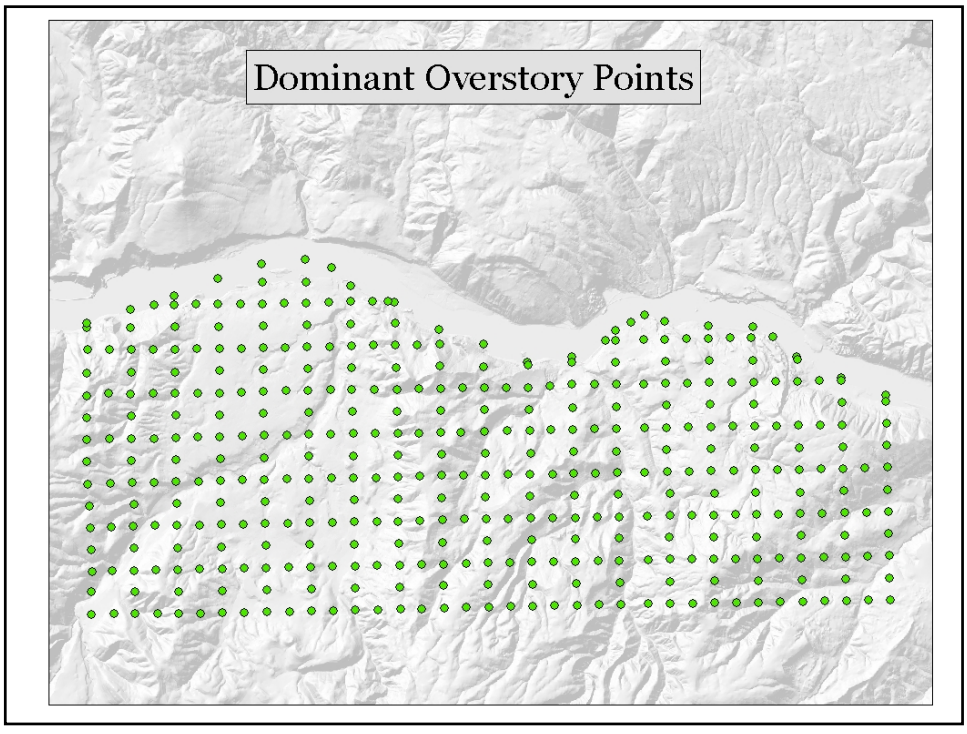
Proceeded to interpolate surface—Spline worked best

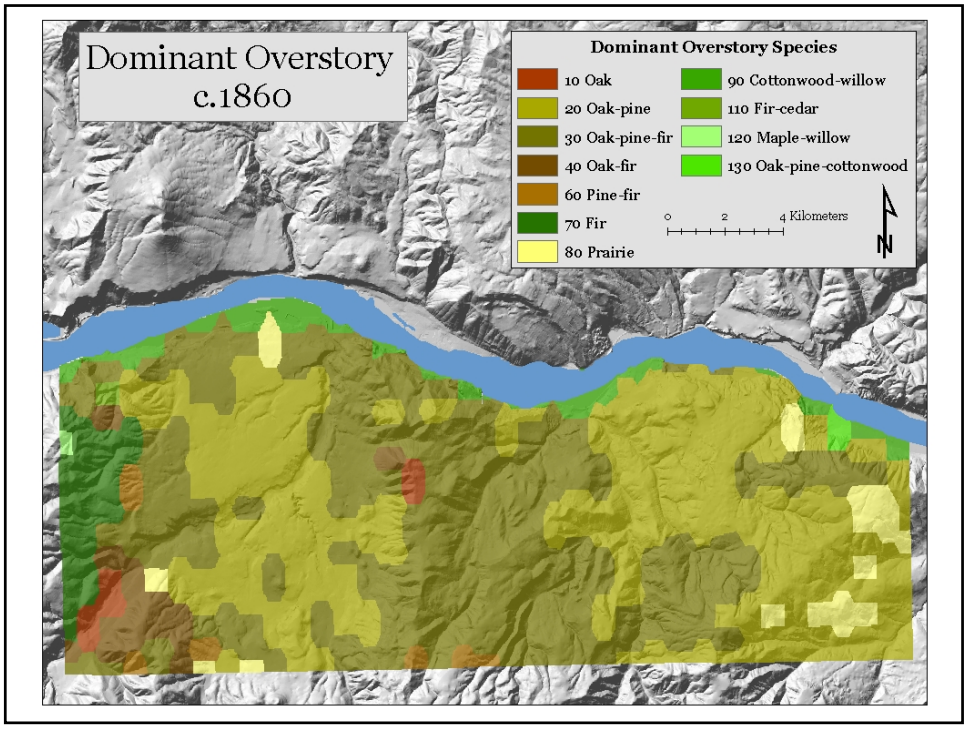


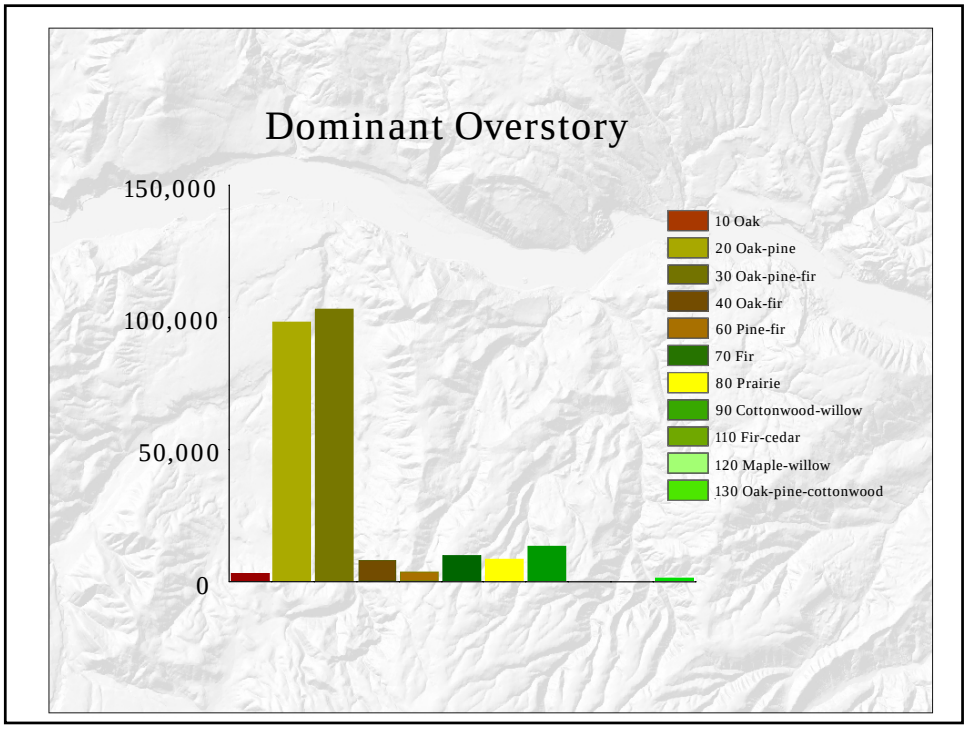

Tree Density c.1860
(stems/ha)
Prairie (<0.5)
Savannah (0.5 - 46)
Woodland (47 - 98)
Forest (>99)
Washington
Oregon
N
3 1.5 0 3 6 9
Kilometers


Density Types
100,000
80,000
60,000
40,000
20,000
0
Prairie
Savannah
Woodland
Forest
921
99,345
12,955
3,696


Density Type and Precipitation Isolines
Precipitation (inches)
16 - 20
21 - 29
30 - 39
40 - 43
Density Type (stems/ha)
Prairie (<0.5)
Savannah (0.5 - 46)
Woodland (47 - 98)
Forest (>99)
N
0
2.5
5
10 Kilometers


Dominant Overstory Points


Dominant Overstory
c.1860
Dominant Overstory Species
10 Oak
20 Oak-pine
30 Oak-pine-fir
40 Oak-fir
60 Pine-fir
70 Fir
80 Prairie
90 Cottonwood-willow
110 Fir-cedar
120 Maple-willow
130 Oak-pine-cottonwood
0
2
4 Kilometers
N

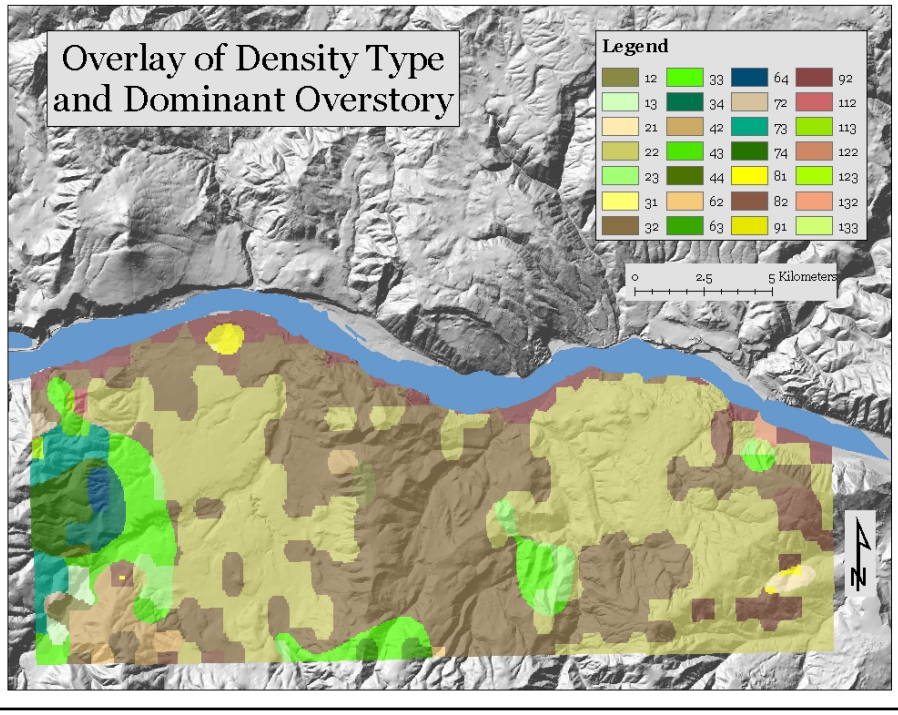

Dominant Overstory
150,000
100,000
50,000
0
10 Oak
20 Oak-pine
30 Oak-pine-fir
40 Oak-fir
60 Pine-fir
70 Fir
80 Prairie
90 Cottonwood-willow
110 Fir-cedar
120 Maple-willow
130 Oak-pine-cottonwood

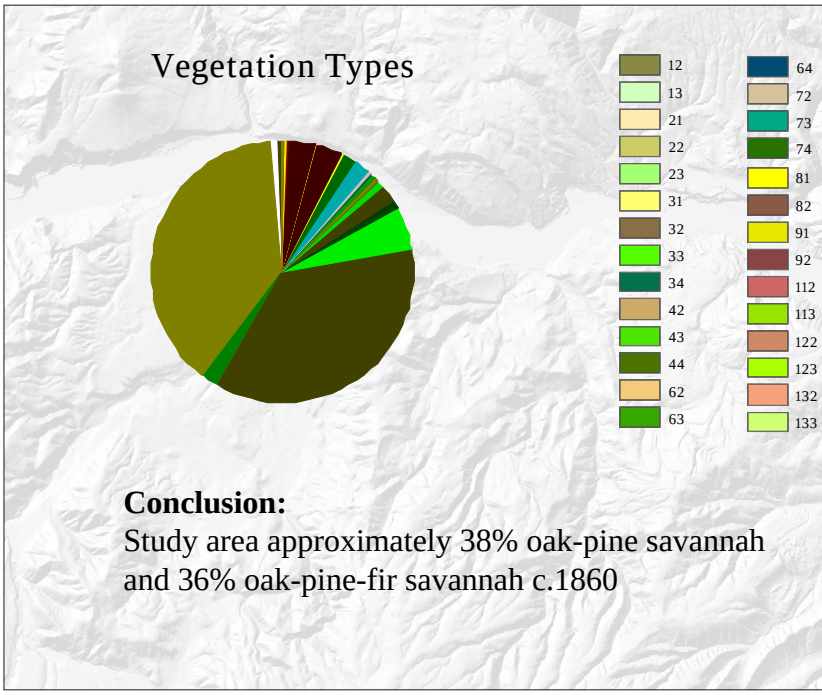
Combined density and dominant overstory layers

•Rasterized dominant overstory polygon layer

• Reclassified density raster into four density classes

• Used Spatial Analyst's Raster Calculator to combine the two layers into one map that shows density type and dominant overstory





Conclusion:
Study area approximately 38% oak-pine savannah and 36% oak-pine-fir savannah c.1860