# Prairie Soils for Sustainable Restoration

USDA United States Department of Agriculture
Natural Resources Conservation Service

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

May 30, 2019
Teresa Matteson

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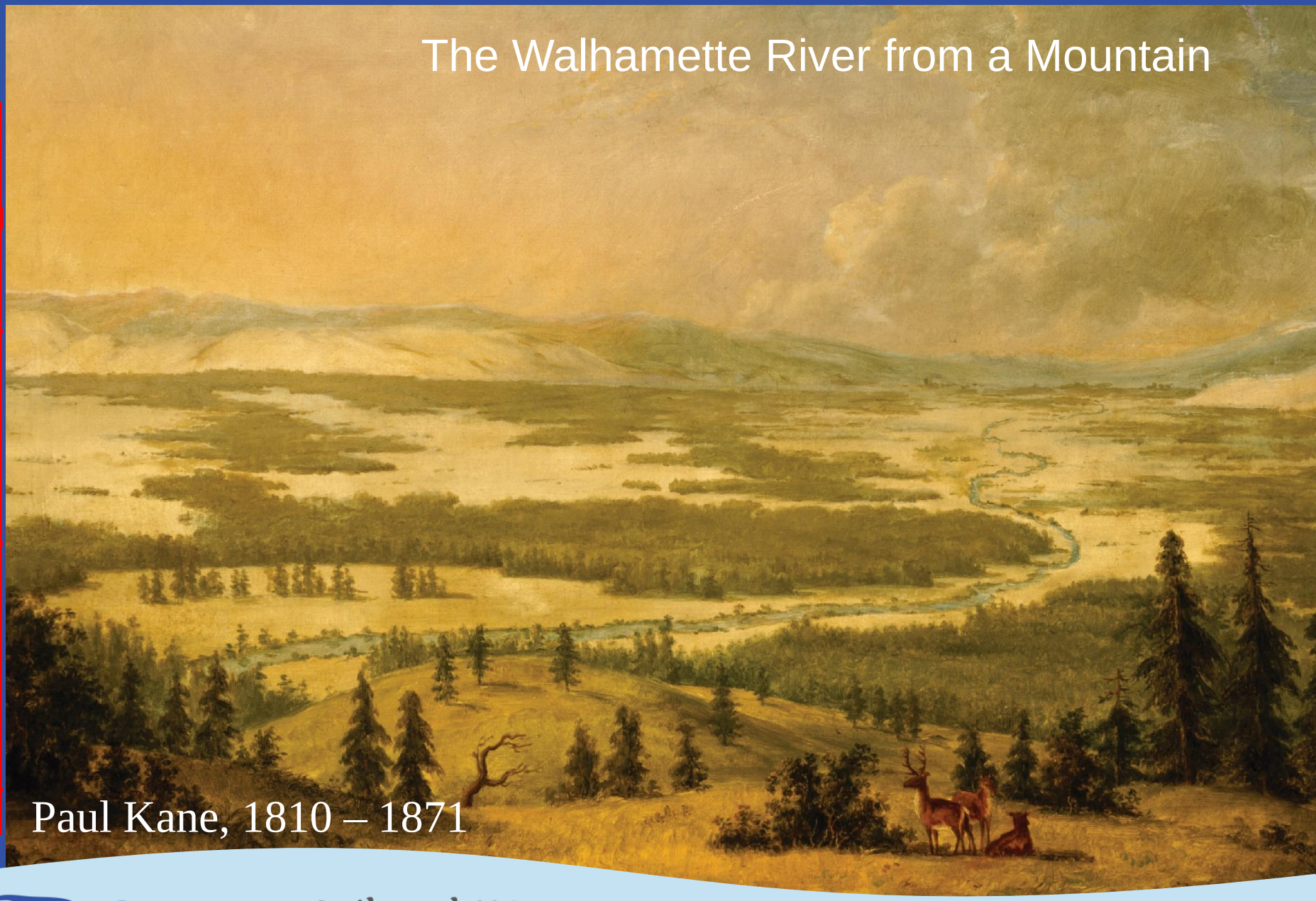


https://commons.pacificu.edu/pacific_160/5/

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# Degradation of (upland) prairies:

- Reduced burning
- Crop lands
- Forage species
- Timber trees, orchards
- Succession to scrub/forest
- Non-native plants
- Urban sprawl

Photograph of vegetation from around 1900
Corvallis with largely deforested skyline

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## PSSR Goal:

Increase success & sustainability of restoration

## Objectives:

- Soil & veg surveys
- Correlate data
- Predictive GIS

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# To challenge how we see prairies…

# 1 - Human Resources

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google.com/search?q=kalapuya

Alfred Thomas Agate 1812 – 1846
US Exploring Expedition 1838 - 1842

*A.T. Agate's sketch: "Costume of a Callapuya Indian"*

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3 Counties

- 22 landowners
- 27 remnant sites
- 28 restoration sites

| | |
|---|---|
| Benton | 70 |
| Lane | 30 |
| Yamhill | 36 |
| | 136 borings |

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Theresa & Victor Berthelsdorf
Yamhill

Daniel & Genevieve Casares
Lane

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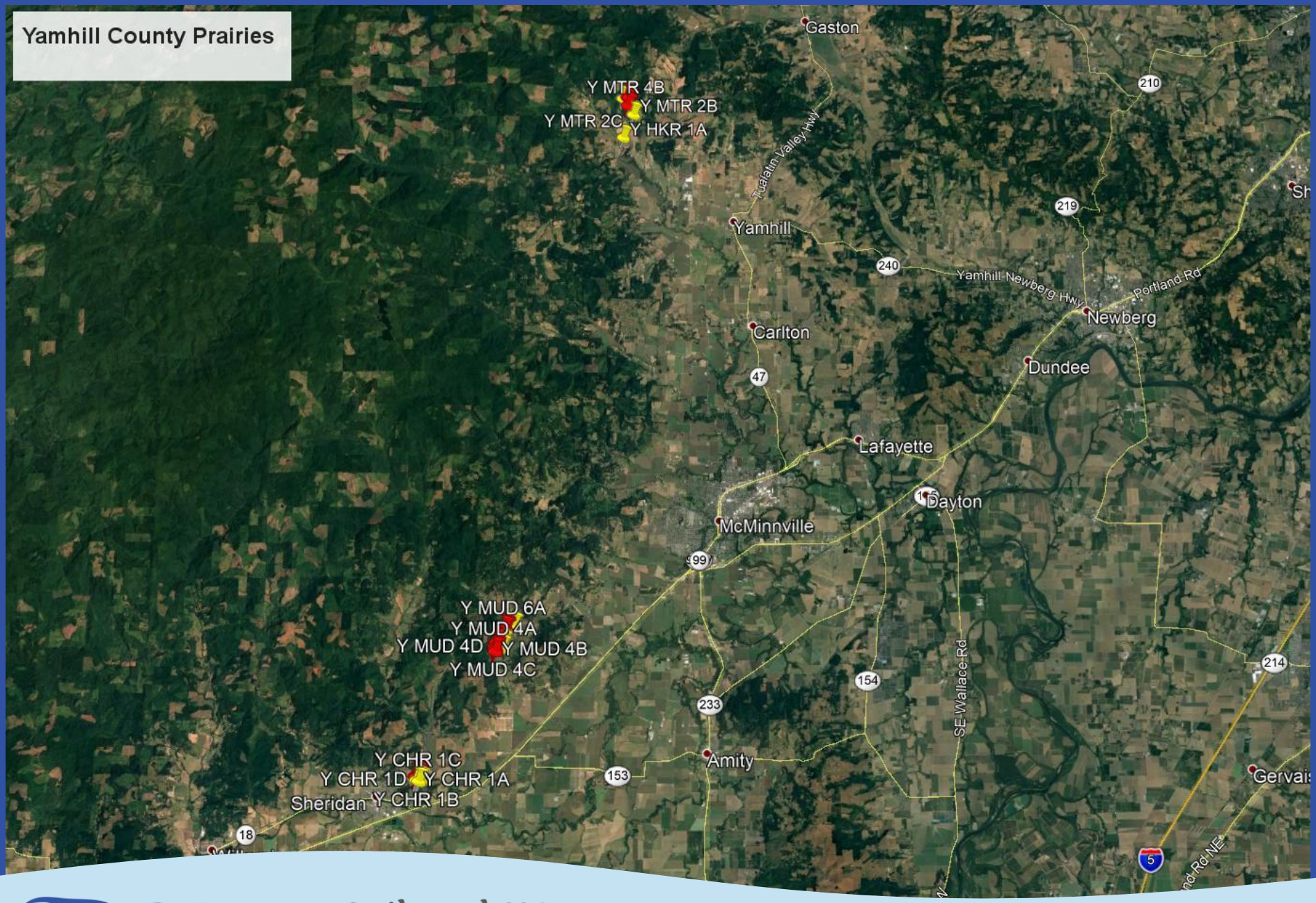


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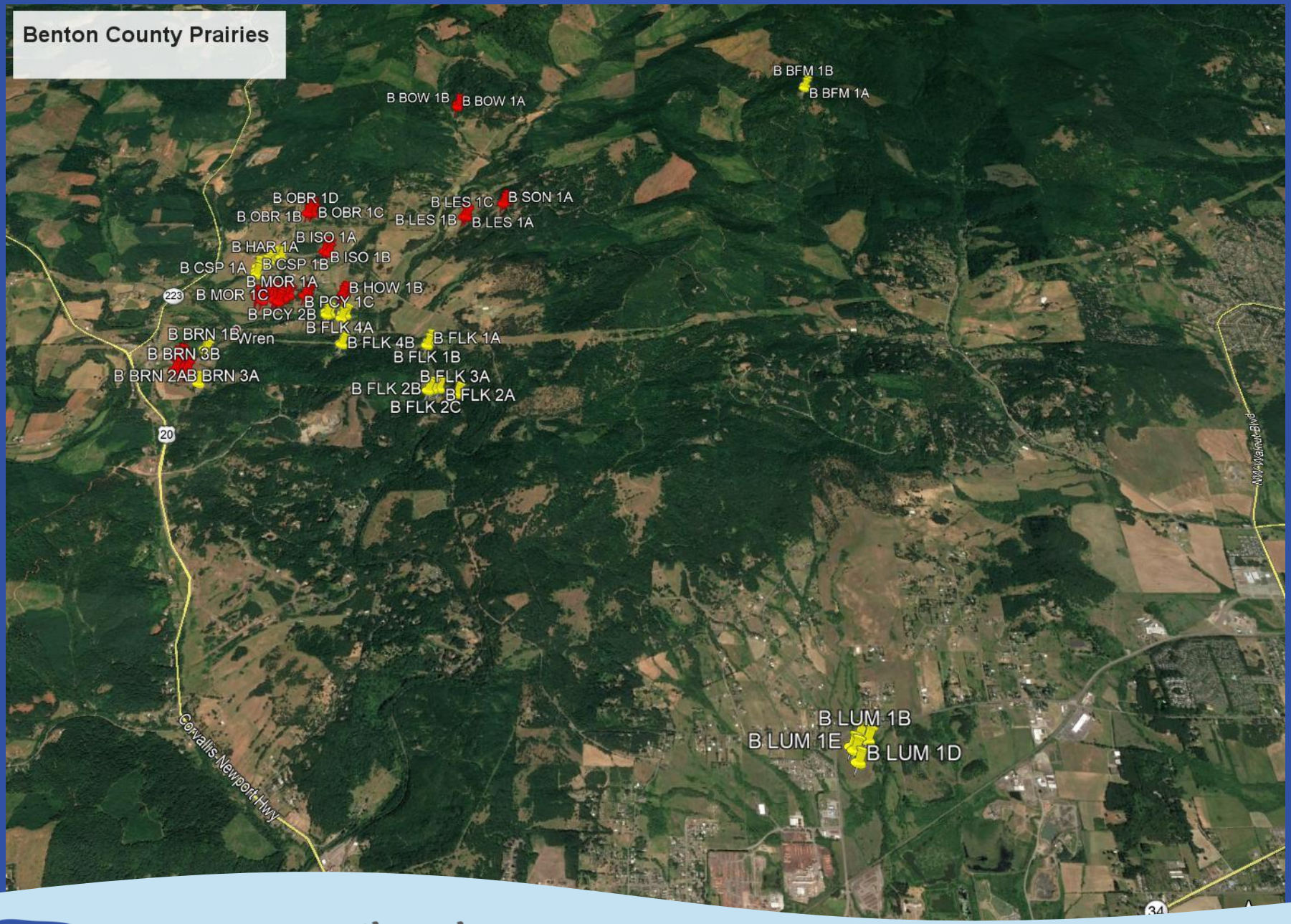


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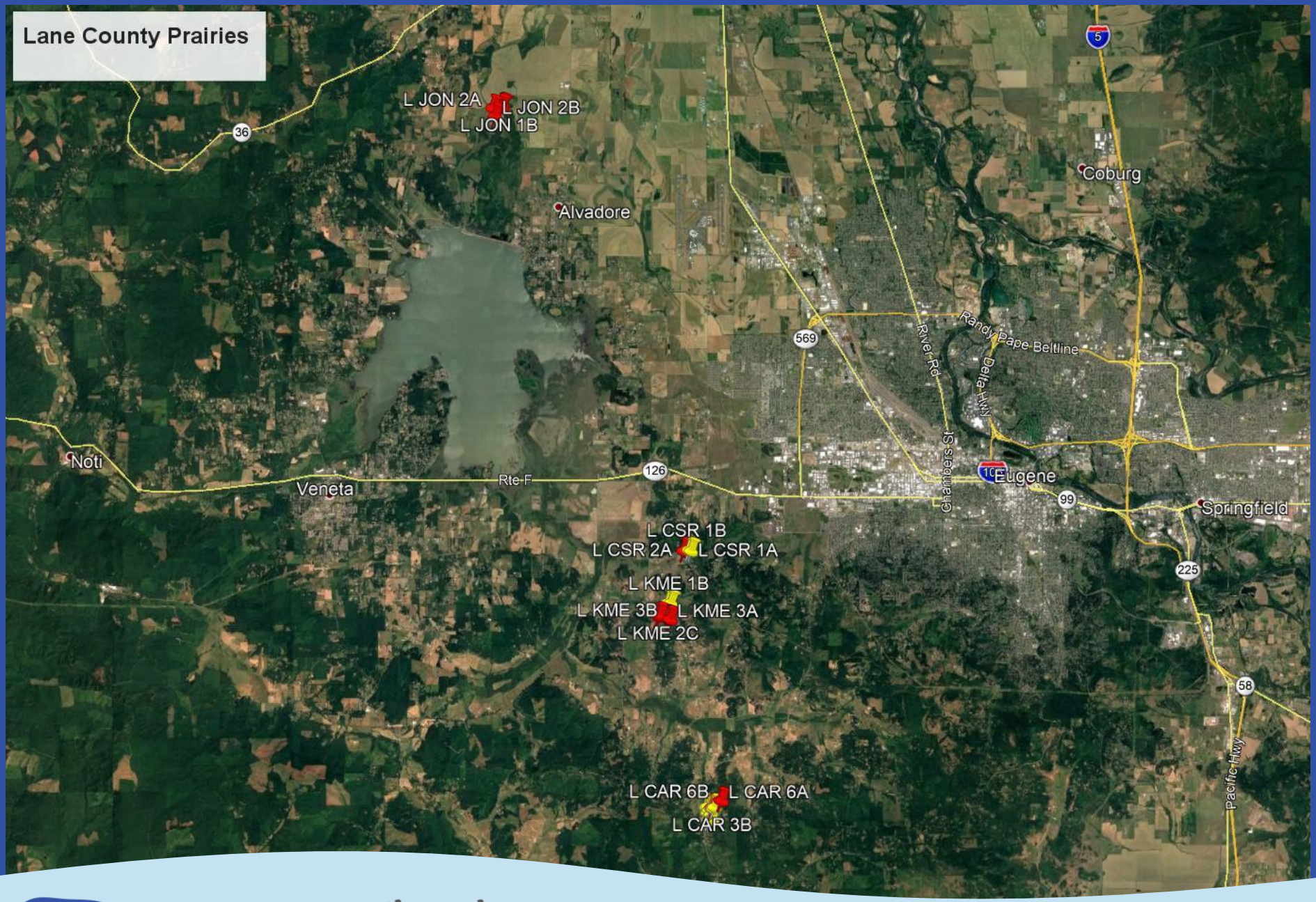
*“This restoration project is empowering, helping us do what we have always wanted to do, which is recreate a place of thriving natural health and beauty, it’s like building a dream.”*

**Kathleen Dean Moore & Frank Moore, Wren landowners**

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# 2 - Soil

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# Soil Field Data

- Geolocation
- Soil classification
- Site characteristics
- Compaction

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# Lab Assessments

- Moisture
- pH and EC
- Sikora (lime)
- Total CN
- $NO_3$, P, K, Ca, Mg, Mn, Fe, Cu, Zn, B
- CEC
- Microbial Respiration

## Prairie Composite Samples

- Soil enzymes
- Phytophthora screen

# 3 - Vegetation

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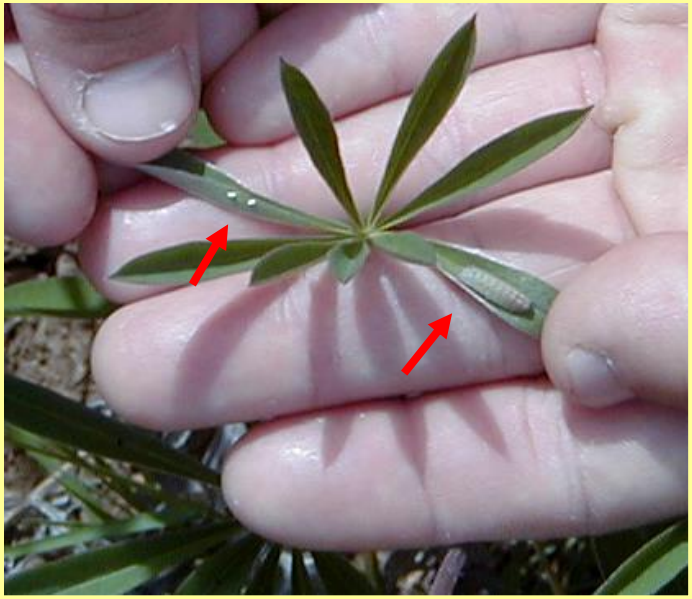

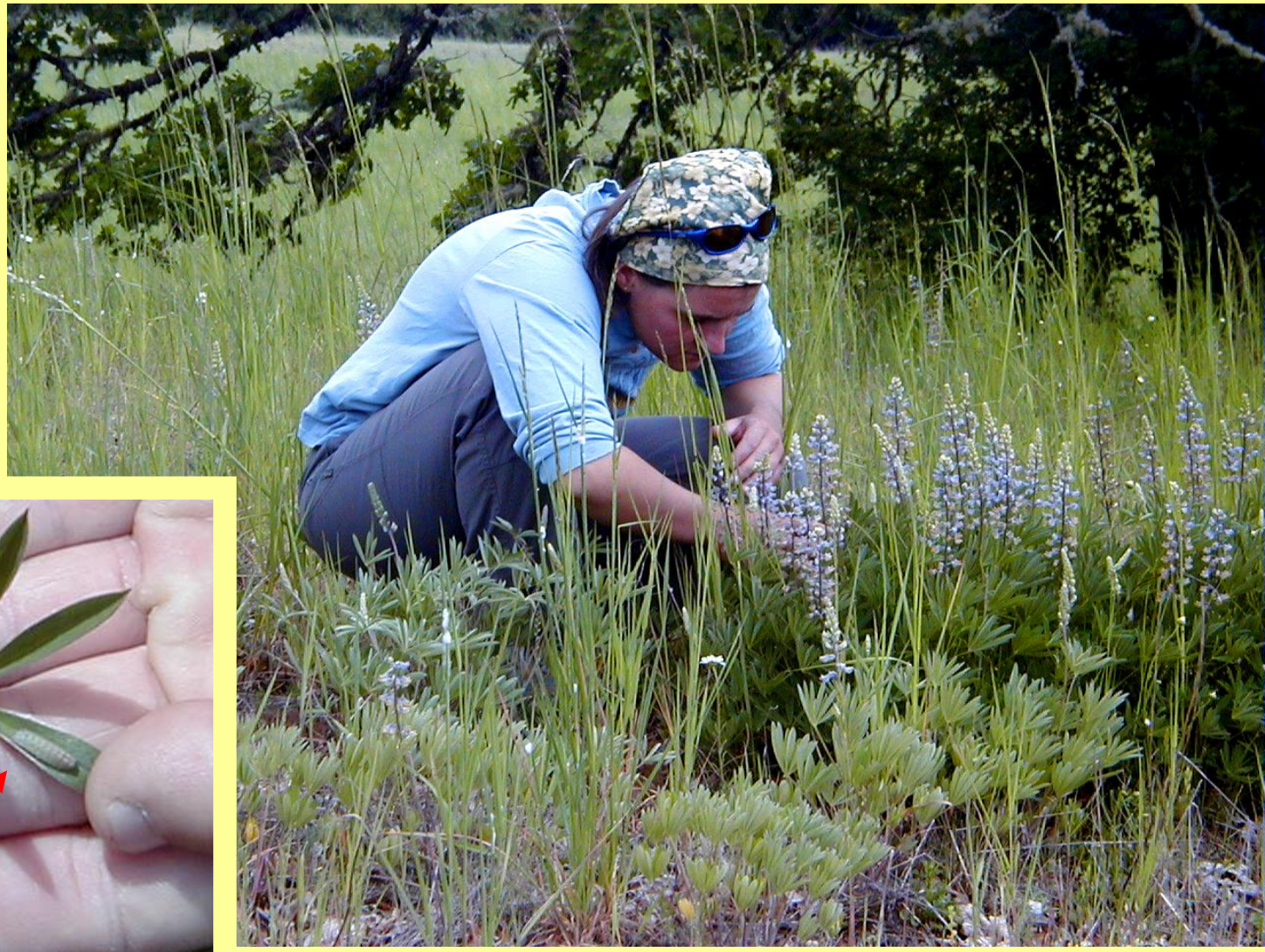

**Kincaid's lupine and Fender's blue butterfly**

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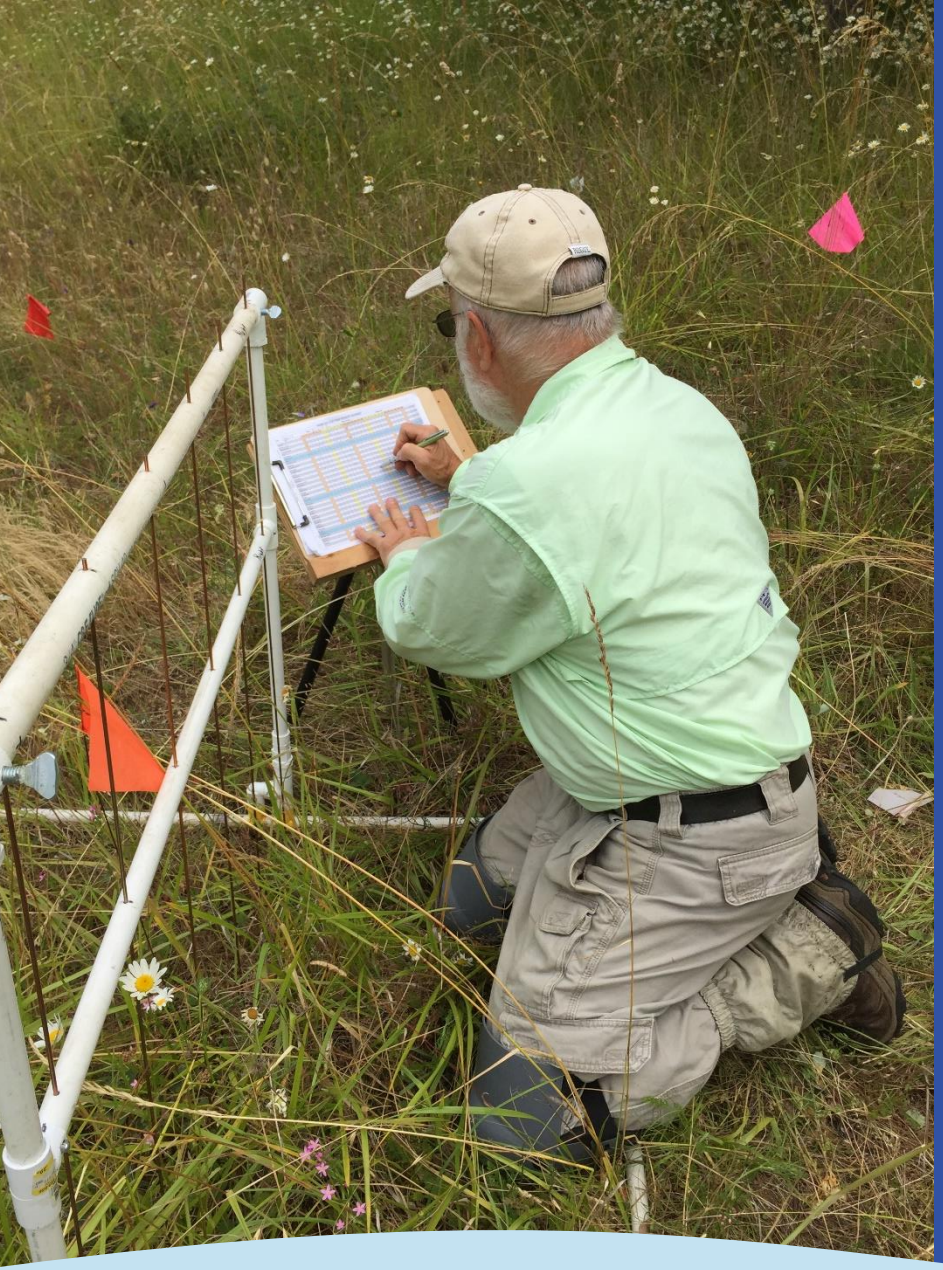

# Vegetation Survey

Vegetation Survey

- Micro / Macro
- PHQC

- Planting Index
- Management Index

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## Prairie Habitat Quality Calculator (%)

- Structure
- Invasive plants
- Natives
- Pollinator Resources
- Final Score – Average of four criteria

Introducing Greg Fitzpatrick's Point Intercept Frame

https://youtu.be/76O1KHsnYD0

Tolmie's Mariposa Lily

Wyethia Mule's Ears

Iris tenax

Scouler's catchfly

Rose Checkermallow

Prunella vulgaris

Hall's Aster

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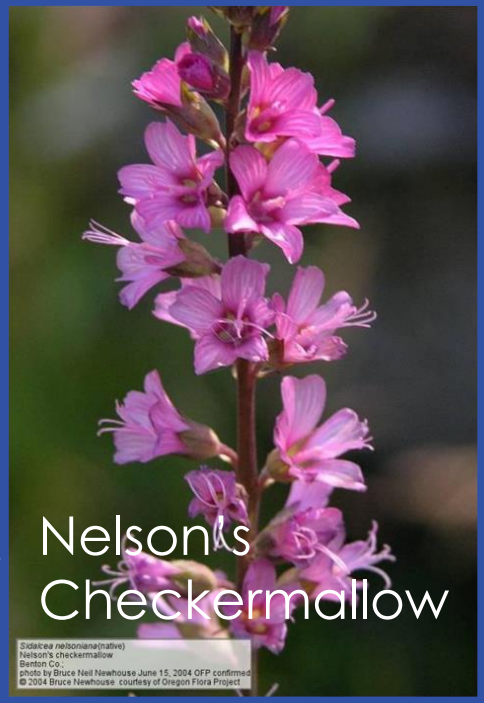


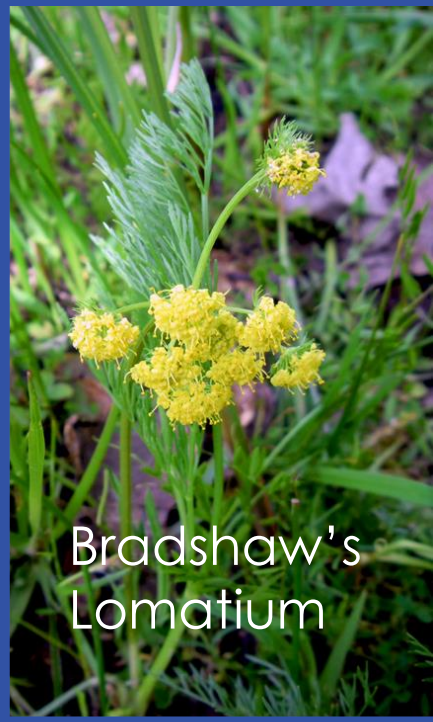

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In the presence of ancient beings…

# Other native species

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Management concerns

- false brome
- scotch broom
- Armenian blackberry
- tall oat grass

oregon.gov/oda/shared/Documents/Publications/Weeds/ScotchbroomProfile.pdf

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More non-native species

- oxeye daisy
- tall fescue

# 4. Data - 133 soil borings

| Date | County ID | Property ID | Prairie ID | Sample ID | Weather | Latitude | Longitude | landform | slope gradient | Epipedon | Dom Hue Sub | Depth Top Bt | Part size Family | Revised Series | pH | EC | Sikora | Total C (%) | P (ppm) | K (ppm) | Structure (*100=%) | Invasives (*100=%) | Pollinator Resources (*100=%) | Natives (*100=%) | Final score average (*100=%) | Management Index - yellow updated | Planting Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11/18/2016 | B | HAR | 1 | A | cool cloudy | 44.597318 | -123.417651 | Hillslope | 16 | ochric | 5YR | 21 | fine | Gelderman | 6.1 | 102 | 5.6 | 2.52 | 6.47 | 124.2 | 0.75 | 0.43 | 0.75 | 0.17 | 0.52 | 4 | 7 |
| 11/18/2016 | B | HAR | 1 | B | cool cloudy | 44.596931 | -123.417926 | Hillslope | 3 | ochric | 10YR | 9 | fine | Dixonville | 5.8 | 97 | 5.8 | 2.78 | 5.02 | 318.5 | 0.75 | 0.79 | 0.48 | 0.25 | 0.57 | 4 | 7 |
| 11/18/2016 | B | HAR | 1 | C | cool cloudy | 44.597503 | -123.4174 | Hillslope | 3 | ochric | 5YR | 8 | clayey skeletal | Ritner-Nekia | 6.0 | 85 | 5.6 | 4.61 | 4.79 | 184.9 | 0.75 | 0.33 | 0.23 | 0.08 | 0.35 | 4 | 7 |
| 11/18/2016 | B | CSP | 1 | A | cool cloudy | 44.5958 | -123.41845 | Hillslope | 4 | ochric | 5YR | 8 | fine | Saum | 5.6 | 136 | 5.6 | 2.86 | 5.17 | 281.3 | 0.50 | 0.38 | 0.23 | 0.47 | 0.39 | 5 | 7 |
| 11/18/2016 | B | CSP | 1 | B | cool cloudy | 44.596261 | -123.418592 | Hillslope | 24 | ochric | 5YR | 14 | fine | Saum | 5.4 | 150 | 5.7 | 2.84 | 5.93 | 448.7 | 0.50 | 0.33 | 0.35 | 0.23 | 0.35 | 5 | 7 |
| 11/18/2016 | B | CSP | 1 | C | cool cloudy | 44.59685 | -123.41869 | Hillslope | 5 | mollic | 5YR | 21 | fine | McAlpin | 5.9 | 156 | 5.9 | 2.74 | 7.64 | 126.8 | 1.00 | 0.52 | 0.35 | 0.38 | 0.56 | 5 | 7 |
| 11/23/2016 | B | PCY | 1 | A | cool cloudy | 44.591376 | -123.407336 | Bedrock Bedrock Bench | 4 | ochric | 5YR | 16 | fine | Nekia | 6.1 | 111 | 5.8 | 3.17 | 4.18 | 173.7 | 0.75 | 0.67 | 0.35 | 0.65 | 0.60 | 8 | 7 |
| 11/23/2016 | B | PCY | 1 | B | cool cloudy | 44.591206 | -123.406975 | Bedrock Bench | 2 | ochric | 5YR | 15 | fine | Nekia | 5.6 | 128 | 5.6 | 3.25 | 5.2 | 316.4 | 0.25 | 0.43 | 0.23 | 0.08 | 0.25 | 8 | 7 |
| 11/23/2016 | B | PCY | 1 | C | cool cloudy | 44.590783 | -123.407383 | Bedrock Bench | 2 | ochric | 5YR | 12 | fine | Saum/Gelderman | 5.9 | 112 | 5.8 | 2.85 | 5.43 | 279 | 0.75 | 0.57 | 0.48 | 0.48 | 0.57 | 8 | 7 |
| 11/23/2016 | B | PCY | 2 | A | cool misting | 44.591335 | -123.408818 | Bedrock Bench | 12 | ochric | 5YR | 14 | fine | Nekia | 6.1 | 141 | 5.7 | 3.02 | 6.59 | 134.5 | 1.00 | 0.67 | 0.35 | 0.38 | 0.60 | 8 | 7 |

# GIS Mapping & Statistical Analysis

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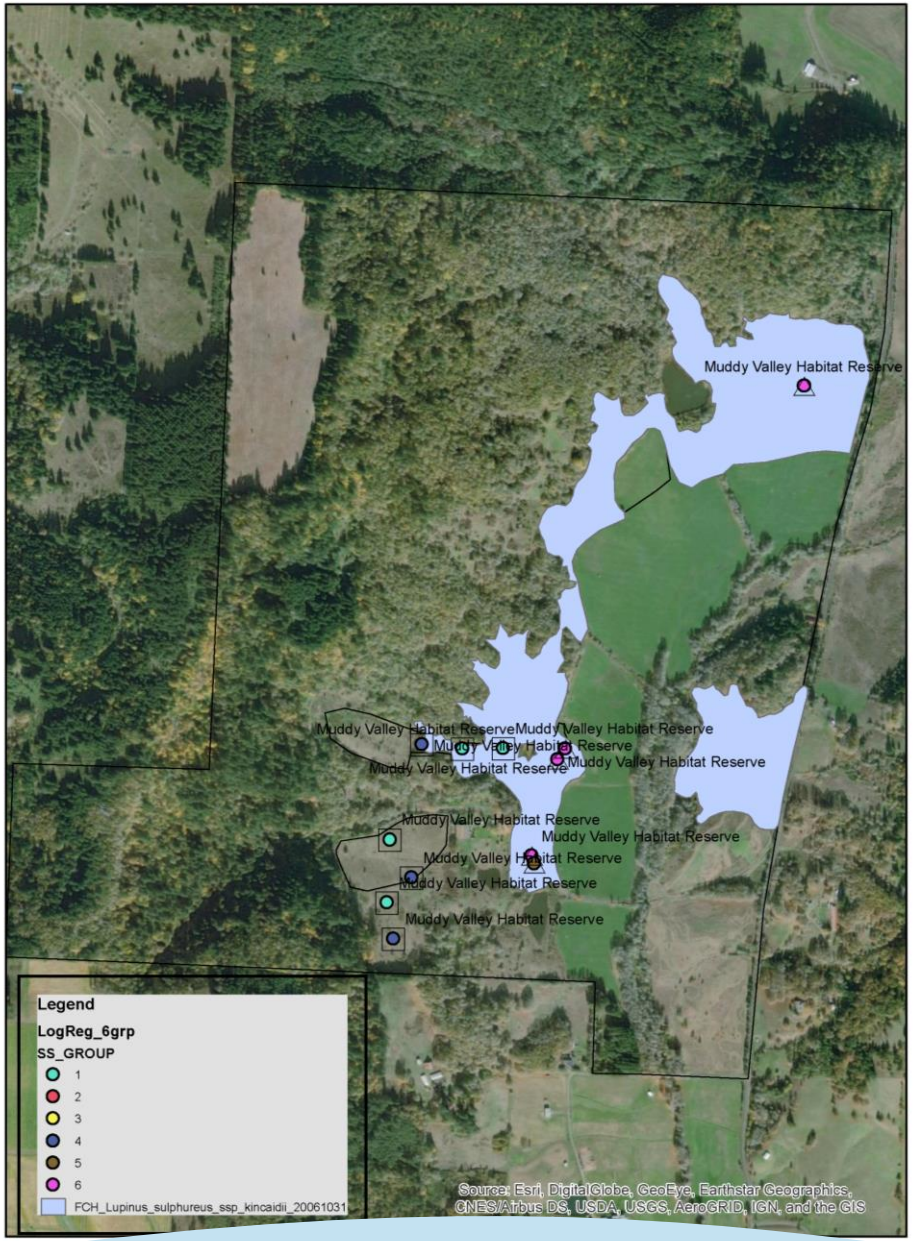


# Grouping Analysis

## 6 groups

# Final Critical Habitat for Kincaid's Lupine

*Yamhill map*

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## #2 Boron

6 remnants = high

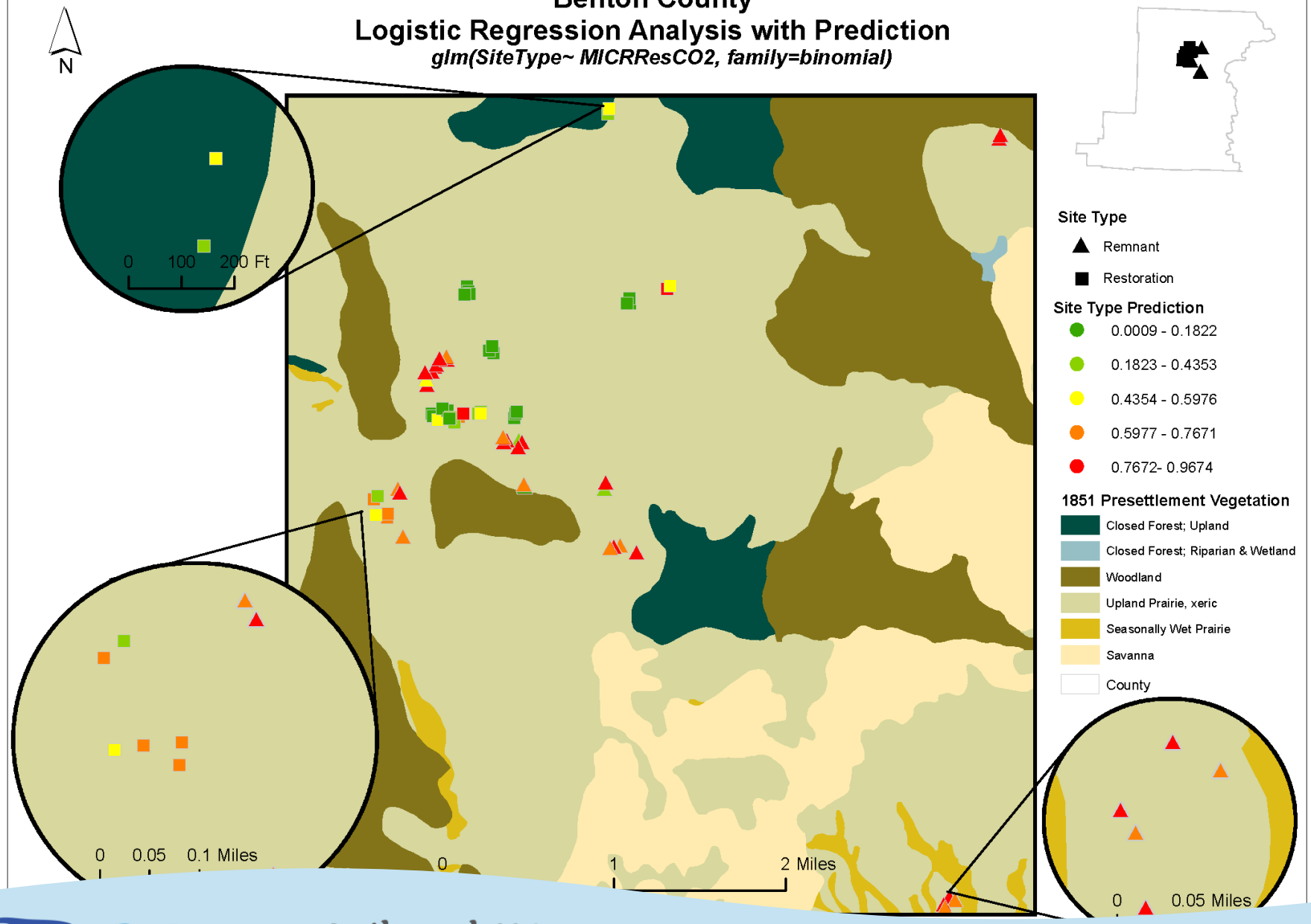
## #4 Microbial Respiration

23 restoration = high

## #6 Phosphorus

44 remnants/1 restoration = low

# Benton County
## Logistic Regression Analysis with Prediction
*glm(SiteType~ MICRResCO2, family=binomial)*

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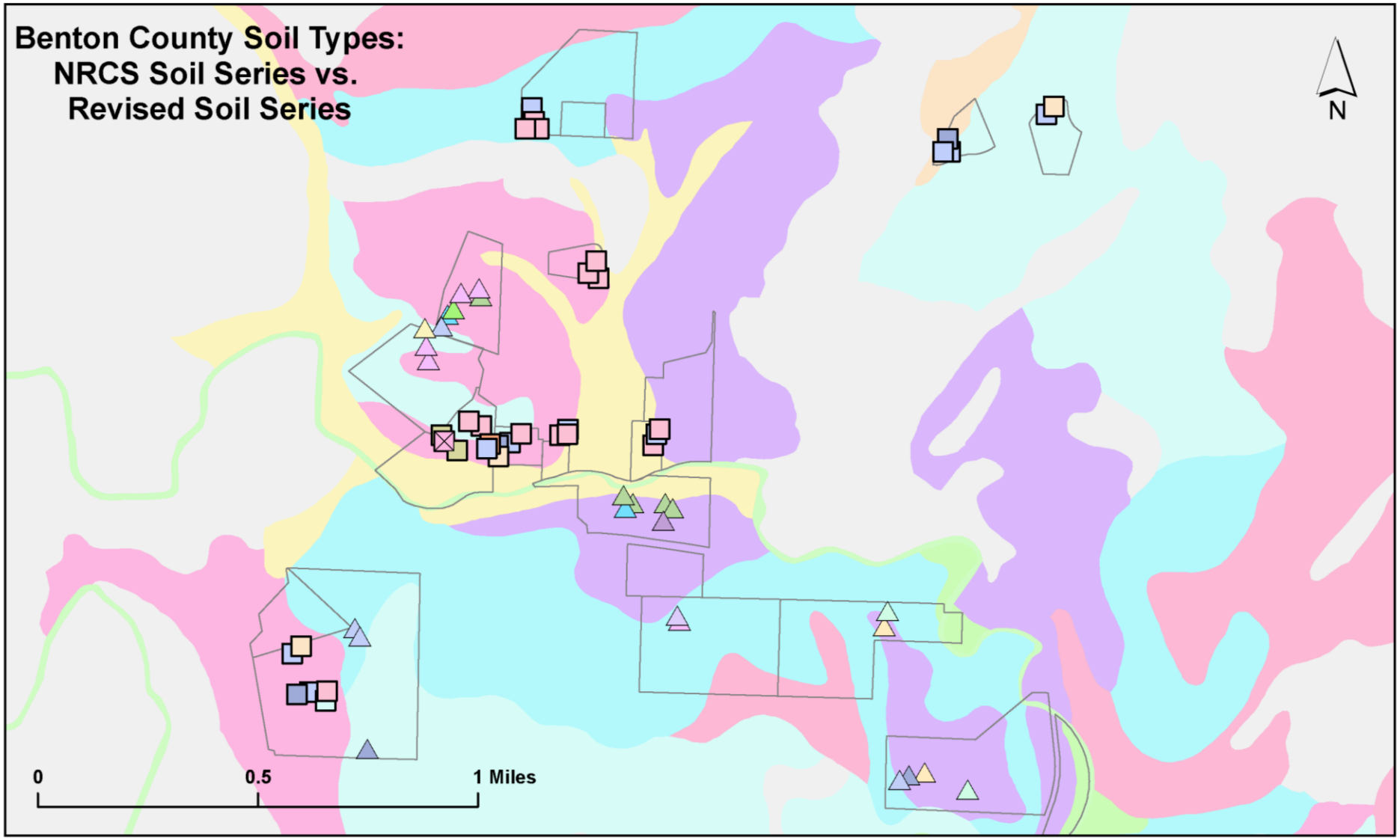


Site Type
- Remnant
- Restoration

Revised Soil Series
- Courtney
- Gellatly
- Saum

NRCS Soil Series
- All other soils
- Coburg
- Jory-Gelderman complex
- Marcola
- McAlpin
- Witham-Dixonville complex
- Witzel

Created by: Candice Landry & Lorene Becker

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# If I had an afternoon – Andy Gallagher

- Web Soil Survey
- Draw a circle around clusters of the remnants
- Extend the circle a mile or so wider
- Locate NRCS map units Dixonville or Jory
- 300 and 700 feet elevation
- Slopes 0 to 20 percent
- Aspect south, southwest, west

## Aerial photos

- Pastures
- Openings in forest cover
- Not cropland

# Additional benefit – gold nugget!!

PSSR Final Report - Appendix I: Soil Series and Native Plant Associations
1 of 4

| Soil Series | PSSR Vegetation Survey Native Species | NRCS OSD Species lists |
|---|---|---|
| Chehuplum | Brodiaea, Poison Oak, Dogbane, California oat grass | annual grasses, wild rose, oak, poison-oak |
| Dixonville | Yarrow, Brodiaea (harvest lily), Clarkia, strawberry, Iris tenax, Kincaid's lupine, Tarweed, navarretia, slender cinquefoil, self heal, rose checker mallow, goldenrod, death camus, dogbane, California brome, sedge, California oat grass, blue wild rye, black berry (native), Oregon oak, poison oak. | Oregon white oak, Douglas fir, bigleaf maple, grand fir, western brackenfern, common snowberry, western hazelnut, Pacific poison-oak, and baldhip rose. |
| Dupee | Halls aster, strawberry, slender cinquefoil, self- heal, sedge, California brome, California oat grass, rush, serviceberry | Oregon white oak, rose, poison-oak, grasses, and sedges |
| Gelderman | Brodiaea (harvest lily), strawberry, Oregon sunshine, Iris tenax, self-heal, slender cinquefoil, rose checkermallow, dogbane, Lotus spp., tarweed, California brome, California oat grass, Roemers fescue, service berry, red flowering currant, manzanita, madrone. | Douglas fir and Oregon white oak with an understory of poison oak, western hazel, common snowberry, and western brackenfern. |
| Gellatly | Brodiaea (harvest lily), strawberry, tarweed, slender cinquefoil, self-heal, rose checker mallow, death camas, death camus, dogbane, California brome, California oat grass, blue wild rye, Roemers fescue, rushes (Juncus), wood rush (Luzulu) Oregon oak, poison oak, rose native, serviceberry. | Oregon white oak, Douglas fir, Pacific poison oak, common snowberry, and baldhip rose, and grasses. |

Additional benefit – gold nugget

# Base-line pathogen levels

*Dr. Jennifer Parke, OSU Crop and Soils*

*“The inadvertent spread of Phytophthora species from nurseries into native ecosystems can have long-term environmental and economic impacts,*

*as has been seen with Phytophthora ramorum, P. lateralis, P. cinnamomi, P. tentaculata, and other species.”*

*"The objective of this study was to estimate the prevalence and species composition of Phytophthora and Pythium in upland prairie restoration sites in western Oregon.*

*Pythium species were nearly ubiquitous, detected in 46 of the 55 sites.*

*Phytophthora species were detected, but in only 7 of 55 sites.*

*There was no clear association between planting history or management practices and pathogen presence.*

*Results of this study provide a snapshot of the current distribution of Phytophthora and Pythium species in restoration sites in western Oregon and can*
*serve as a baseline for recognizing future introductions."*

*~ Parke*

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*Andy Gallagher, Red Hill Soils*

*We like to think we understand soils and prairies but until we understand them together, interacting and indivisible, we don't and can't really know them fully.*

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# THANKS for listening!

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# Questions?

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Teresa Matteson

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