Regional Inventory of Prairies

in the Southern Puget Trough:

Phase One

Prepared by:

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Abstract:

This project germinated from the inventory of native prairies done on the Ft. Lewis Military Reservation by Rex Crawford and Chris Chappell. As a result of that work it became clear that native prairie vegetation should to be inventoried on a regional rather than site specific basis to portray an accurate distribution of native prairies and their conversion due to human settlement, and forest encroachment.

Prairies are a characteristic natural feature of the southern Puget Trough in the state of Washington. This is the first step in a regional inventory of the current distribution of native prairies and the extent of their conversion to other uses. The information will be used for regional conservation planning as it will provide an overview of the condition of native prairies in the southern Puget Trough and provide leads for future conservation efforts.

The development of what was once contiguous prairie landscape has lead to the native community becoming increasingly rare. If the distribution of prairie soils is indicative of the historical extent of prairies in the region, approximately 80% of native prairie habitat has been converted to other uses. This coupled with the fact that fire suppression has encouraged the proliferation of coniferous forests in the region warrants the attention of regional biologists to consider conservation and restoration of prairies. In addition, the continued loss of open bunchgrass prairie could result in a lack of information about unknown values this ecosystem could have to society (Bachmann et al, 1993).

Geological and Ecological background:

Pleistocene glaciation, specifically the Puget Lobe of the Cordilleran Ice Sheet, and associated fluvial events made major changes in the landscape of the southern Puget Trough. This period of glaciation is known as the Vashon stade, and occurred between thirteen and eighteen thousand years ago. Glaciers deposited till, and sorted / unsorted outwash sands and gravels. Following this glaciation, loess and volcanic ash was deposited over the glacial

material (Pringle, 1990).

Native prairies in the southern Puget Trough form on soils derived from glacial and alluvial sediments. The remnants of this habitat still display the mix of communities once abundant in the region. Puget Trough prairies are composed of grasses, a thin moss layer, and low herbaceous plants, are bordered by trees, and are often defined by a change from level to sloping land (Bachmann et al, 1993).

Soils:

Prairies form on somewhat shallow, sandy to gravelly loams which have been collectively referred to as the Spanaway series, including Nisqually and Carstairs soils. These soils typically have a thin layer (2.5 cm) of well decomposed organic material on the surface (Clampitt, 1984). The A1 horizon (0-14 inches) is a strongly acidic, gravelly sandy loam with high organic content. The soil becomes less acidic with depth until is consists of large stones in a matrix of sand and gravel below 18 inches (Ness, 1958, in Lang). These soils are low in productivity, and very droughty.

Table 1. Prairie Soil types and their landforms

Spanaway - These soils grade from gravelly sandy loam to stony sandy loam. These very deep somewhat excessively drained soils formed on terraces from glacial outwash and volcanic ash. These soils are sandy-skeletal, mixed, mesic Andic Xerumbrepts.

Nisqually - These very deep, somewhat excessively drained soils are on terraces and formed in sandy glacial outwash. These soils are sandy, mixed, mesic Pachic Xerumbrepts.

Spanaway/Nisqually association - This association occurs on mounds and in areas between mounds (i.e. Mima Mounds NAP). The mounds are circular to elliptical, and they are 3 - 5 feet high in the center.

Spana - This very deep, somewhat poorly drained gravelly loam is in elongated drainageways on outwash plains. It formed in glacial outwash. This soil is a loamy-loamy, mixed, mesic Pachic Xerumbrepts.

Carstairs - These very deep, somewhat excessively drained gravelly loams are on terraces and formed in extremely gravelly glacial. These soils are sandy-skeletal, mixed, mesic Andic Xerumbrepts.

(Pringle, 1990)

Methods:

Soil types which are known to support native prairie were identified. These include: Spanaway, Nisqually, associations of Spanaway and Nisqually, Spana, Carstairs, and Fitch. Table 1 summarizes the characteristics of each soil type. The soils data layer coordinated by the Washington Department of Natural Resources was used to define the approximate maximum extent of prairie vegetation in the southern Puget Trough (Figure 1). Fitch soils were not included in the inventory because they aren't included in the most recent soil surveys and they are not in the state digital soil layer which was the basis for our work.

Using all of the soil polygons we defined the area that we would inventory and acquired all of the quarter township orthophotos for the region. We then reviewed each quarter township using the orthophotos and an overlay of the soil polygons for that quarter. The review consisted of an estimation, in 10% increments, of the usages in each quarter town. The usage categories are: TOWN, FIELD, FOREST, and GRASS. TOWN being land converted to municipal or industrial use, i.e. paved, FIELD being agricultural uses, FOREST being coniferous forest, and GRASS being native prairie or potential native prairie (i.e. sites that have been invaded by Scot's Broom). Each quarter town was reviewed twice for an average use percentage to dissuade bias.

After the orthophoto review the results were entered into a spreadsheet, using Quattro Pro,

and totals were calculated for each soil type, and the acres per use for that soil type in each quarter township.

Results:

Prairie soils were found to occur in five counties Grays Harbor, Thurston, Lewis, Mason, and Pierce; Grays Harbor county has Spanaway & Carstairs soils, Lewis county had Spanaway & Nisqually soils, Mason county has Carstairs, Pierce has Spanaway, Nisqually, and Spana soils, Thurston county has Spanaway, Nisqually, Spanaway/Nisqually, and Spana soils. It should be noted that the prairie soils in Pierce county are far more extensive than represented in the layer used for this analysis due to Fort Lewis being absent from the state digital layer. Fort Lewis encompassing a total of 86,176 is comprised of over ninety percent prairie soils (primarily Spanaway). I calculated the acreage of prairie soils at Fort Lewis by multiplying 92% by the total acreage to get approximately 79,281 acres of prairie soils.

Prairie Soils County Distribution

Table 2a.

	survey acre	Spanaway	%	Nisqually	%	Span - Nisq	%	Spana	%	Carstairs	%
Grays Harbor	877470	5414	0.006	0	0.000	0	0.000	0	0.000	3690	0.004
Lewis	1228335	3425	0.003	228	0.000	0	0.000	0	0.000	0	0.000
Pierce*	389967	31744	0.051	1036	0.002	0	0.000	1157	0.002	0	0.000
Mason	618880	0	0	0	0	0	0	0	0	5503	0.005
Thurston	487040	35335	0.073	13955	0.029	9975	0.020	1555	0.003	0	0.000

*does not include 79,281 acres of Spanaway soils for Fort Lewis

Table 2b.

	legal acres	Spanaway	%	Nisqually	%	Span - Nisq	%	Spana	%	Carstairs	%
Grays Harbor	1222400	5414	0.004	0	0.000	0	0.000	0	0.000	3690	0.003
Lewis	1550720	3425	0.002	228	0.000	0	0.000	0	0.000	0	0.000
Pierce*	1072640	111025	0.180	1036	0.002	0	0.000	1157	0.002	0	0.000
Mason	615680	0	0	0	0	0	0	0	0	5503	0.052
Thurston	456960	35335	0.077	13955	0.031	9975	0.022	1555	0.003	0	0.000

*includes 79281 acres of Spanaway soils for Fort Lewis

Based on the orthophoto review (approximately) twenty-two percents of native or restorable grasslands are left, while twenty-five percent of soils have been converted to forest, twenty percent to agricultural uses and thirty percent to municipal/industrial uses.

Table 3. Prairie Soils Use Analysis

	acres	town	%	field	%	forest	%	grass	%
Spanaway*	60710.1	17919.6	30	15663.7	26	14874.2	25	12257.9	20
Nisqually	11160.38	5800.49	52	2858.34	23	1741.26	16	1033.31	9
Span. - Nisq.	9494.38	165.79	2	1754.84	18	2427.62	26	5146.13	54
Spana	2095.69	692.615	33	402.045	19	535.42	26	527.5985	25
Carstairs	8837.1	2253.47	26	1616.05	18	3626.36	41	1341.21	15
Total	92297.65	26832	30	22294.98	20	23204.86	25	20306.15	22

Discussion :

Conservation efforts may be able to be prioritized based on the figures in Table 2. Whether distinct soil types support natural features is worth researching. Soil types and processes could lead to natural variability in prairies. The cadre of soil uses span from 9 - 54%. The soils which have the most extreme (high or low) relative use figures provide some interesting leads for questions and associations worthy of further study. They also confirm some things we already know.

Spanaway soils are the largest group of the prairie soils covering approximately 150,000 acres in four counties. Approximately 111,000 acres occur in Pierce County alone with over 79,000 of those acres lying within the boundaries of Fort Lewis. Fort Lewis holds the highest density of native prairie in the region, including many of the best condition prairie communities (Crawford, 1994). Conservation of features specific to Spanaway soils should be adequately addressed by research and restoration efforts currently underway at the Fort.

The uses for Nisqually soils, specifically TOWN and GRASS are interesting. Fifty-two percent of this soil type has been converted to TOWN (industrial/municipal), while nine

percent appears to be native or restorable grass. (Nisqually soils underlie the greater Olympia, Lacey, Tumwater area). Nisqually soils are distinct from Spanaway soils in particle size, they tend to be sandier with fewer large clasts (Crawford, 1995). If there are attribute unique to Nisqually soils is seems that the high conversion factor for this soil type would make it a priority for conservation.

The Spanaway -Nisqually Association which forms on mounded topography has the largest relative percent of native grass (54%). This soil association and it's biological counterparts is preserved in the Mima Mounds NAP, Rocky Prairie and the Thurston County Glacial Heritage Site. This three sites encompass approximately 730 acres of native prairie growing on Spanaway-Nisqually soils.

The figures for Carstairs soils support what we know about the type of vegetation these soils support, which is primarily forest. Forty-one percent of Carstairs soils fit into the FOREST use.

In addition to looking at the applicability of this data for the conservation of native bunchgrass and its characteristic plant species, this information will provide leads for conservation of habitat for vertebrate and insect species (Stock, 1995). Particular species may prefer plant distributions or geomorphic regimes which are unique to one soil type, or assemblages of soil types. For example, *Thomomys mazama* (pocket gopher) populations could be mapped and overlain on the soil layer to surmise whether the gophers tend to less cobbly or gravelly soils for habitat. If this is true we should find a higher density of gophers on Nisqually soils. As indicated by Dick Taylor of the Department of Wildlife, "The more gravel, the less likely gophers will be found" (Taylor, 1994), this isn't an unreasonable hypothesis. If it is found that gophers prefer Nisqually soils, this would be a direction for conservation of gopher habitat.

In conclusion this work should be continued, a list of tasks follows:

1) Compare GRASS locations with known high quality prairie/prairie species occurrences
2) Ground-truthing and digitizing of grass polygons
3) Recommendation of sites that should be preserved or restored
4) Acquisition and/or restoration of sites

The mapping done thus far, and the continuation of this project will allow for prairie habitat being inventoried and mapped on a regional scale. It will provide the information needed to define high quality areas of native prairies which will result in maintaining viable populations of animal and plant species dependent on native prairie habitat. This process will also allow regional planners to make educated choices for preservation and restoration.

References

Bachmann, Anna et al. 1993. Feasibility Assessment for Restoration of Puget Trough Prairie, Fort Lewis WA. The Nature Conservancy, a study.

Clampitt, Christopher. 1984. The Ecological Life History of Aster curtus, a grassland Endemic in a Forested Region. M.S. Thesis, Univ. of Washington.

Crawford, Rex C. et al. 1994. Inventory and Mapping of Endangered Native Ecosystems on Fort Lewis: Draft Final Report. The Nature Conservancy and Washington Natural Heritage, a study.

Crawford, Rex. 1995. Personal Communication.

Evans, R.L. and Fibich, W.R. 1987. Soil Survey of Lewis County Area, Washington. USDA Soil Conservation Service. 466 p.

Kruckeberg, Arthur. 1991. The Natural History of Puget Sound Country. University of Washington Press.

Moral, R. D. and Deardorff, D. C. 1976. Vegetation of the Mima Mounds, Washington

Ness, A.O. and Fowler R.H. 1960. Soil Survey of Mason County, Washington. USDA Soil Conservation Service. 76 p.

Pringle, R.F. 1987. Soil Survey of Grays Harbor County Area, Pacific County, and Wahkiakum County. USDA Soil Conservation Service. 296 p.

Pringle, R.F. 1990. Soil Survey of Thurston County, Washington. USDA Soil Conservation Service. 283 p.

Ritter, Dale. 1986. Process Geomorphology, second edition. William C. Brown publishers. State. Ecology 57: pp. 520-530.

Stock, Amy. 1995. Personal Communication.

Taylor, Richard. 1994. Letter to Chuck Turley, DNR.

U.S. Corps of Engineers. 1994. FEIS Stationing of Mechanized or Armored Combat Forces at Fort Lewis, Washington.

Washington State Department of Natural Resources. 1990. Geographic Information System - Detailed Soil Layer.

Yates, Richard and Charity. 1993. Washington State Atlas and Yearbook, third edition.

Zulauf, A.S. 1979. Soil Survey of Pierce County Area, Washington. USDA Soil Conservation Service. 131 p.