The background image shows a natural habitat with a central clump of beargrass (Xanthoxylum) surrounded by other plants, including broad-leaved shrubs and mosses on the ground.

Incorporating Traditional Land Management into the Restoration of Anthropogenically- Maintained Beargrass Habitat on the Olympic Peninsula Lowlands

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**With Justine James
Quinault Indian Nation**

**Washington Native Plant Society Presentation
November 21, 2005**

Outline of the Presentation

- ▶ **Introduction**
- ▶ Beargrass Autecology
- ▶ Historical ecology
- ▶ Effects of fire on beargrass seed germination
- ▶ High-intensity fire's effects on beargrass
- ▶ Low-intensity fire's effects on beargrass
- ▶ Conclusion



Glacial History, PNW:

Beargrass in lowlands can be initially attributed to late Pleistocene Frazer Glaciation and subsequent deglaciation.

- ▶ Late Pleistocene Frazer Glaciation: Cold, dry conditions, open canopy. Tundra and parkland vegetation at low elevations.
- ▶ Deglaciation Begins 14,000 ybp → Early and Mid-Holocene: Warmer, dry conditions with lightning. Drought → xerophytic species expansion.
- ▶ Late Holocene (4,500 ybp - now): Cool, wet conditions - Forests develop. Yet beargrass remains in low elevations.

Cultural History, PNW



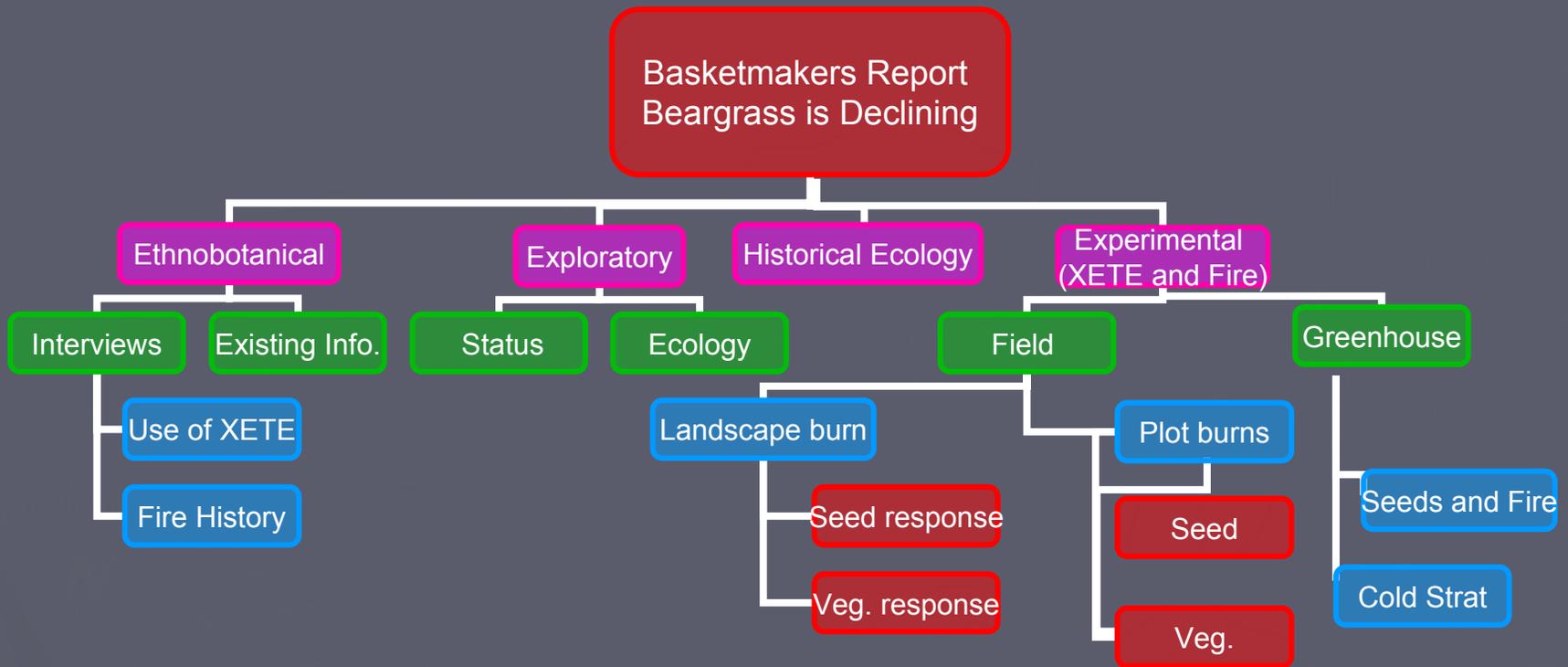
- ▶ Many open areas remained, despite precipitation.
- ▶ Humans arrived in PNW over 10,000 ybp.
- ▶ Evidence of habitation near prairies on the Olympic Peninsula ~3,500 years ago.
- ▶ Native Americans began burning during cooling trend 3,000-4,000 ybp.
- ▶ Prairies and savannas provided necessary resources.

Ethnographic findings about beargrass:

- ▶ A fundamental basketry material.
- ▶ Is declining in quality and quantity.
- ▶ Traditionally gathered in lowlands on periphery of prairies and in savannas.
- ▶ Grows best in partial shade.
- ▶ Habitats not been burned for over 150 years.



Outline of my research approach: XETE= beargrass



Integrating traditional knowledge to restore a resource and an anthropogenic landscape

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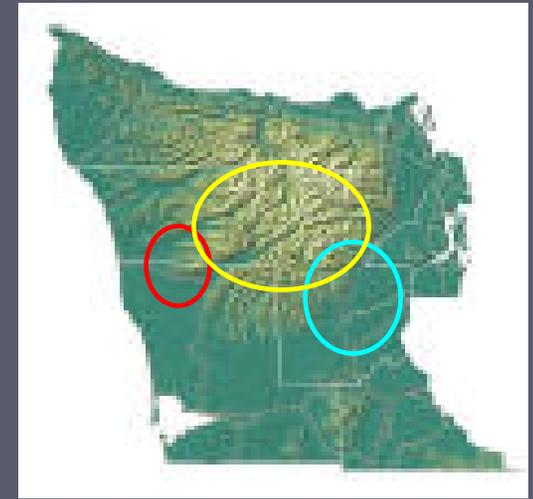
Beargrass, *Xerophyllum tenax* (Melanthiaceae)

- ▶ Perennial, evergreen herb.
- ▶ Mostly in mid- to high-elevations.
- ▶ In lowlands on Peninsula.
- ▶ Reproduces vegetatively and sexually.
- ▶ Moderately shade-tolerant (can't flower under canopy).
- ▶ Fire-adapted.
- ▶ Basal leaves form dense tussocks.
 - Leaves used by tribes and floral industry.



Exploratory Field Work :

Autecology of Beargrass (XETE) on the Olympic Peninsula



- Distribution and Ecology of XETE on the Olympic Peninsula
 1. Are there distinct habitat zones of beargrass on the Olympic Peninsula?
 2. What characterizes these habitat zones?
 3. Are beargrass seed germination requirements different according to parent plant location?

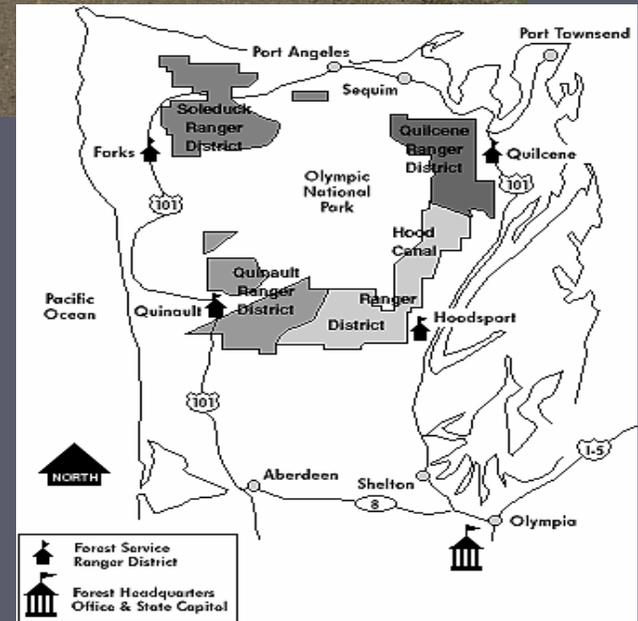
Forested Plant Associations of the Olympic National Forest

Henderson et al. 1989

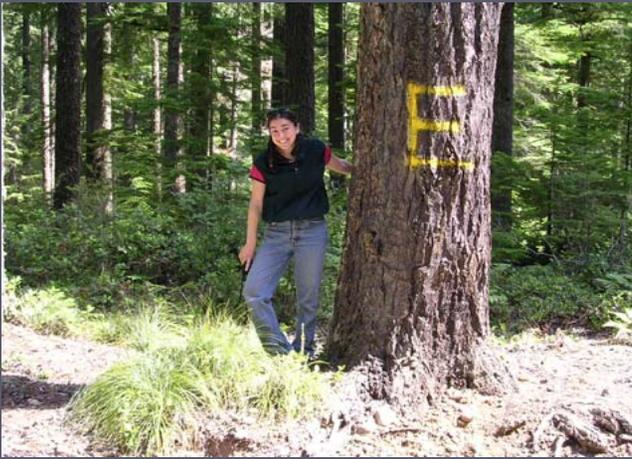
- ▶ Objective: To develop and implement a classification of the Forested Plant Associations of the Olympic National Forest.
- ▶ Authors provided location information for 84 permanent plots in which they found XETE: aerial photographs, map, directions from "E" tree.
- ▶ Original environmental variable measurements provided for each plot.

Exploratory Research: What did I do?

- ▶ Trained with authors on sampling technique.
- ▶ Visited and sampled 45 plots established by Henderson et al.
- ▶ Relocated and sampled at 29 plot centers. Confident of proximity of location and sampled XETE in 15 others (1 plot was a mystery).



Brief Lesson on Technique: 1/10th acre plots – Randomly located in ONF



Data Collected at Each Plot

Plot Characteristics:

- ▶ Slope
- ▶ Aspect
- ▶ Elevation
- ▶ Species %Cover
- ▶ CC over
- ▶ CC under
- ▶ Litter Layer
- ▶ TM
- ▶ Stand Description
- ▶ Bedrock
- ▶ Regolith



Beargrass:

- ▶ Length of plant
- ▶ Width of plant
- ▶ Height of plant
- ▶ Length and width of 5 random leaves
- ▶ Species %cover in vertical space.
- ▶ # Rosettes
- ▶ Color



Three Beargrass Habitat-Zones:



Subalpine



Low elevation
East Side



Low elevation
West Side

Dry, Subalpine Forest

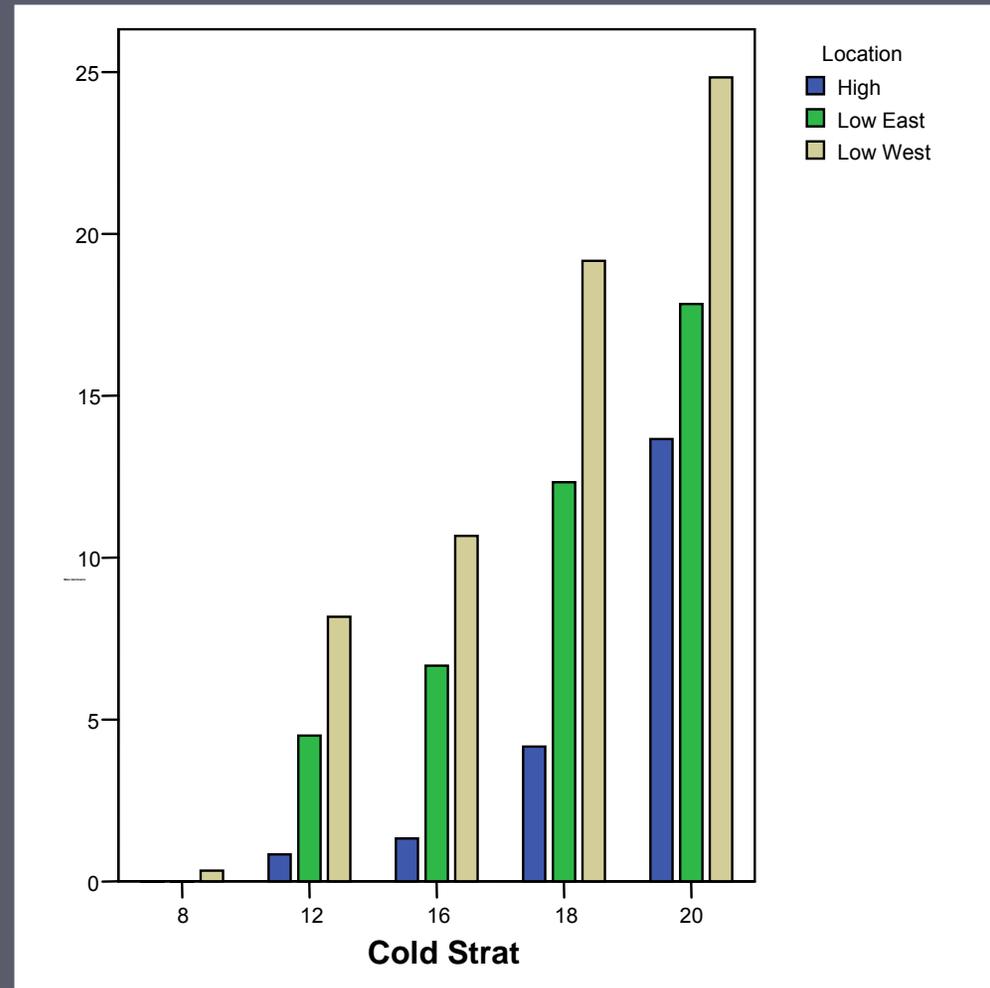


Wet, Low-Elevation Forest



Seed Germination Experiment: Varying Lengths of Cold Stratification

- ▶ Seeds collected from three habitat zones.
 - Different length of time in cold stratification



Exploratory Findings: Beargrass Status

- ▶ Beargrass is declining in plots sampled 17ybp on Southeastern Olympic Peninsula
- ▶ Possible explanations:
 - Overharvesting by the floral industry
 - ▶ HARVESTING DYNAMIC STUDY
 - Corresponding increase in canopy cover
 - ▶ RESTORATION EFFORTS

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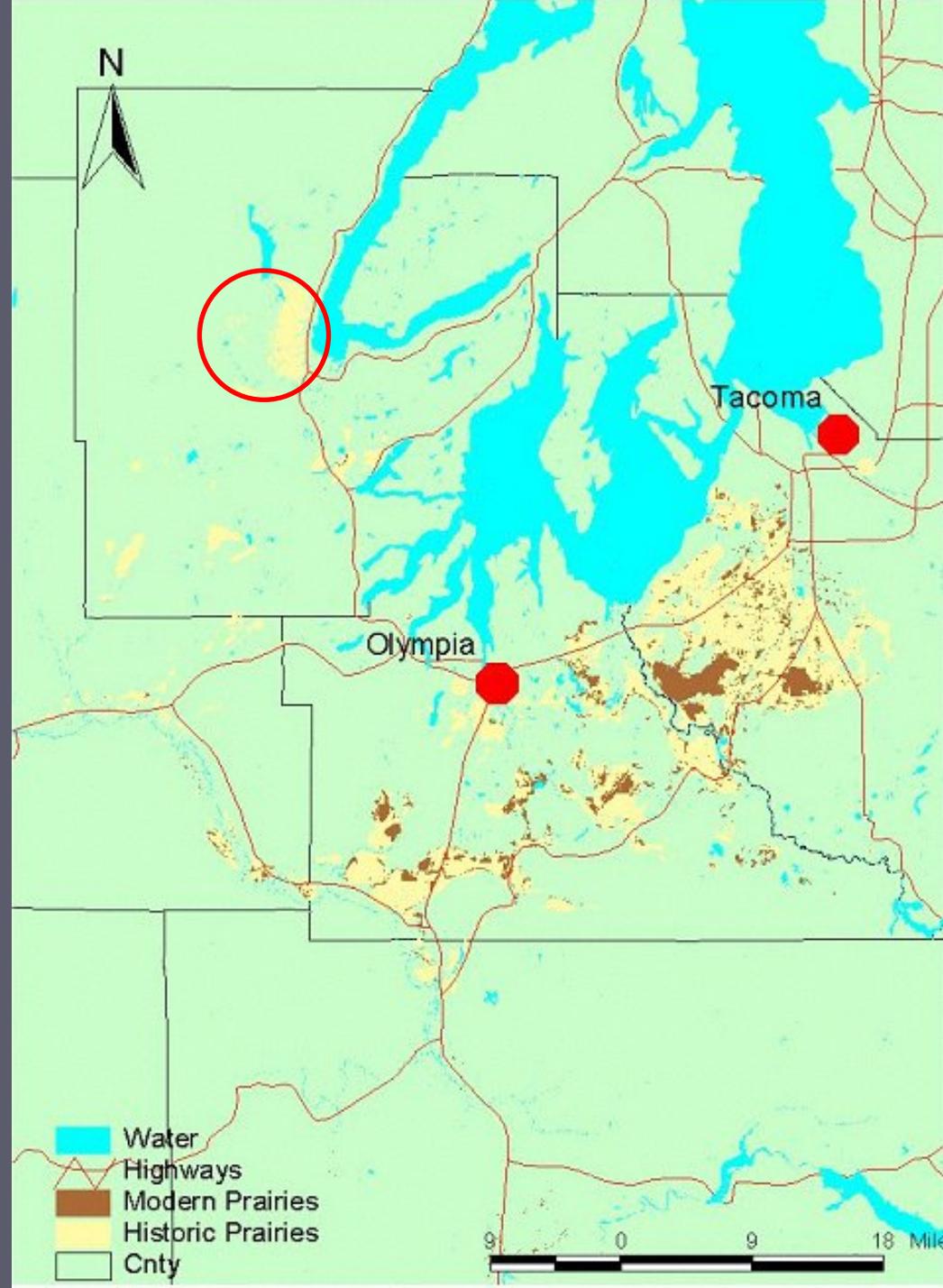
Historical ecology of southeastern Olympic Peninsula savannas

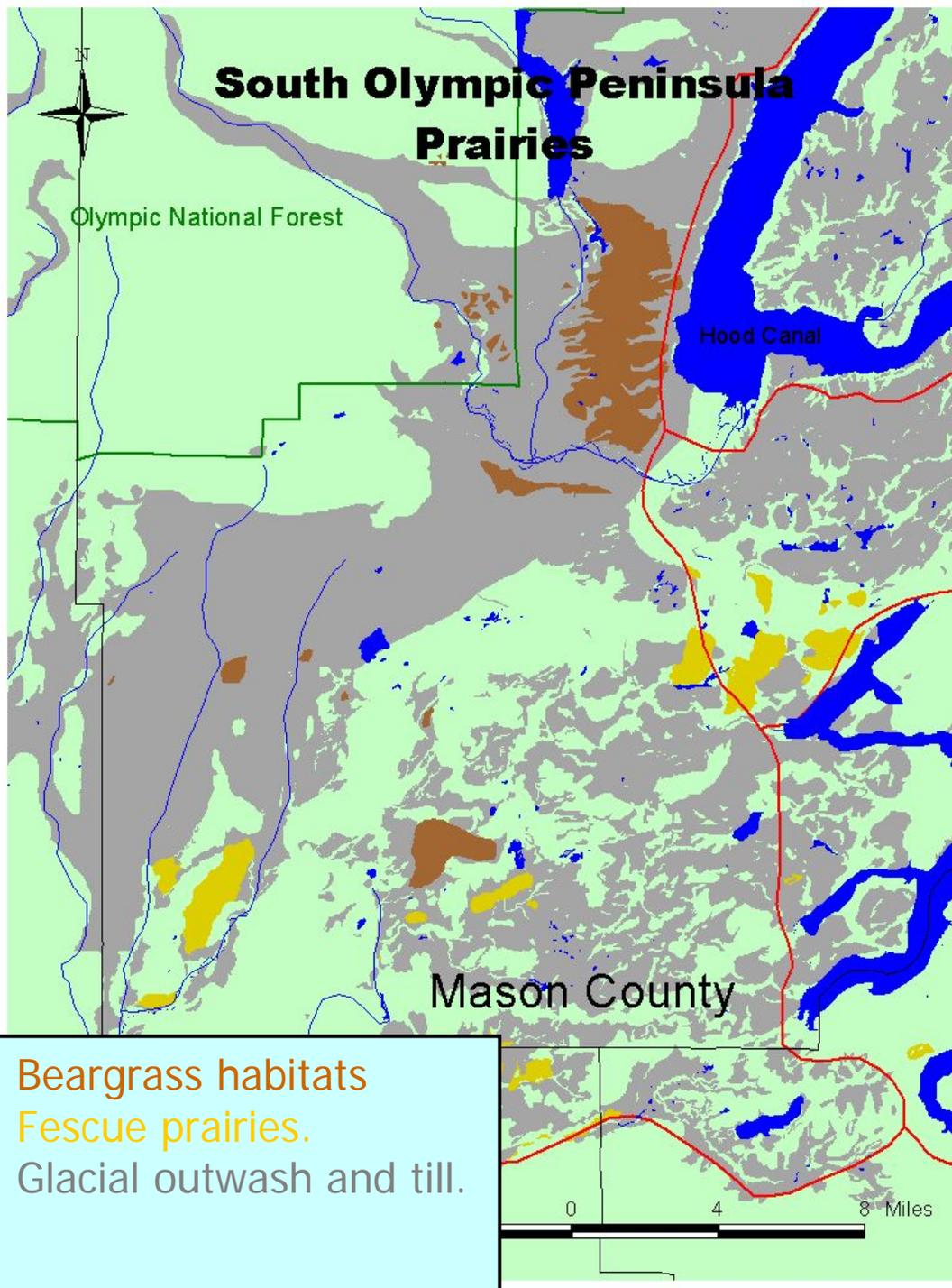
- ▶ Southeastern Olympic Peninsula.
- ▶ Savannas had <30% tree cover. (Prairies did not have scattered trees).
- ▶ The dominant vegetation was low growing.



Pre-European and Present Prairie and Savanna Distribution

- ▶ Originally ~150,000 acres.
- ▶ Now ~20,300 acres.
- ▶ ~3000 acres with native vegetation.





Pre-European contact:
A network of prairies and savannas were scattered throughout the forests.

Beargrass habitats in areas of higher precipitation than fescue prairies.

Now...



Beargrass habitats
Fescue prairies.
Glacial outwash and till.

Evidence for Savannas in the Southeastern Peninsula:

- ▶ Aerial photographs from 1929.*
- ▶ Oral accounts of the Skokomish people.*
- ▶ Historic documents of anthropogenic burning and/or prairies.*
- ▶ Evidence for a greater than natural fire frequency.
- ▶ Evidence against a prairie climax potential.
- ▶ Tree establishment and fire history: cores and stump slabs.
- ▶ Current forest conditions.

1929 Aerial Photographs



George N. Jones (1936)

► "In several places on the Olympic Peninsula these outwash plains appear as areas of small, dry... 'prairies'... As a cause of these prairies it is said that the Indians prevented the growth of trees by burning the ground over annually."

► Noticed prairies in Mason County with beargrass: "But most surprising of all is the pine lily *Xerophyllum tenax*..."

Oral Accounts of Skokomish People



Michael Pavel: “This prairie area was extremely important to the wellbeing of...the Skokomish people...”

Bruce Miller: “...prairies were part of our commitment to our ancestors to maintain grazing grounds for elk and deer”.



Duwamish et al. v. USA, 1927-1930:

Q: Was there any prairie land in the Skokomish country?

A: Yes, we own a little...prairie.

Experimental Approach: XETE's Response to Fire



Research Questions



What is the Relationship Between Beargrass and Fire?

- Does beargrass vegetatively respond to fire?
- If XETE does respond vegetatively to fire, is this response due to the absence of competing vegetation and/or the effect of fire as a stimulus?
- Is XETE seedling establishment greater in plots that have been burned than in plots that have not been burned?
- Is seed germination affected by smoke-water and ash?

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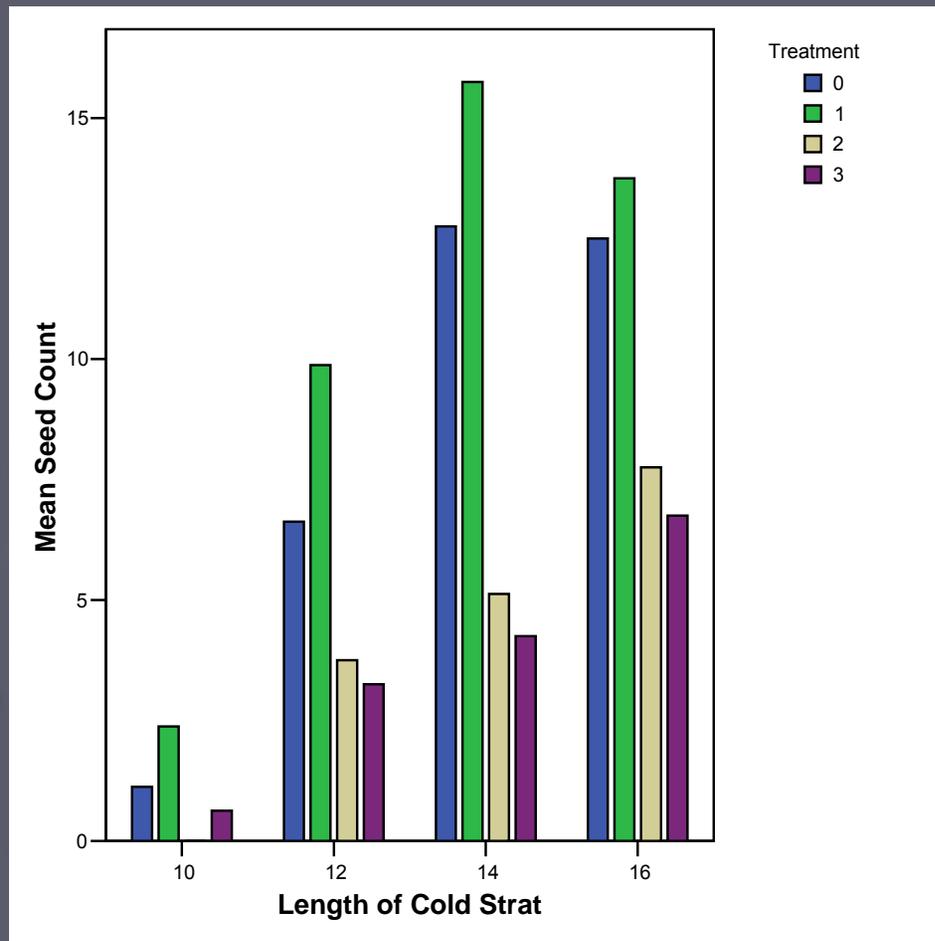
Effects of Fire on Beargrass Seed Germination

► Greenhouse Experiment:

- 4 preliminary treatments with low elevation seeds: Smoke-water vs. water (control) ash vs. control
- Then exposed to 5 different lengths in cold stratification (8, 10, 12, 14, 16 weeks).
- 4 replications of 50 seeds.



Effects of Fire on Beargrass Seed Germination: Results



Water

Smoke-Water

Control

Ash

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Effects of High-intensity Burn on Beargrass Reproduction and Growth

- ▶ Two field experiments: veg and seed.
- ▶ Low-elevation (660ft) in O.N.F.
- ▶ Air photos from 1929 show savanna.
- ▶ Thought to be savanna until ~1850.
- ▶ Part of a larger (33 acre) savanna restoration project initiated in 1995.
- ▶ In 2001, thinned.
- ▶ On September 30, 2003, burned



Response of XETE to High-intensity Burn

Vegetative Response:

- ▶ 10 plots: 5 burn, 5 cont
- ▶ Plot size: 5 m x 5 m
- ▶ Data recorded:
 - % cover of each species
 - Map drawn of XETE

Seedling Establishment

- 6 plots: 3 burn, 3 cont
- ▶ Plot size: 3m x 3m
- ▶ ~840 seeds/plot







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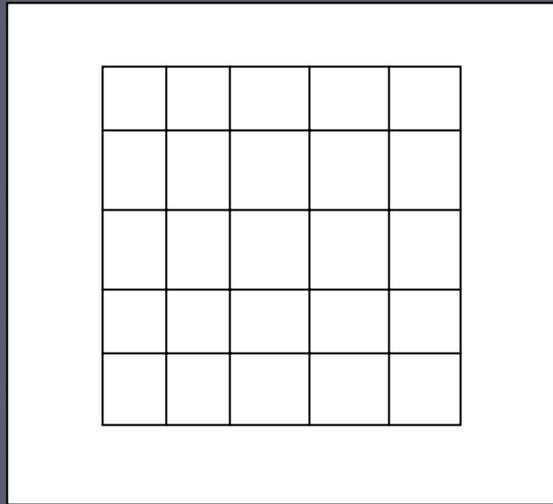
Low-intensity Fire's Effects on Beargrass



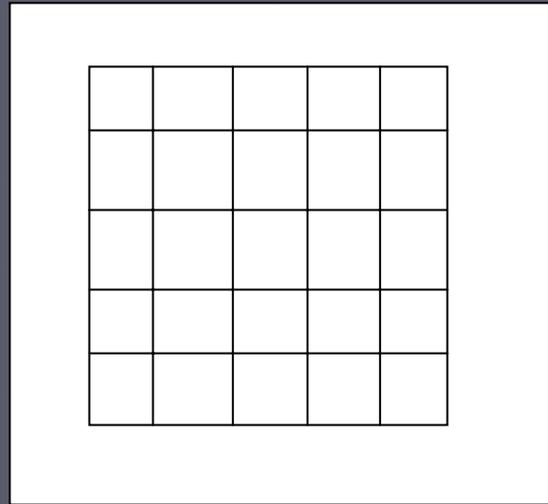
- ▶ Plot burns, September 2004
- ▶ 2 sites: Quinault Reservation and ONF
- ▶ 3 treatments:
 - ▶ Burn
 - ▶ Vegetation manually cleared
 - ▶ Control
- ▶ Vegetative plots 5m x 5m with a 1.5m buffer
- ▶ Seedling plots are 1.5m diameter circular plots.

Follow-up Experiment: Burn, Competition Removal, Control

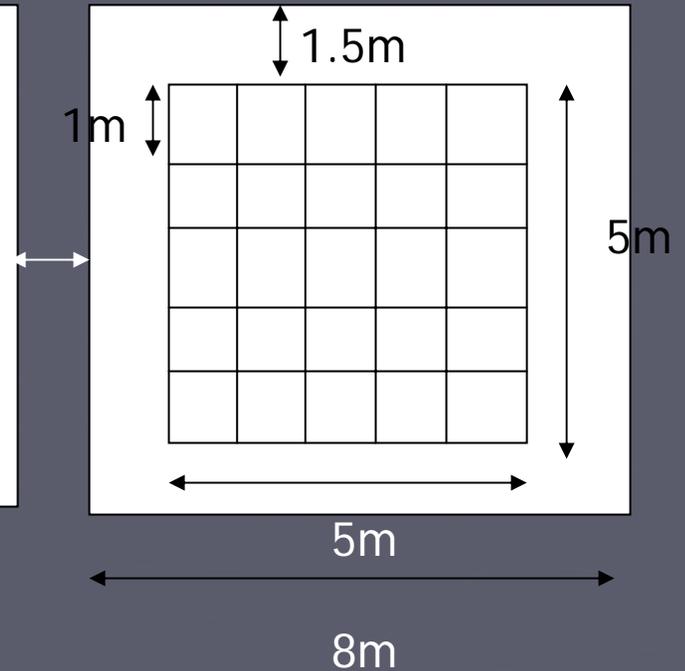
Burn



Manual Veg. Removal

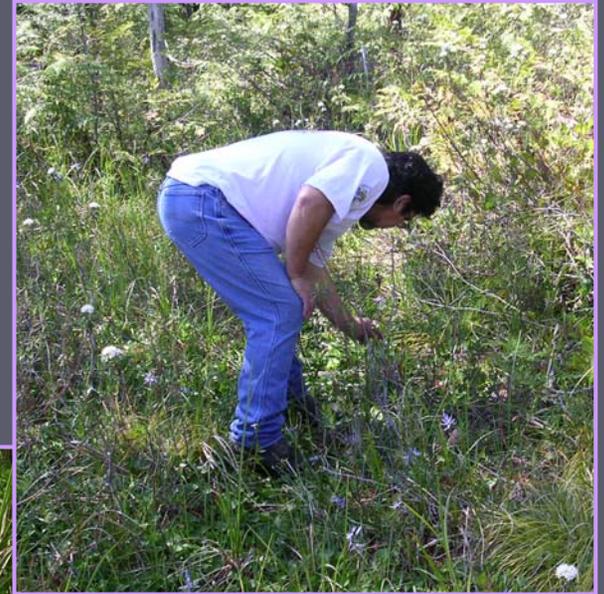


Control



The Quinault Site

- ▶ Sea level
- ▶ Dry sphagnum bog
- ▶ Unique assemblage of plants, incl. *Cammasia quamash*



Quinault Site

- ▶ Historically a Quinault migratory route.
- ▶ Anthropogenic burning ceased ~150 ybp → succession.
- ▶ Area clear-cut 5 ybp
- ▶ Historical ecology study ongoing.



The Two Field Sites: Will XETE Respond Similarly in Both Sites?



Quinault Plots

Lots of slash – Clear-cut

No canopy cover

Wetter environment



ONF Plots

Some slash - Thinned

~30% canopy cover

Dry forest

Vegetative Plots

- ▶ 5m x 5m plots divided into 25 quadrats.
- ▶ Pre-treatment data recorded.
- ▶ 5 random XETE/plot measured and marked
- ▶ Treatments conducted by QIN and ONF fire crews.
- ▶ 1-year data were taken fall, 2005.



1st attempt to record 2005 data: June



8 months pregnant and few
plants are growing – ARGH!!!



2nd Attempt to Record Data September, 2005



Quinault and Forest Service Sites- Very Different Results



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Conclusion

- ▶ Researching the landscape to restore its historical condition offers an opportunity to unite knowledge bases.
- ▶ Beargrass habitat on the Peninsula as a case study.
- ▶ The relationship between beargrass and fire are explored.
- ▶ Separate studies test the theory that beargrass and savannas can be maintained through fire.

Conclusion, cont.

- ▶ Cultural implications.
- ▶ Ecological implications.
- ▶ This project lays the foundation for and initiates an habitat restoration effort on the Peninsula which involves tribes, ONF, and UW.



A photograph of a forest fire. A large, dark plume of smoke rises from a line of trees in the foreground, filling much of the sky. The sky is filled with white and grey clouds, and the overall scene is dramatic and somewhat somber.

"Such a project can span generations as well as cultures and it affords a unique opportunity to investigate, monitor and adaptively manage natural resource landscapes."

Keith Dublanica, Director, Skokomish Natural Resources

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