Effects of English Holly on Native Plant Species in St. Edward State Park

ELLIOTT CHURCH
& DR. DAVID STOKES

A Nightmare Before Christmas (Tim Burton)

Meeting The Challenge: Preventing, Detecting, and Controlling Invasive Plants
UW Botanical Gardens | September 17th 2014
Outline

• Research need
• Methods
• Results
• Some discussion
Research need

- English holly
  \textit{(Ilex aquifolium)}
  - Evergreen shrub/tree
  - Shade tolerant
  - Native in British Isles through southern Europe

King County 2014
Research need

• Holly is spreading in western Washington forests
• Reports of negative impacts
• Has potential to radically impact forests

But...

• Little information available regarding its effects on natives
Hypotheses

1. Native vegetation abundance and diversity are reduced under holly
Hypotheses

1. Native vegetation abundance and diversity are reduced under holly

2. Holly shade and litter fall are mechanisms contributing to suppression
Methods

- Sampled native Woody and evergreen Vegetation

- Sampling method designed to
  - Compare outside vs. under holly canopy
  - Differentiate between shade and litter effects

![Diagram of 1m² quadrat with North, South, East, and West directions and 360° angle marker.]

**Figure 1:** Sampling method.

- Treatments
  - Shade (S)
  - Litter (L)
  - Shade + Litter (S+L)
  - None (N)
Methods

• Sampled native Woody and evergreen Vegetation

• Measured percent cover for each species in quadrat

• Summed to get total cover for quadrat

Figure 1: Sampling method.
Treatments
Shade (S)
Litter (L)
Shade + Litter (S+L)
None (N)
Results

• Species
  – 19 native woody and evergreen species
  – Three most common (# plots present):
    • *Gaultheria shallon* (salal)
    • *Rubus ursinus* (trailing blackberry)
    • *Polystichum munitum* (sword fern)
Results

Looking at under vs. outside holly canopies

Average of two quadrats
Results

Total cover - Under vs. outside holly canopies

Mean difference: 60.125
P < .000 (paired t-test)

31.63 ± 17.55
91.75 ± 35.82
Results

Total cover - Under vs. outside holly canopies

<table>
<thead>
<tr>
<th></th>
<th>Mean % Cover</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under</td>
<td>31.63 ± 17.55</td>
<td></td>
</tr>
<tr>
<td>Outside</td>
<td>91.75 ± 35.82</td>
<td></td>
</tr>
</tbody>
</table>

95% confidence interval for difference: 44.72 - 75.53
Results

Total cover - Under vs. outside holly canopies

Native cover underneath holly was 36.60% of native cover outside of holly canopy
Results

Diversity - Under vs. outside holly

Mean difference: 0.33
P < .000 (paired t-test)

↓ 46%
Results

Cover of top 3 species under vs. outside holly

Salal (Gaultheria shallon)  Sword fern (Polystichum munitum)  Trailing blackberry (Rubus ursinus)

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http://www.wnps.org/landscaping/herbarium/pages/gaultheria-shallon.html

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© Heidi Bohan
http://www.wnps.org/landscaping/herbarium/pages/rubus-ursinus.html
Results

Cover of top 3 species under vs. outside holly

Mean salal cover outside vs under holly

- Outside: $33.68 \pm 18.01$
- Under: $11.62 \pm 12.62$

**SIGNIFICANT DIFFERENCE**

Average difference: **23.5 points**

$P=0.00098$, Wilcoxon signed-rank test

$n=17$
Results

Cover of top 3 species under vs. outside holly

Mean trailing blackberry cover outside vs under holly

SIGNIFICANT DIFFERENCE

Average difference: 8.24 points

P=0.001641, Wilcoxon signed-rank test
Results

Cover of top 3 species under vs. outside holly

Mean sword fern cover outside and under holly

DIFERENCE NOT SIGNIFICANT
P=0.1152, Wilcoxon signed-rank test

14.11 ± 14.37

6.25 ± 7.52

outside

n=14

under
Some discussion

• Clear reduction in woody and evergreen native cover under holly
• Suggests holly invasion has capacity to alter
  – biodiversity
  – succession
  – structure
Some discussion

- Difference between response of top 3 species suggests that one possible impact of holly is to alter native vegetation community
Contact

Elliott Church
edd2@uw.edu
MS Student
School of Environmental and Forest Sciences
University of Washington

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