When does natural science uncertainty translate into economic uncertainty? Insights for ecosystem service valuation

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Economic assessments are necessary for justifying the costs of preventing invasive species:
Economic assessments rely on uncertain natural science projections

- lack of data
- measurement errors
- variable spread rates
Partial Equilibrium Theory

Price of Good 1

\[ S_2 = S_F \]

\[ P_F \]

\[ P_1 \]

\[ Q_F \]

\[ Q_1 \]

Quantity of Good 1

Price of Good 2

\[ P_1 = P_F \]

\[ Q_1 = Q_F \]

Quantity of Good 2
General Equilibrium Theory

Price of Good 1

Price of Good 2

Quantity of Good 1

Quantity of Good 2
**Infesting other trees**
- white fringetree or “old man's beard”

**Limited management**
- quarantines
- random monitoring of firewood
- ash removal around effected areas
- SLAM

**Weather**
- 98% of larvae die at -30F

**Uncertain EAB Infestation**
- “If you have an Ash tree, eventually these beetles are going to find it.”
- Texas A&M entomologist
- EAB spread is slowing?
Magnitude of Impacts
Simulations in GAMS

Variable Impacts
- Small
- Medium
- Large

Two Model Types
- General equilibrium
- Partial equilibrium

Ash Substitutes
- Perfect substitution
- Partial substitution

Markets
- Industry Only
- Industry plus household and state impacts
Industry Only Impacts
Household Impacts

PARTIAL SUBSTITUTION

<table>
<thead>
<tr>
<th>Household</th>
<th>Household Income</th>
<th>Average Income</th>
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<tbody>
<tr>
<td>HHD1</td>
<td>&lt;$10K</td>
<td>$6,342.55</td>
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<tr>
<td>HHD2</td>
<td>$10-$15K</td>
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<td>HHD8</td>
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<td>HHD9</td>
<td>&gt;$150K</td>
<td>$221,989.53</td>
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Applications
Considerations

1. Impacts over time
2. Negative information only
3. “Grayscale” functioning economy
4. Each household treated equally
5. No control mechanisms
Ecosystem service valuation depends on considering natural science and economics simultaneously.
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