Cooperation on pre-invasion assessment of Asian wood borers

Jiri Hulcr
University of Florida
There are lots of invasive insects

Very few were suspected before they showed up
Is there a threat to Florida’s trees on the horizon?

1: Pest reports from overseas
2: Sentinel gardens
3: Beetle-associated pathogens
4: Model and predict risk
5: Communicate priority pests
1: Work with overseas scientists

1) Build trust
1) Work with overseas scientists on their pests

Method 1: Building trust

- Use our expertise
- Some funding
- Shared publications
- Local help
- More friends
- Pest reports
1) Build trust
   1. Work with overseas scientists

2) Inform: www.AianForestHealth.org
1: Work with overseas scientists

1) Build trust
2) Inform
3) Social networks across Asia

- LinkedIn - 361 members
- WeChat - 339 members
- Twitter - 258 members
1: Work with overseas scientists

1) Build trust
2) Inform
3) Social networks
4) Conferences
1: Work with overseas scientists

1) Build trust
2) Inform
3) Social networks
4) Conferences
5) Free collecting kits
1: Work with overseas scientists

1) Build trust
2) Inform
3) Social networks
4) Conferences
5) Free collecting kits

Results: reports of aggressive beetles
YouTube Clip: Predicting Future Invasive Pests
Several exceptional beetle and fungus species can kill living trees.

Colleagues overseas can report them.
2. Sentinel gardens

Borers attracted to live trees
All wood borer taxa
Key commodities
2. Sentinel gardens

Borers attracted to live trees
Not dead-wood borers

All wood borer taxa
Scolytinae, Buprestidae, Cerambycidae...

Key commodities
pines, oaks, avocado, citrus, sweetgum, commercial nut trees, etc.
### 2. Sentinel gardens

<table>
<thead>
<tr>
<th>Site</th>
<th>Species</th>
<th>Incidences</th>
<th>Tree</th>
<th>Tree Condition</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shuyang</td>
<td><em>Anoplophora chinensis</em></td>
<td>1 Citrus</td>
<td>Good</td>
<td>Reproducing</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td><em>Anoplophora chinensis</em></td>
<td>1 Oak</td>
<td>Good</td>
<td>Ovipositing</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cryphalini</td>
<td>1 Oak</td>
<td>Poor</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td>borer</td>
<td>1 Oak</td>
<td>Good</td>
<td>Boring</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td><em>Hypothenemus</em> sp.</td>
<td>1 Citrus</td>
<td>Poor</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td><em>Euwallacea</em> sp.</td>
<td>1 Citrus</td>
<td>Poor</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>2 Citrus</td>
<td>Good</td>
<td>Boring</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>1 Pine</td>
<td>Poor</td>
<td>Boring</td>
<td></td>
</tr>
<tr>
<td>Shuyang</td>
<td>Buprestidae</td>
<td>1 Pine</td>
<td>Poor</td>
<td>Boring</td>
<td></td>
</tr>
<tr>
<td>Kunming</td>
<td><em>Anoplophora chinensis</em></td>
<td>1 Citrus</td>
<td>Good</td>
<td>Feeding</td>
<td></td>
</tr>
<tr>
<td>Kunming</td>
<td>Bostrichidae</td>
<td>1 Pine</td>
<td>Good</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Kunming</td>
<td><em>Cryphalus lipingensis</em></td>
<td>7 Pine</td>
<td>Various</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Kunming</td>
<td><em>Hyledius kesyiae</em></td>
<td>6 Pine</td>
<td>Various</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Culai</td>
<td><em>Cryphalus piceus</em></td>
<td>9 Pine</td>
<td>Good</td>
<td>Gallery</td>
<td></td>
</tr>
<tr>
<td>Culai</td>
<td>Cerambycidae</td>
<td>1 Oak</td>
<td>Good</td>
<td>Feeding</td>
<td></td>
</tr>
</tbody>
</table>
## 2. Sentinel gardens

<table>
<thead>
<tr>
<th>Site</th>
<th>Species</th>
<th>Incidences</th>
<th>Tree</th>
<th>Tree Condition</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shuyang</td>
<td>Anoplophora chinensis</td>
<td>1 Citrus</td>
<td>Oak</td>
<td>Good</td>
<td>Reproducing</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Anoplophora chinensis</td>
<td>1 Oak</td>
<td>Oak</td>
<td>Good</td>
<td>Ovipositing</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cryphalini</td>
<td>1 Oak</td>
<td>Oak</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>borer</td>
<td>1 Citrus</td>
<td>Citrus</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Hypothenemus sp.</td>
<td>1 Citrus</td>
<td>Citrus</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Euwallacea sp.</td>
<td>1 Citrus</td>
<td>Citrus</td>
<td>Good</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>2 Citrus</td>
<td>Pine</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>1 Pine</td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Buprestidae</td>
<td>1 Citrus</td>
<td>Pine</td>
<td>Good</td>
<td>Feeding</td>
</tr>
<tr>
<td>Kunming</td>
<td>Anoplophora chinensis</td>
<td>1 Pine</td>
<td>Pine</td>
<td>Good</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td>Bostrichidae</td>
<td>7 Pine</td>
<td>Pine</td>
<td>Various</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td>Cryphalus lipingensis</td>
<td>6 Pine</td>
<td>Pine</td>
<td>Various</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td>Hyledius kesyiae</td>
<td>9 Pine</td>
<td>Pine</td>
<td>Good</td>
<td>Gallery</td>
</tr>
<tr>
<td>Culai</td>
<td>Cryphalus piceus</td>
<td>1 Oak</td>
<td>Oak</td>
<td>Good</td>
<td>Feeding</td>
</tr>
<tr>
<td>Culai</td>
<td>Cerambycidae</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 2. Sentinel gardens

<table>
<thead>
<tr>
<th>Site</th>
<th>Species</th>
<th>Incidences</th>
<th>Tree</th>
<th>Tree Condition</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shuyang</td>
<td><em>Anoplophora chinensis</em></td>
<td>1 Citrus</td>
<td>Oak</td>
<td>Good</td>
<td>Reproducing</td>
</tr>
<tr>
<td>Shuyang</td>
<td><em>Anoplophora chinensis</em></td>
<td>1 Oak</td>
<td>Oak</td>
<td>Good</td>
<td>Ovipositing</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cryphalini</td>
<td>1 Oak</td>
<td>Oak</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cryphalini</td>
<td>1 Oak</td>
<td>Oak</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td><em>Hypothenemus</em> sp.</td>
<td>1 Citrus</td>
<td>Oak</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td><em>Euwallacea</em> sp.</td>
<td>1 Citrus</td>
<td>Oak</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>2 Citrus</td>
<td>Oak</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>1 Pine</td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>1 Pine</td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Buprestidae</td>
<td>1 Citrus</td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Kunming</td>
<td><em>Anoplophora chinensis</em></td>
<td>1 Pine</td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Kunming</td>
<td>Bostrichidae</td>
<td>7 Pine</td>
<td>Pine</td>
<td>Various</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td><em>Cryphalus lipingensis</em></td>
<td>6 Pine</td>
<td>Pine</td>
<td>Various</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td><em>Hyledius kesyiae</em></td>
<td>9 Pine</td>
<td>Pine</td>
<td>Good</td>
<td>Gallery</td>
</tr>
<tr>
<td>Culai</td>
<td><em>Cryphalus piceus</em></td>
<td>1 Oak</td>
<td>Oak</td>
<td>Good</td>
<td>Feeding</td>
</tr>
<tr>
<td>Culai</td>
<td>Cerambycidae</td>
<td>1 Oak</td>
<td>Oak</td>
<td>Good</td>
<td>Feeding</td>
</tr>
</tbody>
</table>
## 2. Sentinel gardens

<table>
<thead>
<tr>
<th>Site</th>
<th>Species</th>
<th>Incidences</th>
<th>Tree</th>
<th>Tree Condition</th>
<th>Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shuyang</td>
<td>Anoplophora chinensis</td>
<td>1</td>
<td>Citrus</td>
<td>Good</td>
<td>Reproducing</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Anoplophora chinensis</td>
<td>1</td>
<td>Oak</td>
<td>Good</td>
<td>Ovipositing</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cryphalini</td>
<td>1</td>
<td>Oak</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>borer</td>
<td>1</td>
<td>Oak</td>
<td>Good</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Hypothenemus sp.</td>
<td>1</td>
<td>Citrus</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Euwallacea sp.</td>
<td>1</td>
<td>Citrus</td>
<td>Poor</td>
<td>Gallery</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>2</td>
<td>Citrus</td>
<td>Good</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Cerambycidae</td>
<td>1</td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Shuyang</td>
<td>Buprestidae</td>
<td></td>
<td>Pine</td>
<td>Poor</td>
<td>Boring</td>
</tr>
<tr>
<td>Kunming</td>
<td>Anoplophora chinensis</td>
<td>1</td>
<td>Pine</td>
<td>Poor</td>
<td>Feeding</td>
</tr>
<tr>
<td>Kunming</td>
<td>Bostrichidae</td>
<td>1</td>
<td>Pine</td>
<td>Good</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td>Cryphalus lipingensis</td>
<td>7</td>
<td>Pine</td>
<td>Various</td>
<td>Gallery</td>
</tr>
<tr>
<td>Kunming</td>
<td>Hyledius kesyiæ</td>
<td>6</td>
<td>Pine</td>
<td>Various</td>
<td>Gallery</td>
</tr>
<tr>
<td>Culai</td>
<td>Cryphalus piceus</td>
<td>9</td>
<td>Pine</td>
<td>Good</td>
<td>Gallery</td>
</tr>
<tr>
<td>Culai</td>
<td>Cerambycidae</td>
<td>1</td>
<td>Oak</td>
<td>Good</td>
<td>Feeding</td>
</tr>
</tbody>
</table>
3. Institutions and individuals providing beetle-associated fungi
3. Institutions and individuals providing beetle-associated fungi

Collect exotic ambrosia beetles

Grow the fungi

Inoculate into American pines or oaks

Or get strains from colleagues overseas.
3. Institutions and individuals providing beetle-associated fungi

5 years of work
111 fungal strains inoculated
1) harmless fungi: 99
2) mild pathogens causing lesions: 12
3) tree-killing pathogens: NONE
4. Risk analysis
4. Risk analysis

Objective Prioritization Exotic Pests (OPEP) model

54 variables

---

Probability of impact uncertainty simulation

- Low: < 0.34
- Moderate: 0.34 - 2.56
- High: ≥ 2.56

<table>
<thead>
<tr>
<th>Impact Level</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.99</td>
<td>Mitigated Score: -1.068449</td>
</tr>
<tr>
<td>0.94</td>
<td>Mitigated Score: -1.068449</td>
</tr>
<tr>
<td>0.14</td>
<td>Unmitigated Score: 0.26711225</td>
</tr>
</tbody>
</table>

---

54 variables

---

Table with columns labeled A through P, showing data entries and calculations.
4. Risk analysis
Objective Prioritization Exotic Pests (OPEP) model

Decision-support for action against new invasives
5. Communicating risk to partner agencies
5. Communicating risk to partner agencies
Partnerships

It’s not less work. It’s MORE work.
Expect to do 95% of the work in each partnership.
Partners are enablers, but YOU have to go and catch the bugs.
But partnerships enable feats that are impossible alone.