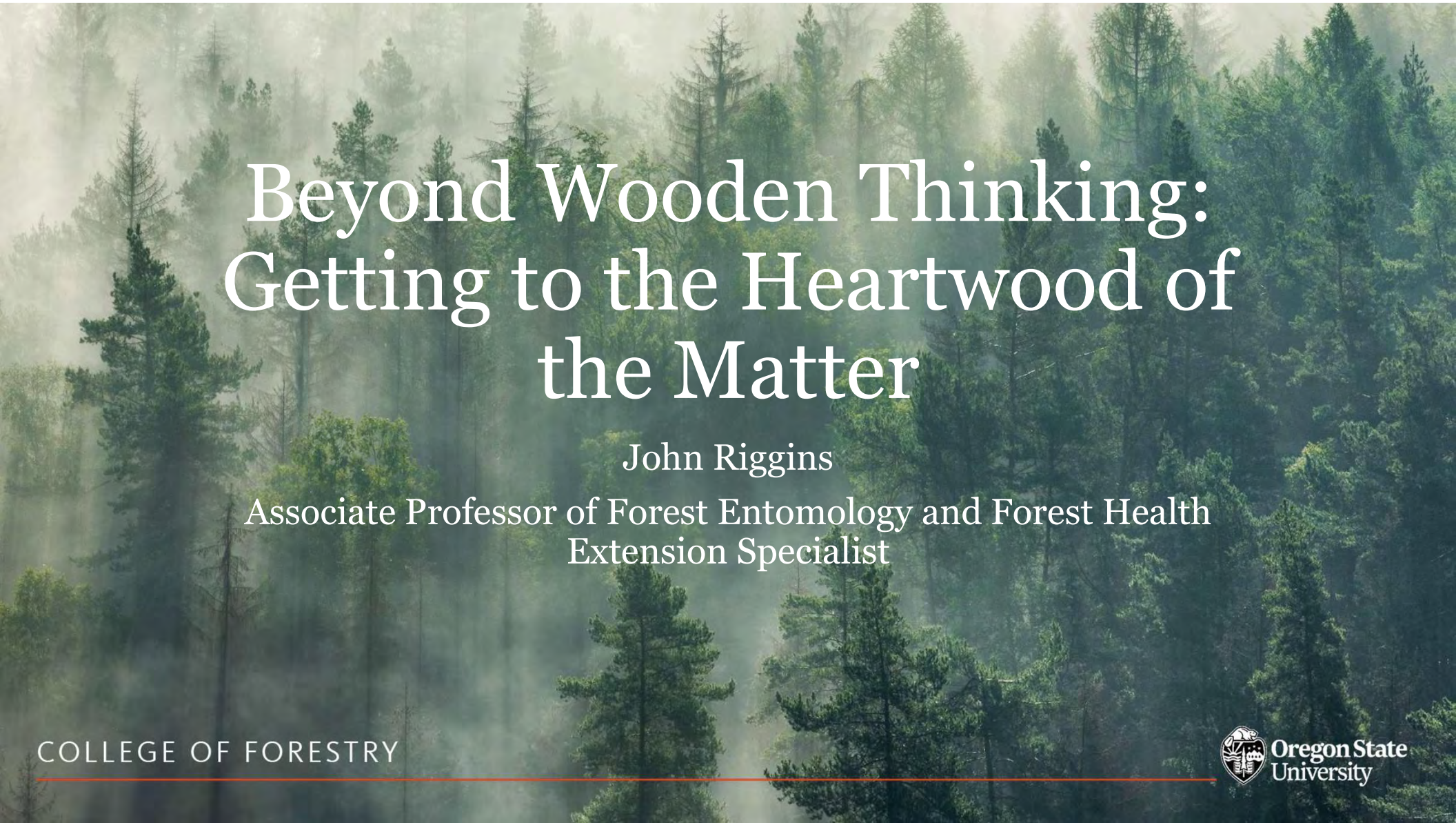


Beyond Wooden Thinking: Getting to the Heartwood of the Matter

John Riggins

Associate Professor of Forest Entomology and Forest Health
Extension Specialist

COLLEGE OF FORESTRY

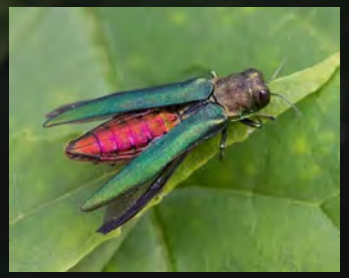
Oregon State University

The Growing Threat of Invasive Pests

- USA
  - >450 tree-infesting species
  - ~ 2-3 ambrosia beetles / year
  - >$4.5B in damages / year Aukema et al. (2010)
- Oregon
  - ~10 new non-native insects / year
  - ~30 new woodborers since 2007

The Growing Threat of Invasive Pests

- Well-known examples
  - EAB
  - ALB
  - RAB/LWD



After Establishment

COLLEGE OF FORESTRY

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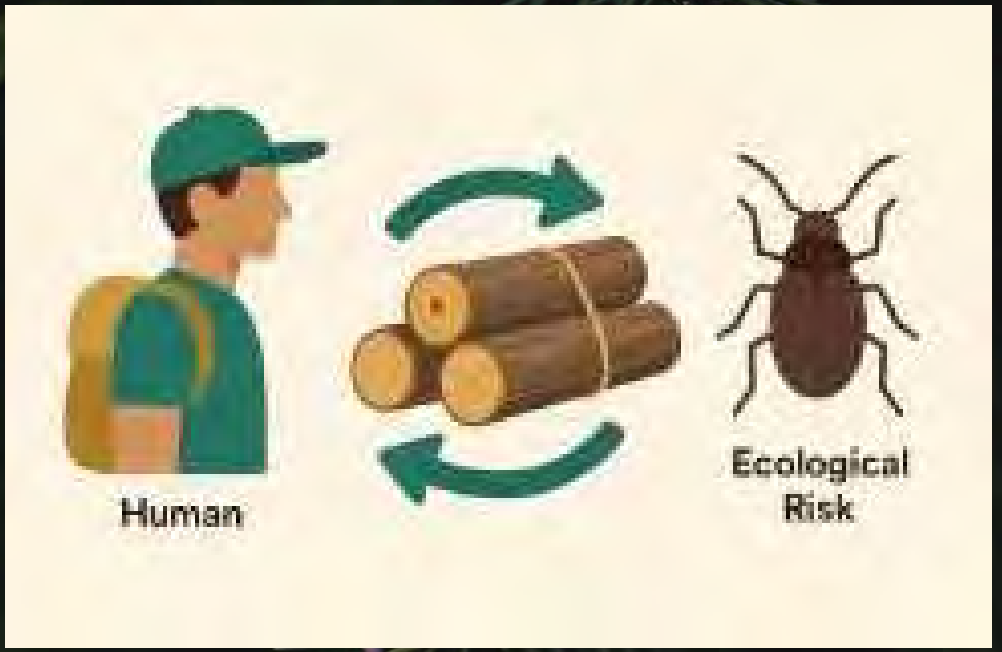
Bridging Behavior and Biology

- Pest spread is driven by both human behavior and insect biology
- Past studies focused on one or the other
- This study connects camper choices with firewood's ecological risk



Connecting Human Actions and Ecological Risk

- Objective 1: Quantify how firewood's physical properties—like moisture and provenance—contribute to the presence of insects.

- Objective 2: Investigate how campers' knowledge and attitudes influence their actions regarding firewood.

Biol Invasions (2025) 27:51
https://doi.org/10.1007/s10530-024-03518-9

ORIGINAL PAPER

Burning questions: how human behaviors and firewood characteristics influence the transport of wood-boring insects

Davide Nardi · Costanza Geppert · Matthew J. Thorn · Samuel F. Ward · Richard L. Brown · Jason S. Gordon · John J. Riggins

Surveying Campers

- Four Mississippi state parks (two in the north, two in the south).

- 170 campers
  - demographics
  - where they obtained their firewood
  - how far they traveled
  - knowledge of pests
  - attitude toward the problem

Firewood Inspection and Rearing

- Campers exchanged firewood
- We split ~50% and reared the rest for emergence
- Recorded wood species, moisture and provenance
- Linked findings to survey responses

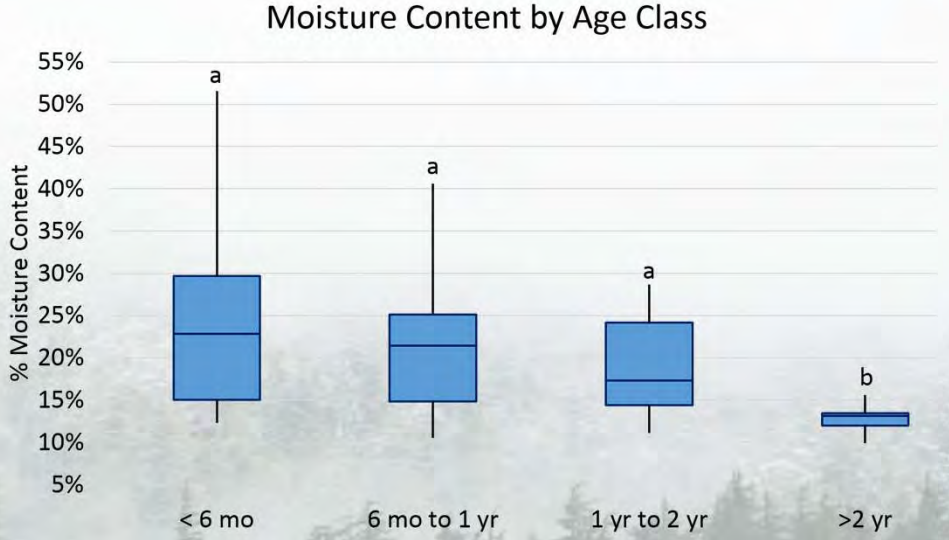
Who Moves Firewood?

- 36% of campers brought firewood
  - 79% oak; 13 tree genera
- Avg. transport: 92 km (57 mi)
- 67% brought from home
- 57% cut it themselves
- 44% cut from unhealthy trees

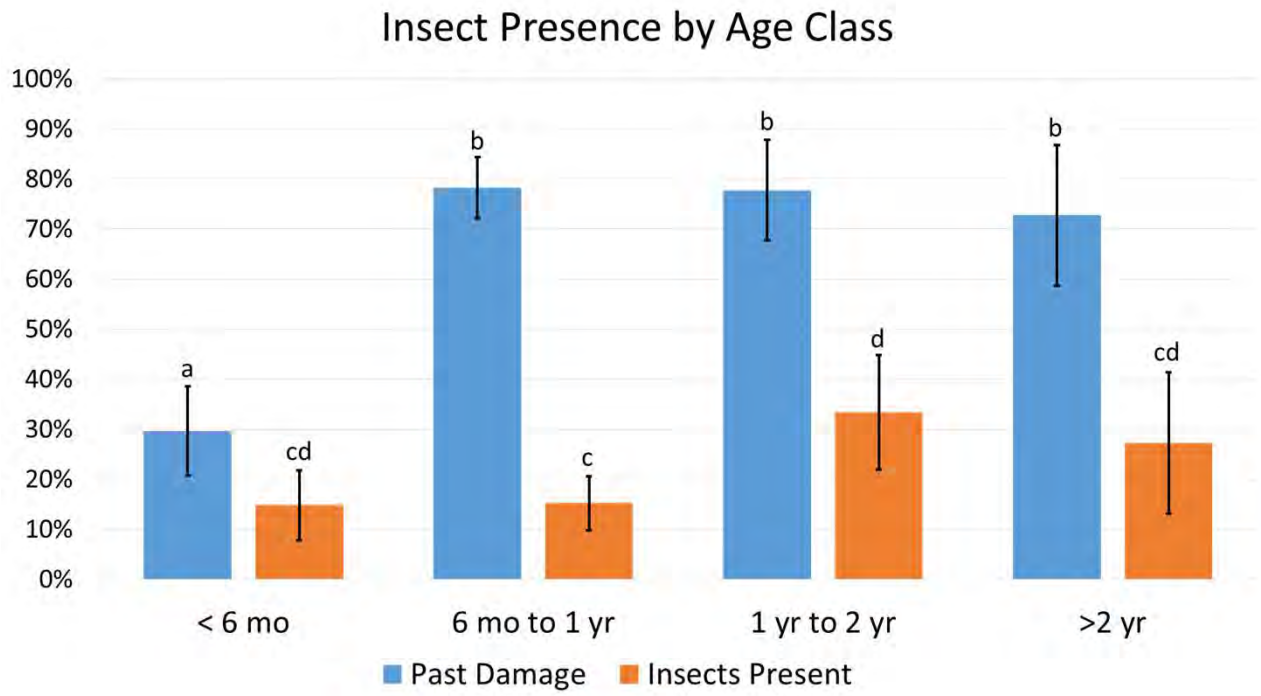
Who Moves Firewood?

- Older campers more likely to buy firewood
- Most unaware of regulations (66%) and campaigns (78%)
- Frequent transport: 40% >3x/year, 31% 2–3x/year

What Were the Firewood Characteristics?



What Were the Firewood Characteristics?



What Were the Contents of the Firewood?

- 21% of the dissected logs brought by campers contained living insects.
- From the reared logs, we collected nearly 500 insects.
- We found no invasive spp.

What Makes Wood High-Risk?

- Moisture content: wetter logs = more live insects
- Source: cut/non-commercial wood = more moisture & insects
- Commercial wood = less risk

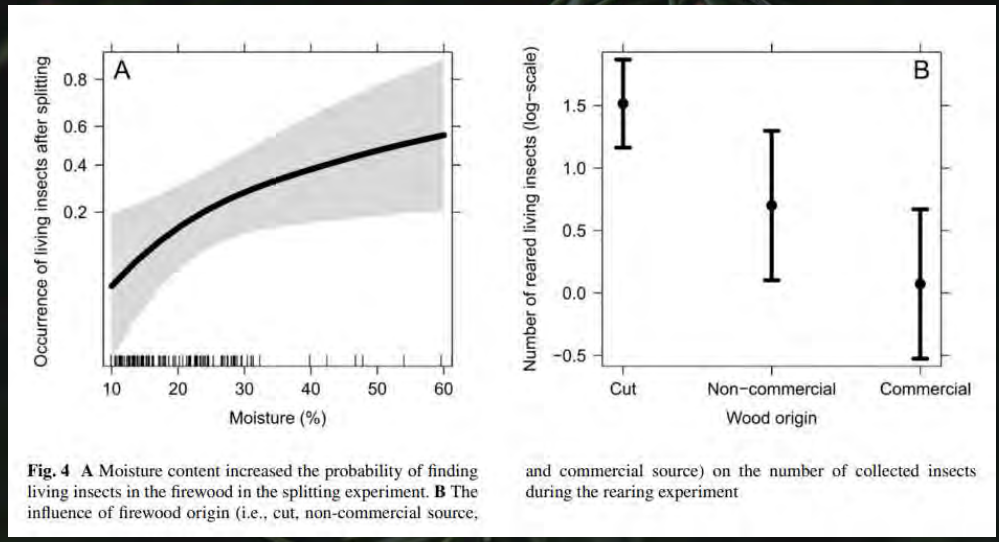
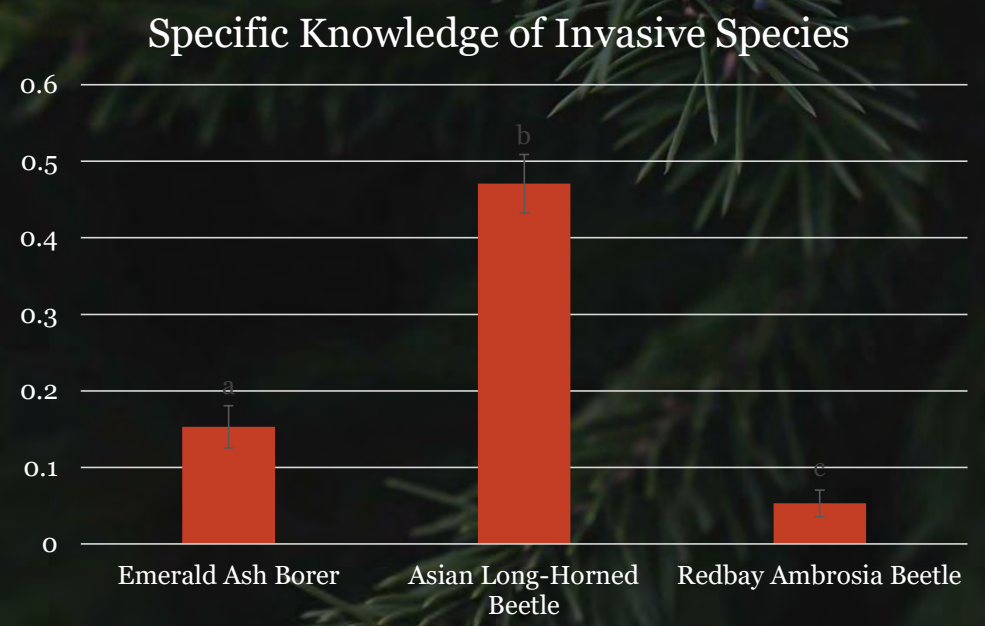


Fig. 4 **A** Moisture content increased the probability of finding living insects in the firewood in the splitting experiment. **B** The influence of firewood origin (i.e., cut, non-commercial source, and commercial source) on the number of collected insects during the rearing experiment

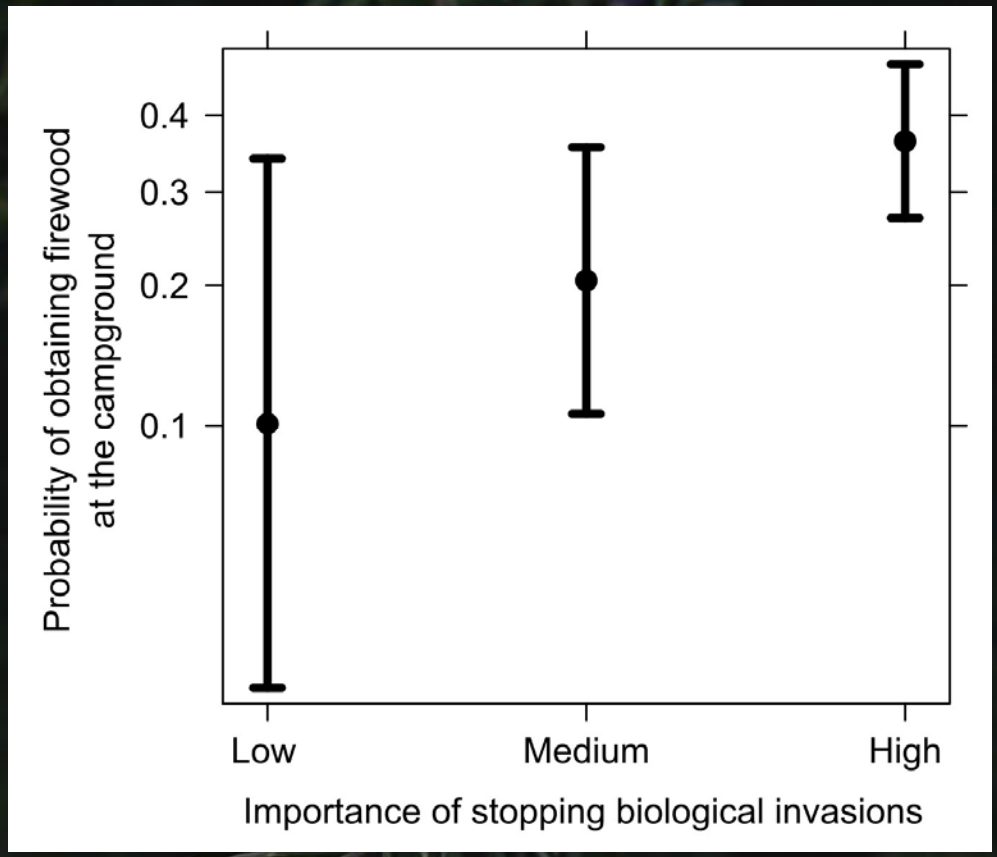
What Were the Drivers of Human Firewood Movement?

- Camper lack of general awareness:
  - 78% unaware of “Don’t Move Firewood” message
  - 66% not aware some destinations regulate firewood movement



Attitude Drives Action

- General knowledge about the problem and awareness of specific pests did not influence their behavior.
- A camper's **attitude** toward stopping invasive species was the **most important factor** in their decision to buy wood locally.



Bridging the “Knowing-Doing Gap”

- Experiential learning influences behaviors more than knowledge acquisition
- Improve learning outcomes
- Make learning more accessible
- Simulate experiences

Hulme, Philip E. 2014. “EDITORIAL: Bridging the Knowing–Doing Gap: Know-Who, Know-What, Know-Why, Know-How and Know-When.” *Journal of Applied Ecology* 51 (5): 1131–36. https://doi.org/10.1111/1365-2664.12321.

Beyond Awareness: A New Approach

- Current awareness campaigns are a good starting point, but they are not enough to change behavior.
- We need to shift from simply providing facts to impacting people's attitudes through more emotional and personal messaging.
- Suggestion: Use different pedagogical approaches to enhance learning outcomes.
  - Gamification, Experiential Learning

Gamification

- Geocaching
  - Digital “treasure hunt”

The Journal of Extension

Volume 59 | Number 3 Article 16

9-16-2021

Geocaching: A New Instructional Tool for Natural Resources Extension and Outreach

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Gamification

- Geocaching
  - Digital “treasure hunt”

Extension Geocaching

Table 2. Geocache and Travel Bug User Comment Examples

Outreach source	User comments
Geocaches	“Beautiful here!!! Traded TBs and on our way. A perfect example of why I love geocaching!”
	“TFTC! Very informative and fun find while camping.”
Travel bugs	“We recently did a construction project near Mississippi State and enjoyed our stay there very much! Such friendly folks. This TB surely does tell a sobering tale. I will make an effort to be careful. Thanks for sharing.”
	“Grabbed alby from the TB hotel and will assist in spreading awareness.”
	“I hate you ash borer.”

Note. TB = Travel Bug; TFTC = Thanks For The Cache.

Gamification

- iNaturalist
  - Forest insect and pathogen projects
    - Increase learner interest in subject matter
    - Added Benefit: Citizen science

Received: 31 October 2021 | Accepted: 4 March 2022
DOI: 10.1002/nse2.20081

Natural Sciences Education

ORIGINAL RESEARCH ARTICLE

Undergraduate Education

There's an app for that: Teaching entomology in the online age

Angela Mech[1] | Derek Rosenberger[2] | Philip Fanning[1] | John J. Riggins[3] | Brian Aukema[4] | Jess Hartshorn[5]

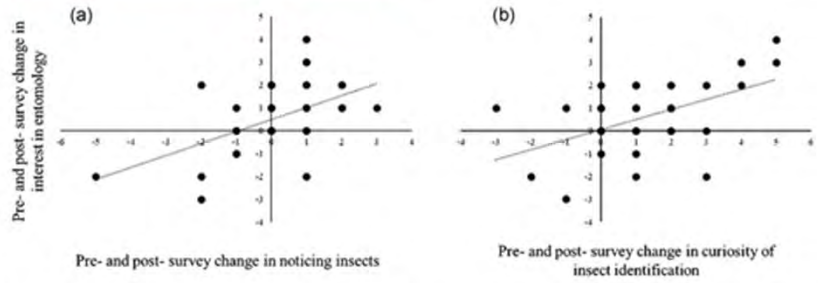

FIGURE 2 Relationship between the change in student responses regarding (a) their interest in entomology after using iNaturalist and their observations of insects ($p < .001$) or (b) their curiosity regarding the identification of insects ($p < .001$). Positive values indicate a positive change (i.e., more agreement with the statement) between pre and post-surveys; negative values indicate less agreement with the statement in the post survey (i.e., after using iNaturalist)

Experiential Learning

- VR headsets?
- Experiential learning influences behaviors more than knowledge acquisition
- Improve learning outcomes
- Make learning more accessible
- Simulate experiences

The Path Forward

- Firewood movement spreads forest pests
- Awareness alone doesn't change behavior
- Combine regulations, safe firewood access, and new communication strategies

Funded By USDA Farm Bill

Questions?

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- **THANK YOU!!**