Integrated Pest Management for Eastern Hardwood Forests
at Swallow Falls State Park

Aubrey Tingler
Megan Massa
MEES 718I

Aubrey Tingler (she/her)
MEES MS Student (2022)
Environment and Society Concentration
UMD College Park Campus

Megan Massa (she/her)
MS Student (2022)
Applied Ecology & Conservation Biology
UMCES Appalachian Lab

With thanks to **Craig Kuhn and Biff Thompson** from the Maryland Department of Agriculture

Northern hardwood forests

Swallow Falls State Park

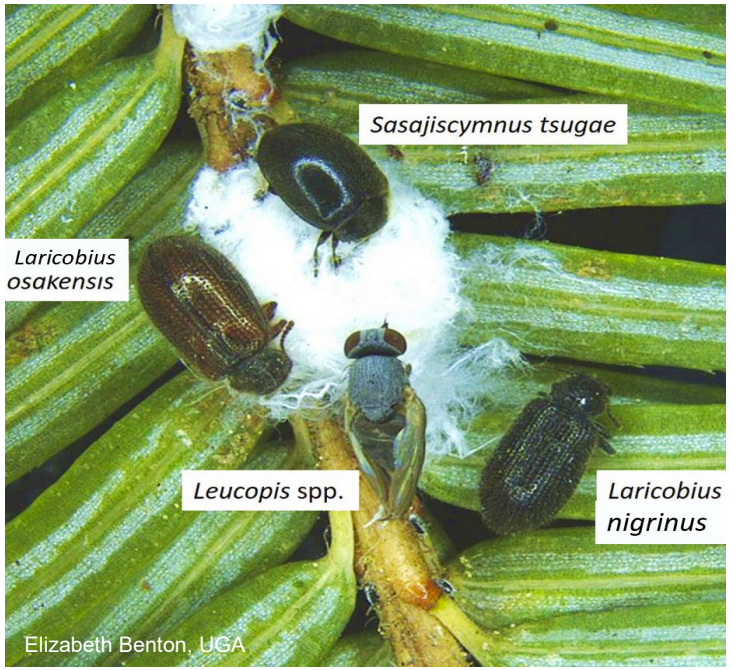
Major invasive species & impacted relevant species of concern

Hemlock woolly adelgid (HWA)
Adelges tsugae
↓
Eastern hemlock
Tsuga canadensis

Emerald ash borer (EAB)
Agrilus planipennus
↓
Ash trees
Fraxinus spp.

Lymantria dispar
↓
Various hardwoods

Management approaches



Management challenges: Unintended consequences

- Imidacloprid runoff detected in streams near HWA treatment (Benton et al. 2016)

- **Non-target impacts:**
  - Death of ground-nesting bees (Fortuin et al. 2021)
  - Bioaccumulation of neonics in many amphibians with sublethal effects (Crayton et al. 2020, Sweeney et al. 2021)
  - *L. dispar* spray kills any lepidopteran caterpillar

Thomas Shahan

Hargle / CC-BY-SA 3.0

Brian Gratwicke / CC-BY 2.0

Management challenges: Unintended consequences

Caution with biocontrol

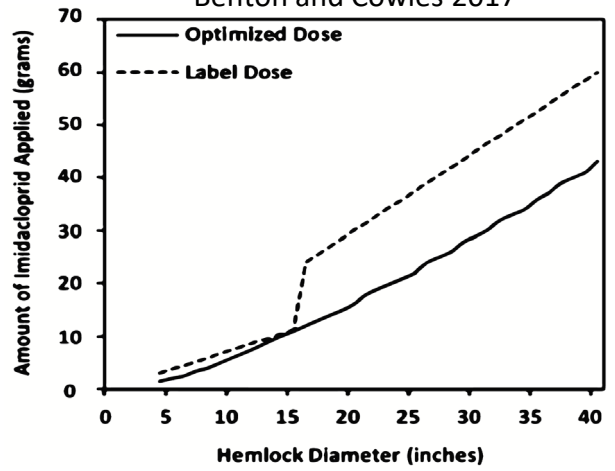
Joyce Gross, BugGuide.net

- **HWA:**
  - Hybridization of *Laricobius nigrinus* with native *Laricobius rubidus* (Mayfield et al. 2015)
- ***L. dispar*:**
  - Introduced parasitic fly also targets natives, including Luna moth and Cecropia silk moth

Management solutions

- Lower volume & less frequent pesticide applications (Mayfield et al. 2015)
- Research lowest viable treatments
  (Cowles 2008, Eisenback 2014, Benton and Cowles 2017)
- Expand biocontrol efforts + monitoring
  (Havill et al. 2010, Jones et al. 2014, Mayfield et al. 2015, Vose et al. 2013)
- Restore ecosystem function by using other species (Vose et al. 2013)

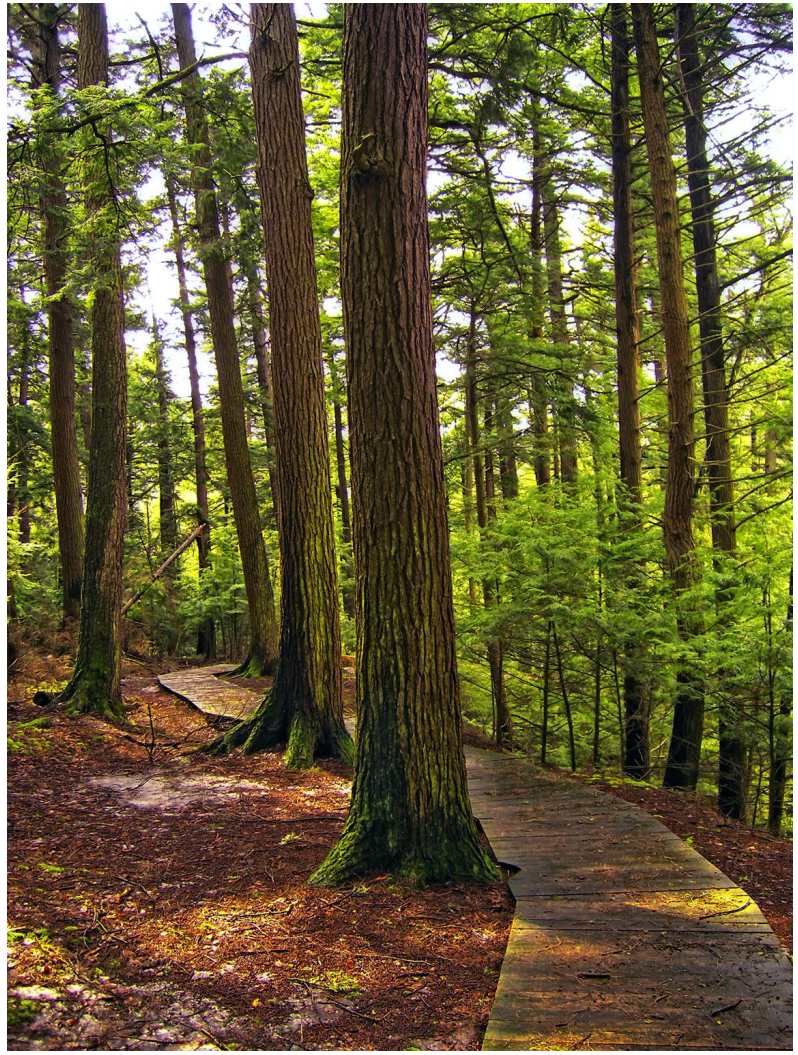
Benton and Cowles 2017



Management solutions

- **Integrated management:**
  Less-frequent pesticide application + biocontrol → **reduce non-target effects** + maximize tree growth

- **Restoration** where die-off has already occurred
  - Alternative species
  - Genetically resistant trees



Conclusions

- Need for ecosystem-based approach even within a bounded area like Swallow Falls State Park

- Planning longer-term management (> 5-10 years),
  - Targeting areas of importance
  - Managing for a future with fewer hemlock and ash trees

- Ultimately, other invasives need to also be controlled to reduce potentially detrimental dynamics (Vose et al., 2013)

Identify ecosystem threats and challengers → Manage acute threats and mitigate non-target impacts → Research potential future dynamics → Create long-term management and restoration plans