


Challenges of Managing Non-native Forest Pests: Can We Keep Up?

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Outline

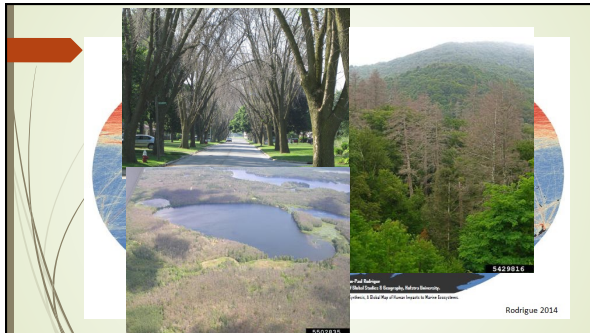
- Introduction
 - Non-native Invasives
 - Problem
- Challenges to management
 - Predictability
 - Invasive synergisms
 - Rapid evolution
- Future implications
- Conclusion



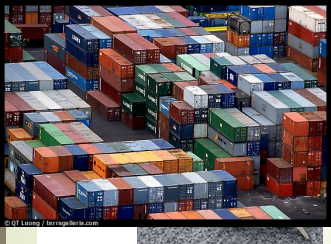
What is "Invasive"?

- Non-native invasive species (NIS):** established outside historic range; perceived harm/damage (Invasives.org)
- General process** (Liebhold et al. 1995)

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graph LR; A[Introduction] --> B[Establishment]; B --> C[Spread]
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Forest Insect Pests



- Insects = significant forest disturbance
- Significant pest increases – anthropogenic dispersal (Liebhold et al. 1995, Aukema et al. 2010)
- Wood packing material
- Plant material
- Containers (McCullough et al. 2006, Haack & Brockerhoff 2011)

Management Options

- 3 Categories (Simberloff et al. 2005):
 1. Prevention
 2. Eradication
 3. Population control
- Use invasion process steps to inform management
- Nice flow charts, messy applications

Invasion Process

INTRODUCTION

↓

ESTABLISHMENT

↓

SPREAD

↓

IMPACT

Management Response

← prevention

← rapid response eradication

← control containment

← restoration mitigation

(Hulme 2006)

Lack of Predictability

INTRODUCTION ← prevention

Table 1. The successive stages of invasion and the factors contributing to success in each of these stages

Factors	Introduction	Establishment	Spread
Human intervention	High	Low	Low
Environmental characteristics	Low	High	High
Propagule pressure	High	High	High
Biological traits	High	High	High
Biological interactions	Low	High	High

Common NIS Traits (Hayes & Barry 2007):

1. Generalist – habitat and feeding
2. R-selected → high fecundity
3. Invasion History

Don't always work: EAB & WTB (Herns & McCullough 2014, Cranshaw 2011)

Too much lag before predictive power increased??

better predictive traits??

Competition, Facilitation, Predation, Competition, Facilitation, Predation

Invasive Synergisms

ESTABLISHMENT ← rapid response/eradication

- "Invasional meltdown" theory—invaders facilitate other invaders (Simberloff & Von Holle 1999)
- Invasive ant & introduced scale insect (mutualism) increase invasive snail abundance by 20x vs. non-ant-invaded forest (Green et al. 2011)
- Non-native forest insects = significant disturbance → opening for subsequent invasion (Gandhi and Herns 2010)

Positive Invasive Feedback Loop exacerbates number to manage and complexity of system

5502470 (Green et al. 2011)

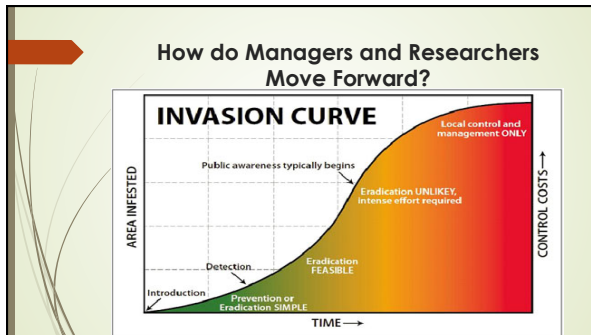
Rapid Evolution

SPREAD ← control/containment

Invader pre-disposed to evolve rapidly → Confound mgmt. efforts

If invaded ecosystem responds quickly → More costly/damaging to then remove?

(a) 2001 (b) 2007 (c) 2001 (d) 2007 (Bergstrom et al. 2009)



Concluding Remarks

- Need to stop the flow of invasives → Trade issue
- Invasions provide valuable ecological insights

Picture References

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Thank you for your attention!

Questions?