

The Benefits of Preventing Invasive Species: Timing Matters

Rebecca Epanchin-Niell and Andrew Liebhold

Experts estimate that invasive plants and animals in the United States cost the nation billions of dollars in damages each year. However, empirical studies of invasion costs and impacts primarily focus on short-term damages rather than long-term total costs, which are important for quantifying the benefits of preventing invasions.

In our new research published in *Ecological Economics*, we find that temporal factors are critical to determining the long-term invasion costs and evaluating the benefits of quarantine and prevention policies. We focused in particular on the lag time between an invader’s arrival and the initiation of damages, as well as the persistence of damages.

Several characteristics of invading species cause damages to accrue quickly,

or over a larger area, increasing the benefits of prevention:

- » short lag times between their introduction and spread;
- » short lags between their arrival and the initiation of damages;
- » larger, short-lived damages as opposed to smaller, persistent damages;
- » faster or earlier spread; and
- » larger potential range sizes.

To illustrate, we predicted the long-term impacts for two forest insects currently spreading through North America—the aphid-like hemlock woolly adelgid and the gypsy moth—from the time of their introduction to their potential future saturation of the eastern United States. We focused on residential property value loss,

Table 1. Long-Term Impacts of Two Invasive Species, from Introduction through Saturation

Species	Lag time	Saturation	Estimated long-term damages
Hemlock woolly adelgid	60 years	100 years	Less than \$4 million
Gypsy moth	11 years	Multiple centuries	\$250 million

the largest single type of damage caused by each species. The disparity across our “back-of-the-envelope” damage estimates for the two species (Table 1) arises from differences in the local damage potential of each species as well as their temporal characteristics.

The timing and pattern of spread vary greatly for each insect. The hemlock woolly adelgid experiences a long lag time (Table 1) but then saturates climatically suitable portions of the eastern United States in only 100 years (Figure 1). In contrast, the gypsy moth invasion unfolds over multiple centuries (Figure 2) after a relatively short lag time (Table 1), saturating a much larger swath of the United States.

These temporal characteristics should be considered in species risk analyses and economic evaluations of quarantine and eradication programs. ●

Figure 1. Past and Predicted Future Spread of the Hemlock Woolly Adelgid (following 60-year lag time)

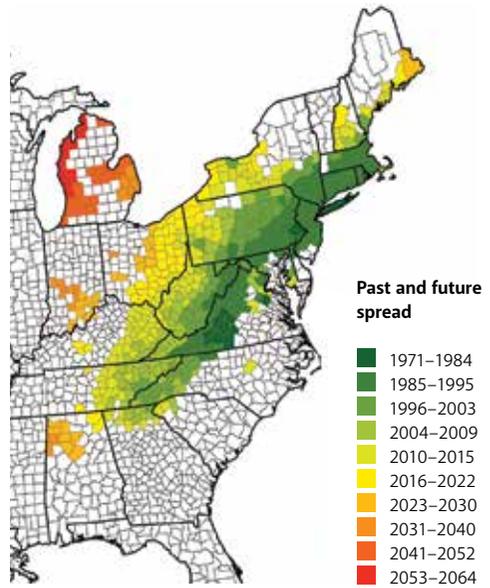
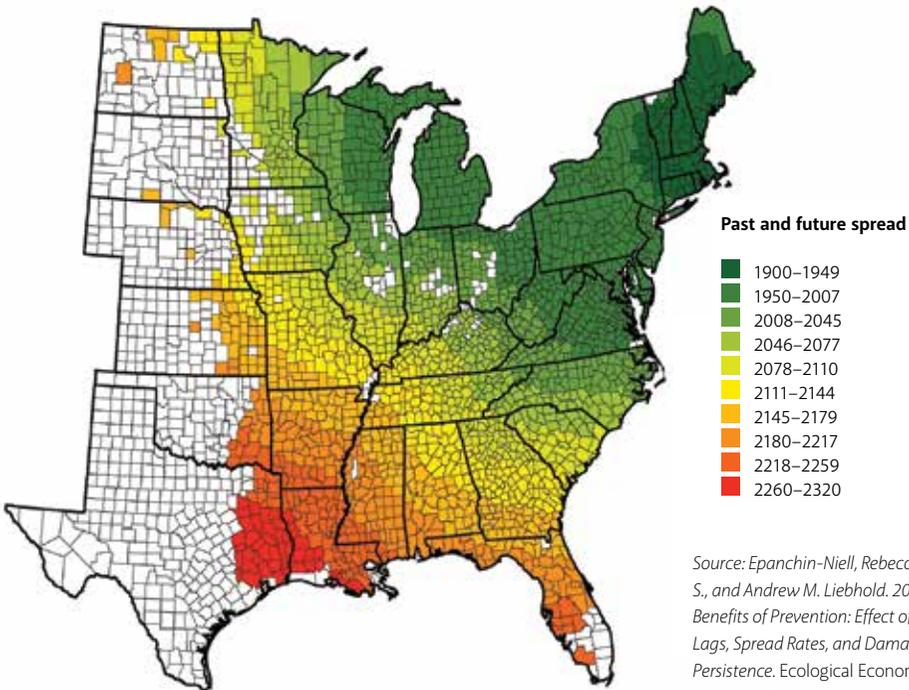


Figure 2. Past and Predicted Future Spread of the Gypsy Moth (following 11-year lag time)



Source: Epanchin-Niell, Rebecca S., and Andrew M. Liebhold. 2015. *Benefits of Prevention: Effect of Time Lags, Spread Rates, and Damage Persistence*. *Ecological Economics* 116: 146–153.