FUEL CHARACTERISTICS OF NONNATIVE INVASIVE PLANTS IN FORESTS OF THE NORTHEASTERN AND MID-ATLANTIC U.S.A.

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Abstract

Nonnative invasive plants have severe consequences for ecosystems. In Northeastern and mid-Atlantic states, Japanese barberry (*Berberis thunbergii*), Asian bittersweet (*Celastrus orbiculatus*), Asian honeysuckle (*Lonicera* spp.), and Norway maple (*Acer platanoides*) are among many species that encroach in native forests and openings. Some can outcompete native vegetation, change soil chemistry and hydrology, degrade habitat for wildlife, and alter fuels that a wildfire might consume. But how do these plants interact with fire in this region? A long record of both small and large wildfires belies the popular assumption that fire is of little consequence here. Typically wildfires in the region are associated with extended drought. A prominent example is October 1947 in Maine, when more than 213,000 ac burned, with losses of 851 year round and 395 seasonal residences in 35 towns.

Presence of nonnative invasive plants might alter a fuelbed in one of two ways. An invaded forest is either more likely to burn, or less likely. In most forest types in our region, fuels that include invasive plants might lead to greater potential for wildfire. At one of our study sites, Acadia National Park in Bar Harbor, ME, early successional forests developed after the 1947 fires. The latter case is detrimental in pitch pine forests such as at Albany Pine Bush Preserve, Albany, NY, because this fire-adapted ecosystem requires occasional fire to keep the pitch pine as the dominant tree species. Understory plants and a rare butterfly, the Karner blue (*Lycaeides melissa samuelis*), depend on fire to maintain the native community.

We compared invaded and uninvaded forest stands at 13 sites in MA, MD, ME (including Acadia National Park), NJ, NY, VA, and VT, mostly on public lands (Table 1). We also examined forest regeneration (woody plant seedlings) relative to invaded conditions as an indication of future forest conditions. Uninvaded conditions were to be as much like the invaded stands as possible, with mature forest and no invasives, and were to represent conditions toward which managers would seek to restore degraded stands. Given the best of what was available, few of our supposedly uninvaded stands were free of nonnative plants.

Using nonparametric tests, we found several patterns: (1) in three pitch pine sites, basal area was lower in uninvaded stands, and fire return interval could be influenced by invading, nonflammable black locust (*Robinia pseudoacacia*) and by exotic grasses; (2) in ten sites with various cover types other than pitch pine, mass of nonwoody litter in tons/acre and duff depth are greater in uninvaded stands, and basal area is lower, while mass of 100 hour fuels (> 7.5 cm diameter) is lower. Where present, nonnative grasses (e.g., fine-leaved sheep fescue, *Festuca filiformis*; sweet vernal grass, *Anthoxanthum odoratum*; wood blue grass *Poa nemoralis*) increase the load of fine fuels (Fig. 1), suggesting that during an extreme drought in autumn, wildfire could spread more easily than it would in a forest stand where grasses are not present. In general, seedlings of native woody plants were more abundant where invasive shrubs were lacking, while seedlings of invasive shrubs were dense in some of the invaded stands, with > 400 seedlings per sq m in some cases. A nonnative shrub, alder buckthorn (*Frangula alnus*), was especially dense in some sites and is a potential competitor of northern red oak and other native hardwoods. It appears that a control program that targets woody plants but neglects the encroachment by invasive grasses might not relieve the buildup of nonnative fine fuels.

Table 1.—Study sites in which we measured fuels in invaded (i) and nearby uninvaded (u) forest conditions. Abbreviations in Column 1 identify study sites in Figure 1.

Site	Location	Total ha	Cover	Forest Type designation	Target invasives
Acadia National Park (AC)	Bar Harbor, Hancock Co., ME	14,165	Poplar sp. (i) Red oak/red spruce (u)	Hardwoods	Ninebark and shrubby St. Johnswort
Albany Pine Bush Preserve (AF)	Albany, Albany Co., NY	809	Black locust (i) (u)	Pitch pine	Black locust
Albany Pine Bush Preserve (AL)	Albany, Albany Co., NY	809	Black locust (i) (u)	Pitch pine	Black locust
Antietam National Battlefield (AN)	Antietam, Washington Co., MD	394	Oak/hickory hardwoods	Hardwoods	Japanese honeysuckle
Cape Cod National Seashore (CC)	Wellfleet, Barnstable Co., MA	17,647	Black locust (i) Pitch pine (u)	Pitch pine	Black locust
Finger Lakes National Forest (FL)	Hector, Schuyler Co., NY	6,221	Oak/hickory hardwoods	Mixed woods	Multiflora rose
Holbrook Island Sanctuary (HI)	Brooksville, Hancock Co., ME	498	Red spruce/ Balsam fir	Softwoods	Norway maple
Manassas National Battlefield Park (MA)	Manassas, Prince William Co., VA	2,024	Oak/hickory hardwoods	Mixed woods	Japanese honeysuckle
Merck Forest and Farmland Center (MK)	Rupert, Bennington Co., VT	1,275	Mixed hardwoods	Hardwoods	Asian honeysuckle
Massabesic Experimental Forest (ME)	Lyman, York Co., ME	1,488	Red oak - white pine	Mixed woods	Oriental bittersweet
Morristown National Historical Park (MO)	Morristown, Morris Co., NJ	686	Oak - yellow poplar hardwoods	Hardwoods	Japanese barberry
Penobscot Experimental Forest (PE)	Bradley, Penobscot Co., ME	1,538	Oak – poplar with softwoods	Hardwoods	Frangula alnus
Rachel Carson National Wildlife Refuge (RC)	Kittery, York Co., ME	1,902	Eastern white pine on old fields and mixed hardwoods	Softwoods	Japanese barberry

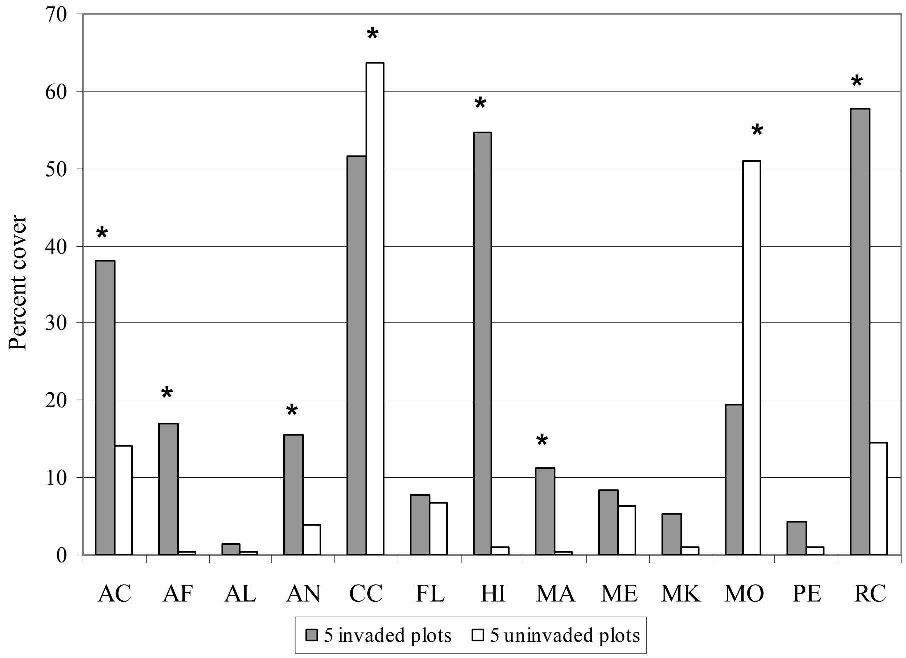

Figure 1.—Graminoid cover at 13 study areas. Values are average midpoint for Braun-Blanquet cover classes in five plots (3 m radius) per condition as invaded or uninvaded at each area. Abbreviations for sites are given in Table 1. AF, AL, and CC are fire-adapted pitch pine types. At CC, native *Carex pensylvanica* accounts for the graminoid abundance. * = significant at alpha=0.05 in two-group t-tests.

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Related study - Julie Richburg, University of Massachusetts, Amherst, MA, has recently completed research on dynamics of total available carbohydrate in invasive plants in response to burning and cutting treatments. Contact: richburg@forwild.umass.edu.

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Additional reading: http://www.fs.fed.us/ne/durham/4155/fire/dibble2_jfsp.html