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Steward's Circle

SEED DISPERSAL BY ROADSIDE MOWING

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ABSTRACT:
Based on many years of stewardship experience in natural areas in Illinois and Pennsylvania, I discuss the potential for roadside mowing to facilitate the spread of aggressive alien plants. Along interstate highways, mowers are a potential mechanism for spread of aggressive plants for long distances. Other factors that may be important are favorable climatic and soil conditions, and positive responses by aliens to disturbances caused by mowing along these highways. This report outlines some differences and similarities between central Illinois and south-central Pennsylvania, which have similar climatic conditions but different soils and length of settlement time.

Index terms: aggressive alien plants, mowing, roadside mowers, seed dispersal

RESULTS AND DISCUSSION

Most ecologists and land managers recognize the spread of aggressive alien plants from the edge of roadsides. Observations suggest that one cause is seed dispersal by roadside mowers, with colonization and success also depending on a good match of the alien species with the disturbance caused by mowing, as well as suitable soils and climatic conditions, such as rainfall, and temperature.

My experience in Midwestern tall-grass prairies, Midwestern woodlands, and Eastern prairies, savannas, and woodlands forms the basis for the contention that roadside mowing has been very important in alien plant spread. This factor is important in both regions, even though the regions differ in soils and in the period of European settlement.

In the Midwestern tall-grass prairie areas of Illinois, the location of prevalent aggressive aliens strongly suggests that they are dependent on mowers for seed spread. These species include teasel (*Dipsacus* sp.), parsnip (*Pastinaca sativa* L.), yellow/white sweet clover (*Melilotus officinalis* (L.) Lam./*albus* Medik.), smooth brome (*Bromus enermis* Leyss.), crown vetch (*Securigera varia* (L.) Lassen), Queen Anne's lace (*Daucus carota* L.), garlic mustard (*Alliaria petiolata* (M. Bieb.) Cavara & Grande), bouncing bet (*Saponaria officinalis* L.), chicory (*Cichorium intybus* L.), and giant hogweed (*Heracleum mantegazzianum* Sommier & Levier). It is important to point out that several species aggressive in the East have the potential to spread westward.

Ironically, a detriment to the spread of aggressive alien plants in the Midwest often may be the conversion to agriculture, including the extensive use of herbicides on Midwestern agricultural fields. For example, the Brimfield Railroad Illinois Nature Preserve is relatively free of aggressive alien plants due to herbicide-treated agricultural fields on both sides of the right-of-way, and the absence of roadsides, except for 30 m on the north side of the 0.8 km right-of-way. Two small areas of white sweet clover kept appearing, probably because of the long life of the seeds. White sweet clover consistently became prominent the second year after a prairie burn, probably due to opening the plant canopy to favor seed germination of this biennial. A small number of parsnip and garlic mustard plants were easily eradicated by annual uprooting. A few individuals of dames rocket (*Hesperis matronalis* L.) appeared next to the 30-m-wide right-of-way bounded by a roadside.

By contrast, an excellent example of mower spread of aliens is illustrated by the trailsides of the Rock Island Trail Illinois Nature Preserve, which is nearly identical in all respects to the Brimfield Railroad Illinois Nature Preserve. Both are abandoned railroad constructed on original prairie composed of level black friable loam. Before the construction of a bicycle trail through the middle of the Rock Island Trail Preserve, the area was assessed as pristine original prairie. A problem with alien species began with the construction of a bicycle trail of crushed limestone through the middle of the 30-meter-wide right-of-way crossing the preserve, approximately 0.8 km in length. A mower was used to clear the sides of the entire trail, 46 km in length. Following mowing, alien plants appeared along the trailside, and subsequently spread from trailside outward into the preserve. Parsnip and white sweet clover were the most aggressive in invading the preserve, while bouncing bet, smooth brome, and garlic mustard were largely restricted to trailside. As a result, it was suggested that a dedicated mower should be used in the preserve, but the damage was already done. For several years, hand-pulling the aggressive aliens—with difficulty—had some limited success. The contrast of aggressive alien plants between the Rock Island Trail and Brimfield Railroad Nature Preserves, which were similar sites, illustrates the dangers of alien plant introduction through mowing.

Another 24.28 ha (60-acre) prairie within

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the Illinois Jubilee State Park was removed more than 1 km from roadsides, and additionally was surrounded by woodlands. There was evidence that most of this prairie was farmed in the past, but overall this area was remarkably free of aggressive alien plants. A mix of native prairie plants continued to encroach from the perimeters. Exceptions were areas of smooth brome, as this plant readily spreads by rhizome. Other principal problems were multifloral rose (*Rosa multiflora* Thunb.) and autumn olive (*Elaeagnus umbellata* Thunb.), due to the spread of woody plant seeds by birds. Controlled burn management was a successful management tool that encouraged natives and discouraged aggressive aliens mentioned above.

Alien plant invasion can be corrected with tremendous effort by volunteers. On the northwest side of Illinois Jubilee State Park, half of a 60.7 ha (150-acre) plot of land is composed of open fields bounded on two sides by roads. Because the fields were fallow for decades, undoubtedly weed spread occurred from roadsides. The principle invaders were smooth brome, white and yellow sweet clover, parsnip, garlic mustard, and crown vetch. Smooth brome rapidly spreads by rhizome. At present, crown vetch has not migrated from the roadside, but is difficult to eliminate because latent seeds continue to germinate. A group of volunteers called "The Prairie Dawgs," spent decades of ongoing effort eliminating aggressive aliens with herbicide, controlled burns, and hand-pulling, followed by introduction of natives. This effort was so successful a public tour of the area is now given annually.

Other natural areas in Illinois have had alien plant invasions that began along roads subject to mowing, For example, the Irene Cull Nature Preserve (prairie) within the city of Peoria and adjacent to Interstate-74, has an infestation of teasel and smooth brome that had undoubtedly spread from thick patches of these two plants growing along the I-74 right-of-way. Mulberry trees (*Morus* sp.) were also invasive in this preserve, probably due to seed carried by birds. The Jubilee College Forest Nature Preserve is a deep gully of upland forest dominated by oaks, hickories, and maples, as well as vernal native wildflowers. Garlic mustard first appeared alongside a lane on the north side used only by park vehicles and horses (presumably mowed occasionally). Garlic mustard prefers partial shade, thus this plant spread downhill into the forest. A recent suburban development constructed on the south side of the gully may threaten the integrity of this preserve from yet another side.

The East has far more problems with aggressive aliens because of the length of time that it has been settled by Europeans. Naturally, horticultural introductions and the desire of immigrants to bring with them familiar plants from "the old country" resulted in a mass replacement of native plants throughout the region.

A private nature preserve in south-central Pennsylvania that was settled since the early 1700s is illustrative of problems in the East. Sixteen ha (approximately forty acres) of this property were intentionally restored by introduction of native species. Interestingly, local people have no knowledge that these plants are native. The preserve has about 2.5 km of road frontage. Roadside mowers likely have been largely responsible for spread of aggressive alien plants in this preserve because infestation generally first occurred adjacent to the road or along the electricity right-of-way. The problem plants are mainly spotted knapweed (*Centaurea stoebe* L. subsp. m*icranthos* Gugler & Hayek), crown vetch, sweet clover, Canada thistle (not native to Canada, *Cirsium arvense* (L.) Scop.), bull thistle (*Cirsium vulgare* (Savi) Ten.), asparagus (*Asparagus officinalis* L.), garlic mustard, English ivy (*Hedera helix* L.), Nepalese browntop (aka Japanese stiltgrass) (*Microstegium vimineum* (Trin.) A. Camus), Japanese honeysuckle (*Lonicera japonica* Thunb.), privet (*Ligustrum vulgare* L.), Amur honeysuckle (*Lonicera maackii* (Rupr.) Herder) and Tartarian honeysuckle (*Lonicera tatarica* L.), buckthorn (*Rhamnus cathartica* L.), multifloral rose, chicory, louise's swallow-wort (aka black swallow-wort) (*Cynanchum louiseae* Kartesz & Gandhi), tree-of-heaven (*Ailanthus altissima* (Mill.) Swingle), dame's rocket, smooth brome, wild garlic (*Allium vineale* L.), and quackgrass (*Elymus repens* (L.) Gould). Especially egregious has been Nepalese browntop, initially found along roadsides and electricity right-of-ways, which has quickly spread into both woodlands and prairies as dense patches that spread outwards. Compounding seed spread by mowers, birds undoubtedly aid in dispersal of certain species found far from roadsides, including Japanese honeysuckle, Amur and Tartarian honeysuckles, privet, and buckthorn. Additionally, dispersal of seeds by wind undoubtedly also occurs with the following species: spotted knapweed, thistle sp., chicory, louise's swallow-wort, and tree-of-heaven. Several areas in this private preserve possessed a near monoculture of smooth brome extending from the roadside into the preserve for about 100 m. These areas were treated with glyphosate in September, followed by a heavy sowing of native seeds, which proved to be an effective solution. It has been noted that cream gentian (*Gentiana alba* Muhl. ex Nutt.) is one of a few natives that competes well with smooth brome. Restoration using native plantings has reversed some of the alien plant incursions. As the native plantings matured, this caused increased competition; thus, quack grass virtually disappeared and several alien plants decreased notably, such as Queen-Ann's lace, Canada thistle, and wild garlic.

The roadside adjacent to the Box Huckleberry Natural Area near New Bloomfield, Pennsylvania, is also illustrative of problems on roadsides. This site has an estimated 8000-year-old monoclonal growth of box huckleberry (*Gaylussacia brachycera* Michx. A. Gray). The soil is mainly composed of underlying shale on sloping land. Aggressive removal by uprooting alien plants on the adjacent roadside for better than 10 years has been successful. Fortunately, the natural area exists up a steep bank from the road, but the opposite side descends toward a small stream. This downside private property is posted with no trespassing signs, thus aggressive aliens have not been pulled on this property and they are increasing. On both sides of the road, the following species have been uprooted: garlic mustard, Japanese honeysuckle, dame's rocket, and celandine (*Chelidonium majus* L.). Only one roadside mile-a-minute vine

(*Polygonum perfoliatum* L.) was detected and removed. Roadside Nepalese browntop has become hopelessly thick in the past few years, and it is creeping up the bank toward the preserve. Thus far, not much invasive activity has been observed in the natural area, but it is anticipated that this will change.

The infestation of mile-a-minute vine in southeastern Pennsylvania is illustrative of the role of horticulturists in introduction of aggressive alien plants. One or more seedlings escaped from a potted plant imported from Asia. This nasty thorny vine is spreading rapidly west. As mentioned above, it was noted on a roadside at the Box Huckleberry Natural Area in Perry County, and it was found near the mountaintop on the Appalachian Trail near Mechanicsburg, Cumberland County. Theoretically, the latter area's seed was carried on a hiker's boot.

CONCLUSIONS

The spread of plants between continents is a worldwide phenomenon requiring multiple strategies for control. Prevalence of types of aggressive alien plants is not only dependent on climatic conditions, but also soil type and numbers of introduced plants. Roadside mowing is only one of many considerations.

Harold Gardner earned a PhD in Biochemistry from Penn State University. Gardner was a research scientist at the Pineapple Research Institute, Honolulu, University of California Los Angeles, and the Agricultural Research Service, USDA, Peoria, Illinois. In addition to publishing numerous articles and books on plant biochemistry, he also has published on the topic of prairie restoration. He is currently retired serving as a volunteer steward and advising the Penn State Arboretum regarding their recent prairie project.

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