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The Invasive Species *Galega officinalis* in Landscaping Along Gill Creek at Porter Road, Niagara Falls, New York

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1. On October 9, 2000, a population of *Galega officinalis* L. (Goat's Rue) was discovered growing in a field along US 62, Pine Avenue, in the City of Niagara Falls, between Military Road on the west and on the north, where Pine Avenue splits off from the terminus of Niagara Falls Blvd by the Niagara Falls International Airport, "growing near the factory outlet mall in Niagara Falls" [the mall is actually in the Town of Niagara]. This station was a little plot of land for sale between a car-wash business and a telephone service outlet. The plot of land (see Figure 1) was not developed, but was a stony, weedy plot, perhaps large enough for a small business to build its shop. Behind this plot of land existed (and exists) an open, undeveloped field. A population of *Galega officinalis* had spread throughout the small plot of land. Officials in Albany were alerted to its occurrence, with some indication of its invasive character. Since that time, the owner of the property carefully mowed his plot and it is now a rich green lawn, no longer for sale. It seems the station was eradicated by mowing or by some other means, suggesting that mowing may be one way of eradicating the population. However, behind the plot, in the open field there, the population was allowed to expand its area, and it is now fully expanded throughout the field in and among nearly impenetrable thickets.

The author published a small article in Res Botanica, a Missouri Botanical Garden Web Site, on July 19, 2004, describing this find and possible problems associated with it as an invasive species. The article stated that it was "found only one mile from the Niagara River, [and] may threaten to overwhelm the riverside, much like the now infamous invader *Lythrum salicaria* L., Purple Loosestrife. The plant will be studied more closely in the future to see whether it could ultimately threaten the [Niagara River] shore-side ecosystems of public lands such as at Buckhorn Island State Park, the Niagara Reservation and even extend to the Buffalo Museum of Science's Tifft Nature Preserve on the Buffalo waterfront."

Attached to the article was "A Letter To A Western New York Citizen With Goat's Re On His Property" cautioning that the plant is " toxic to livestock if enough is eaten. It seems to affect the milk and may be more strongly poisonous to young animals. I say this in reference to your having transplanted some of these plants to your [woodland]

property in the interests of providing forage for White-Tailed Deer." The letter went on to say "The plant is known to develop large colonies, as you can observe in the vacant lot next to your business, and takes years to get rid of. I suggest also that for the time being you destroy the plants you have put on your property and any seedlings that may develop next year until the issue whether these plants are toxic to White-Tailed Deer is considered. Note that the plant is most toxic in the spring." Furthermore, "the plant and issues associated with it need to be studied over the winter to assess whether further steps should be taken to eradicate the colony in the lot in order to prevent threats to the ecology of the nearby Niagara River and the Canadian and American public parks on its shoreline and the wildlife contained in them."

2. *Galega officinalis* was not reported for the New York State flora in 1924 by House, nor by Zenkert for the Niagara Frontier Region (Zenkert 1934). It is recorded in the State from only four counties with a Niagara Co. station from 2001, with a voucher from 2017 (Weldy et al. 2018). It is reported from "roadsides, disturbed soils, and stream banks. Currently very rare in New York" (Weldy et al. 2018).

Early treatments of the flora along the Niagara River in Ontario show no reports (Cameron 1895; Panton 1890). Occurrence of the species was noted in the Province of Ontario, Canada (Morton & Venn 1990). In the Regional Municipality of Niagara, Oldham reported it as a "rare weed. M. J. Oldham #33856 (DAO, MICH) from near St. Catherines in 2006" (Oldham 2010).

Goat's Rue is an alien species in the United States, native from Central Europe to Iran. It "invades wet, disturbed areas such as streambanks, low pastures and ditches. It can form dense thickets and is toxic to livestock" by paralyzing the central nervous system (Invasive Plant Atlas of the United States (IPAUS) website July 2, 2018). It is reported as invasive from several states, the nearest being Pennsylvania (Commonwealth of Pennsylvania, Department of Conservation and Natural Resources website, 1994 [July 3, 2018). It is reported as invasive by the Mid-Atlantic Exotic Pest Plant Council, 2005 (Ipaus website July 2, 2018). The species is on the US Federal noxious weed list. It invaded 60 square miles in one county in Utah.

The habit of the species is to spread, once introduced in a disturbed drainage system, such as wet valleys, riverbanks, streamsides, creeks and other wet shores, it will migrate down the creeksides, that is, it is associated with water. It is reported as invasive in New York State (US Federal Noxious Weed List (draft fact sheet 2011 - National Plant Data Center)

Galega officinalis is reported on the list of plant species reviewed by the New York State DEC in the "Final Report: A Regulatory System for Non-Native Species prepared by the New York Invasive Species Council, 10 June 2010." Its invasive vigor is listed as 'moderate' in New York State, but in other areas, such as Utah, "since its introduction, this species has infested moist, waterlogged and acidic soils in pastures and old fields in Utah. It is proving difficult to eradicate in those habitats (Lasseigne 2003). The Canadian Food Inspection Agency has considered the species as a Primary Noxious, Class 2 weed in the Canadian Weed Seeds Order, 2016 under the Seeds Act.

Galega officinalis, although introduced in Utah as a potential forage plant for animals, was found to contain an alkaloid toxic to livestock (Tingey 1971). Although it is demonstrated to be toxic to mammals, it is used commercially to increase lactation in

breastfeeding mothers, a rather alarming thought as so many "natural" remedies are untested. The plant is said to be fatal if ingested. The leaves may have been processed so that they become nontoxic, although they are then are useless as a galactogogue.

Galega orientalis Lam., a species with a deeper blue flower, is a closely related Caucasian species and considered acceptable for forage and fodder as it has a low toxic alkaloid concentration, unlike *Galega officinalis*, whose toxicity (the alkaloid galegin) is demonstrable for livestock. Another related species but a New York State native, once placed in the genus *Galega*, but now *Tephrosia virginiana* (L.) Pers., also called Goat's Rue, was also planned to be used as a forage plant, primarily to increase the milk production (in goats), as with *Galega officinalis*, but its use was also discontinued as it also develops a powerful alkaloid called rotenone, presently used commercially as a poison to kill insects and invasive species of fish. This species has been known for the upper Hudson counties and central New York and other places by House (1924).

3. On June 23, 2010, a stand of *Galega officinalis* was found on Route 182, on Porter Road, in the City of Niagara Falls, New York, not far west from the boundary with the Town of Niagara and Interstate I90 (see Figure 2). At the time, isolated plants of this species were noticed scattered throughout the Hyde Park Golf Course on the North side of Porter Road. The golf course spans Porter Road on both its north and south sides.

The East and West branches of Gill Creek cross Porter Rd. and flow in a southerly direction within the golf course, eventually uniting into one stream, and ultimately flowing into the Upper Niagara River. The Niagara River current flows west across the Gill Creek outlet, just upstream from The Niagara Reservation island complex separating the Canadian and American Falls, and then flows into the Niagara River gorge, then on to the Lower Niagara River into Lake Ontario. The Niagara Reservation is under ownership and management by the New York Office of Parks, Recreation and Historic Preservation.

> *Representative collection:* USA: New York, Niagara County, City of Niagara Falls, Hyde Park Golf Course on Porter Road, East branch of Gill Creek. Dense stand in shaded creekside against culvert under Porter Rd. Near a restaurant and bar near Niagara Falls Senior High. Appearing to have been planted. Also scattered throughout the open areas under the high-tension wires N of the course and dense in Gill Greek areas. P. M. Eckel, 24 Aug 2010 (MO).

The source of the plants, however, scattered as isolated individuals throughout the golf course lawns in 2010 was rather peculiar. The plants showed an array across the landscape that did not seem to be the sort of distribution produced by, say, birds or other organisms. It was as though the plants resulted by scattering the seed. Since the golf course routinely mowed its lawns, the plants did not persist in subsequent years, and this is perhaps because the isolated plants had not produced seed. I doubt the grounds-keepers of the course would have appreciated anyone purposefully putting weeds in their beautiful lawns.

And so it came as some surprise that a dense patch or thicket of *Galega officinalis* had been apparently planted on both banks of East Gill Creek, near the roadway verge, in front of a commercial restaurant and bar on the south side of Porter Road, framing a little bridge for golf carts which could be hired just across the road, on the north side. The

dense patch, or monoculture, continued downstream until it was lost in a small stand of native forest. There was an interval of the forest, ringed with *Rhamnus cathartica* (Buckthorn), before another patch of *Galega* grew up against the forest margin downstream. This embankment covered with *Galega* was not a product of natural weed diffusion, but had apparently been put there by a commercial landscape company, as the patches were carefully groomed and mown into an attractive edge with the golf course lawn. The patches were not scattered, but gave a dense and sculpted appearance to show how artifical its presence was. In the specie's invasive dynamic, it forms dense patches and the plants seemed to have been planted to give such an appearance.

4. The seedpods of *Galega officinalis* contain up to 9 mustard-colored, oblong seeds. Each plant can produce 15,000 seeds or more and these may remain viable for ten or more years in the soil. Although seeds can be spread in animal manure, it is spread primarily in (irrigation) water (California Invasive Plant Council (Cal-IPC). (https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/weed-identification/goatsrue.aspx).

The plant is perennial and its deep root-structure is like that of *Galega orientalis*, growing from a taproot and rhizome system which makes it persistent in the field. An individual plant can send out rhizomes, sending up new stems as a genetic clone, leading the plant to survive well over ten years in dense and extensive monocultures. The root crown may produce up to 20 vigorous stems. To remove it manually, much of the root system needs to be taken, but it is known that the plant is very difficult to eradicate once established.

5. I have never before seen this species planted for ornamental cover in Niagara Falls by commercial landscaping. I am assuming it is planted on Porter Road for the same reasons as *Picris hieracoides* (Eckel 2017b) and *Echium vulgare* (Eckel 2018b) were, just east of this station on Interstate bridge abutments. The *Galega* seemed to be planted just where it could cause the most damage, by migrating down the Gill Creek watercourse down to the Niagara River, as indicated in the internet publication posted in 2010 above. However, although the two other weedy species could have been sown by amateurs, it seems evident that the *Galega* station was planted by a landscape professional. This seems consistent with a disturbing observation of the establishment of weedy, quickly spreading species along the Niagara River gorge, such as *Lapsana communis* and *Geum urbanum* (Eckel 2018a). *Eupatorium serotinum* (Eckel 2017a) is also associated with both Interstate on-and off-ramps as well as dense stands stationed in the Niagara River gorge below the Lower Arch Suspension Railroad Bridge.

These stations represent dispersals from dense or heavy inoculations of soil occurring suddenly or abruptly, and represent no gradual or natural dispersal - rather on the order of 'bombs' of invasive species. Other species could be mentioned, such as the planting of *Hesperis matronalis* L. and horticultural shrubs of *Lonicera tartarica (*the cultivar *Lonicera tartarica 'Honeyrose')* at the base of the Niagara gorge.

The parklands along the Niagara River were established as Reservations from development in 1885 on both the Canadian and American shores. This was as a result of an international effort to protect the unique natural elements and assemblages of species from destruction by trivial and ephemeral entertainments for tourists and by local busi-

nesses. Nineteen century efforts to preserve the Niagara River flora at the Cataracts have been recognized internationally as one of the most important of New York State and the Province of Ontario's legacies. That there seems to be a concerted effort to defeat these developments is dispiriting to the conservationist.

The establishment and cultivation of dense populations of invasive *Galega officinalis* and other alien species mentioned lends one to speculate on the reasons for these activities. The spread of these plants covers a wide area, from several miles above the cataracts at Niagara Falls, across Grand Island, down Porter Road in the City of Niagara Falls and in State Parks along the high and low banks of the Niagara River Gorge. The association with government agencies, landscape professionals and probably informed amateurs seems to indicate an network of partnerships - but who stands to gain and what is the advantage to motivate such people to degrade the remarkable botanical, ecological and historic value of the native Niagara ecosystems and landscapes?

Tampering with the ecological health of the Gill Creek and Niagara River shorelines undermines the purpose of several Greenway (Power Authority)-funded projects in the same area by introducing potentially harmful invasive and native plants in a significant ecosystem.

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Figure 1. Original site of *Galega* discovery on Niagara Falls Blvd. in the City of Niagara Falls, New York. The small lot is now mowed, but the large field beyond remains infested. Courtesy of Google Maps.

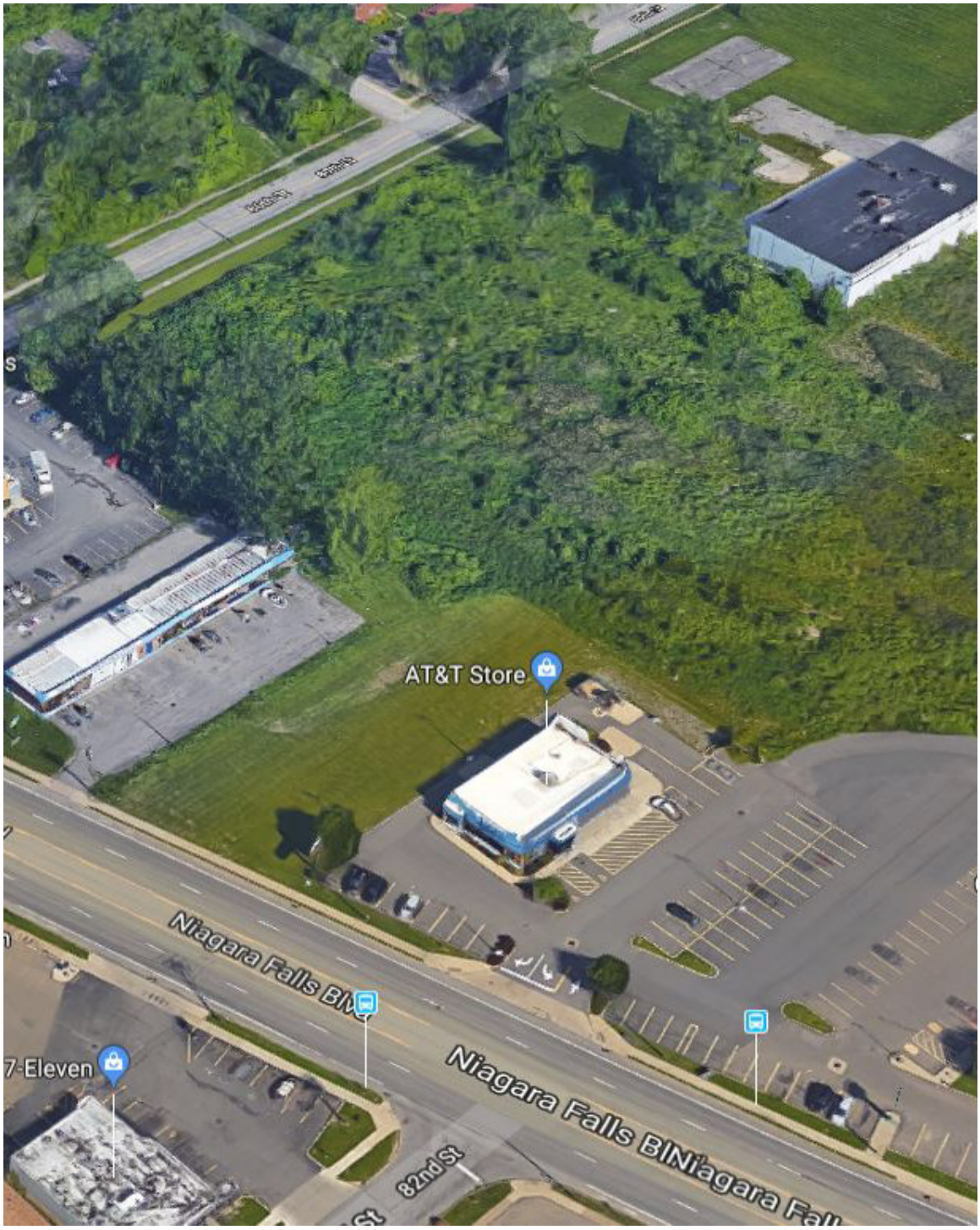

Figure 2. Area along Porter Road at golf course showing neatly trimmed shrubbery including dense stands of *Galega*. Courtesy of Google Maps.