GEOBOTANICAL CONSTRAINTS ON THE RANGE EXPANSION OF JAPANESE KNOTWEED

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INTRODUCTION

The Invasive Plant Counsel of New York State (1999) has identified Japanese knotweed (*Polygonum cuspidatum*) as one of the major invasive species in the state. It is found in a variety of habitats on Long Island, ranging from xeric barrier beaches to hydric intermittent ponds.

This species expands its range by seeds and rhizomes. The rhizomes of Japanese knotweed can extend up to 20 meters from the parent plant (TNC 1999). It forms large monospecific stands that densely shade and cover the ground. This prevents the seeds of native grasses, shrubs, and trees from germinating. In order to determine the potential impact of this species, an attempt was made to determine its geobotanical interactions.

STUDY SITES

Five populations of Japanese knotweed were studied in depth, while an additional six were subject to a more qualitative analysis. Those populations studied in detail were a xeric barrier beach and a hydric intermittent pond at Mt. Sinai Harbor as well as study sites in south central Brookhaven Town, which consisted of a disturbed area adjacent to a pine-oak forest and a submesic firebreak. An area adjacent to the Dwarf Pine Plains was also quantitatively studied.

The barrier beach, located at Mt. Sinai Harbor, is composed of the vegetational communities typical of a baymouth bar, such as bayberry (*Myrica pensylvanica*), beach plum (*Prunus maritma*), and wild rose (*Rosa rugosa*). The intermittent pond is also located at Mt. Sinai Harbor. To the west of the pond is a road, while immediately adjacent to the southern and eastern end of the pond is a beech/oak forest (*Fagus grandfolia / Quercus, spp.*). The dominant understory in this forest is mountain laurel (*Kalmia latifolia*). To the north of the pond is a *Spartina, sp.* marsh. The pond, formerly inhabited by cattails (*Typha, sp.*), has been invaded by *Phragmites australis,* (Klips 1970) and more recently by Japanese knotweed. The pond at Mt. Sinai Harbor has been subject to anthropogenic disturbances in the form of road runoff.

The submesic pine/oak forest in southern Brookhaven Town has an understory dominated by blueberry (*Vaccinium sp.*) and huckleberry (*Graylussa baccata*). Land adjacent to the oak/pine woodland was cleared periodically in the 1990's for the siting of groundwater monitoring wells, paved and unpaved access roads, and firebreaks.

The study site at Westhampton Beach is a submesic area disturbed by land clearing, which is adjacent to the Dwarf Pine Planes at Westhampton Beach.

There were six study sites that were subject to a more qualitative analysis. These sites were a mesic beech/oak forest with an understory of mountain laurel and maple-leaved viburnum *(Viburnum acerifolium)* at Kunz County Park, Smithtown. The study sites at Brookhaven National Laboratory ranged from a xeric scraped area with no understory to submesic areas, including a sighting lane with a blueberry/huckleberry understory, an oak/pine forest dominated by a scrub oak (*Quercus ilicifolia*) understory, and a pine/oak forest with a blueberry/huckleberry understory. Figure 1 shows all study sites.

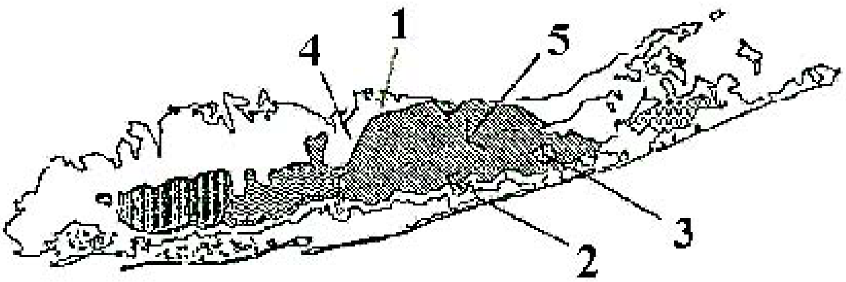

Figure 1. Study Sites: 1. Mt. Sinai Harbor 4. Kunz County Park
2. Brookhaven Town 5. Brookhaven National Laboratory
3. Dwarf Pine Plains

METHODS

Vegetation at all sites was determined by either quadrants, transects, or rapid environmental assessments (Welch 1995). Sediment samples were obtained by the use of a soil borer and were analyzed for percent moisture and size. A total of five chemical parameters (phosphorous, ammonia, nitrite, nitrate, and calcium) were determined by the Mehlich I Extraction Method. This data is summarized in Tables 1 and 2.

TABLE I

Community	**Type**	**Presence of Japanese Knotweed, Growth Form, Mode of Reproduction**	**Degree Of Shading**	**Dominant Sediment Type**	**Percent Sediment Moisture**	**Sediment Chemistry *(ppm)***	
Barrier Beach	Xeric	Yes Low Seeds & Root Sprouting	Low	Medium Sand	0%	PO_4 NH_3 NO_2 NO_3 K	60 3 1 20 37.5
Pine/Oak	Sub-Mesic	No	Moderate	Medium/Fine Sand	8.4%	PO_4 NH_3 NO_2 NO_3 K	7.5 0 1 7.5 60
	Sub-			Medium		PO_4 NH_3	1.5 3

Oak/Pine	Mesic	No	Moderate	Sand	10.47%	NO_2 NO_3 K	2 10 70
Beech/Oak	Mesic	No	High	Fine Sand	12.28%	PO_4 NH_3 NO_2 NO_3 K	12.5 3 1 75 60
Dwarf Pine	Xeric	No	High	Medium/Fine Sand	5.2%	PO_4 NH_3 NO_2 NO_3 K	12.5 3 7.5 25 65

TABLE II

Location	**Type**	**Presence of Japanese Knotweed, Growth Form, Mode of Reproduction**	**Degree of Shading**	**Under-story**	**Dominant Sediment Type**	**Percent Sediment Moisture**	**Sediment Chemistry *(ppm)***	
Old Town Road	Sub-Mesic	Yes Moderate Seeds and Root Sprouting	Low	None	Medium Sand	11.54%	PO_4 NH_3 NO_2 NO_3 K	7.5 3 1 5 70
Old Town Road Fire Break	Sub-Mesic	Yes Small Seeds	Low	Sedge	Medium Sand	13.07%	PO_4 NH_3 NO_2 NO_3 K	10 3 1 7.5 25
Westhampton Beach (Adjacent to Dwarf Pine Barrens)	Sub-Mesic	Yes Tall Root Sprouting	Low	None	Fine Sand	10.65%	PO_4 NH_3 NO_2 NO_3 K	50 3 1 20 80
RHIC Scraped	Xeric	No	Low	None	Medium Sand	3.05%	PO_4 NH_3 NO_2 NO_3 K	5 0 1 7.5 12.5
RHIC Sighting Lane	Sub-Mesic	No	Moderate	Blue-berry Huckle-berry	Medium Sand	9.92%	PO_4 NH_3 NO_2 NO_3 K	5 3 1 10 65
							PO_4	60

Intermittent Pond	Hydric	Yes Moderate Root Sprouting	High	None	Medium Sand	100%	NH_3 NO_2 NO_3 K	0 1 7.5 12.5

SUMMARY

The above data indicates that Japanese knotweed is capable of exploiting a wide range of physical environments. Neither sediment moisture, size, chemistry, nor shading appear to constrain its range. The data, however, shows that although Japanese knotweed is frequently found adjacent to undisturbed woodlands, it rarely invades these areas. In fact, the only undisturbed areas where Japanese knotweed is found are beaches such as Cedar Beach at Mt. Sinai Harbor. Perhaps the reason for its presence in these coastal areas is the similarity between beaches and disturbed areas.

Similar to the disturbed areas studied, the baymouth bar at Mt. Sinai Harbor has a low population density of native grasses and shrubs. Undisturbed communities, on the other hand, have understories dominated by various shrubs and grasses, promoting interspecific competition. It is believed that the lack of root competition on a barrier beach is the major factor involved in the presence of Japanese knotweed. The primary factor preventing its invasion of such habitats is the high degree of interspecific competition in undisturbed woodlands.

Based on its presence in a wide range of geobotanical settings, Japanese knotweed appears to have an unlimited potential for range expansion. However, this study indicates that biotic factors, primarily root competition, constrain range expansion in all habitats except barrier beaches, which most closely approximate disturbed areas.

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REFERENCES CITED

Klips, R.A. 1972, Botanical Survey of the Mount Sinai Marine Sanctuary: Town of Brookhaven. Medford, N.Y.

The Nature Concervancy, 1999, Invasive Plant Fact Sheet/ Japanese Knotweed: http//www.TNT.org.htm.

Welch, R. S., 1995, Rapid Environmental Assessment. Central Pine Barrens Commission: Ecology Committee. Informal Report # 1. Suffolk County Planning Department, Hauppague, NY.

Zaremba, B., 1999, The Newsletter of the Invasive Plant Council of New York State: IPC News, Albany, New York, v. 1, no. 1, p. 1.