

Public Horticulture

Exotic Plant Inventory, Landscape Survey, and Invasiveness Assessment: Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY

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ADDITIONAL INDEX WORDS. ornamental, garden forb, crop, weed, aquatic, cultural landscape reports, invasive species management plan

SUMMARY. An exotic plant cultural landscape inventory, area wide survey, and natural resource area invasiveness assessment was conducted in 2002 at the Roosevelt-Vanderbilt (ROVA) National Historic Sites (NHS) in Hyde Park, NY. At the species level, 40% of 90 assessed landscape species had not escaped cultivation, 44% had escaped and invaded natural resource areas, and 16% were categorized as migratory invaders. The most prolific introduced woody trees and vines at ROVA are members of the trumpetvine, bittersweet, pea, buckthorn, quassia, and grape families (Bignoniaceae, Celastraceae, Fabaceae, Rhamnaceae, Simaroubaceae, and Vitaceae, respectively). Shrub species occurring with more frequency in the natural areas than other escapes are the introduced native atlantic nine bark (*Physocarpus opulifolius*), burning bush (*Euonymus alatus*), forsythia (*Forsythia* sp.), japanese barberry (*Berberis thunbergii*), morrow's honeysuckle (*Lonicera morrowii*), tatarian honeysuckle (*Lonicera tatarica*), and mock orange (*Philadelphus* sp.). For the subset of assessed woody vines, shrubs, and tree species found in cultivation for at least 50 to 67 years (the "50 plus club species"), slightly more had escaped from cultivation for the Vanderbilt Mansion (VAMA) and Eleanor Roosevelt (ELRO) estates but for the Franklin Delano Roosevelt (FDR) collection the numbers were equivalent. The approach used in this study illustrates with data the "movement" of exotics over a significant period of time and underscores the importance of site-specific and species-specific assessments. This assessment also emphasizes the value of understanding the history (e.g., cultivated, cultivated escaped, or migratory invaders), purpose (e.g., aquatic, crop garden forb, groundcover, ornamental, or weed), and management over time (e.g., long since abandoned, recently abandoned, or still maintained, etc.) of the geographic area under consideration and the use of available exotic invasive plant lists to conduct such assessments.

The ROVA NHS is a complex of six parcels located in the town of Hyde Park in the Hudson River Valley of New York State. The VAMA is situated (lat. 41.79°N, long. 73.90°W) on a plateau overlooking the Hudson River and has a unique land feature (Bard Rock) that juts into the Hudson River. The Home of FDR

is 2 miles farther south and includes three properties: the Bellefield estate, the FDR mansion, and the Springwood Viewshed parcel. The VAMA and FDR estates are fronted by Route 9, connected by the Hyde Park Trail, and paralleled by the Hudson River Rail line and the Hudson River. The Home of ELRO and FDR's retreat

(Top Cottage) are farther inland (lat. 41.76°N, long. 73.90°W) on Route 9G, 2 miles east of FDR. All together these sites total about 800 acres. The historical mansions and outbuildings of these estates are surrounded by cultivated areas (manicured lawns, flowerbeds, formal flower gardens, and cropland including conifer plantations) as well as naturally occurring, uncultivated areas described in the various ecological reports reviewed as fallowed crop fields, actively eroding gullies, northern red (*Quercus borealis*)/chestnut oak (*Quercus prinus*) communities, oak (*Quercus* sp.)/tulip poplar (*Liriodendron tulipifera*) communities, miscellaneous hardwood/hemlock (*Tsuga* sp.) communities, and freshwater intertidal mudflats. Each site has a rich history of introduced exotic plant species in the manicured landscape and exotic crops for agricultural and silvicultural purposes.

History of purposeful introduction

Exotic plants were introduced into the landscape of VAMA as early as 1764 when Samuel Bard built the first mansion (Claeys and Coffin, 1995; Glenn, 1998; O'Donnell et al., 1992; Favretti and Rainey, 1988; Rudnicky, 1984). Introductions have occurred since 1881 at the FDR estate (Baker and Curran, 1999; Claeys and Coffin, 1995; Dutton, 1998) and at least since 1926 at the ELRO estate (Claeys and Coffin, 1995; Dutton, 1998; Kane and Carruth, 1981) and presumably earlier given the European colonization of this area of New York in the 1600s. The management of these private homes/parcels was assumed by the National Park Service (NPS) in 1940 at which time additional plantings occurred. The historical interpretive period maintained by the Park Service for VAMA is 1900–38, for FDR is 1941–45, and for ELRO is 1960–62. The cultivated vegetation associated with these interpretive time periods includes a significant number of exotic species and they are an integral component of the preservation for these NHS. By reviewing hundreds of historical archived photographs and historical planting records, a range for the decade of introduction of specific exotics throughout ROVA was determined and if noted, the exact year the species was planted.

Method and materials

STUDY SITE. An exotic plant inventory of the cultural landscape plantings followed by an exotic plant survey of all areas of the estates and an invasive exotic plant assessment of the natural resource areas were conducted in the Summer 2002. At the time, the NPS flora list (Hayes, 1992) for ROVA contained 380 species (native and exotic) known from the cultural landscape and natural areas including herbarium specimens. Because of the volunteer management of the public flower gardens (i.e., no formal recordkeeping from year to year), the thousands of annual and perennial forbs (garden forbs) in these formal gardens were excluded from this study unless they were referenced in the early garden plans (1903 and 1910) and subsequently also found in the flora list, herbarium, or cultural landscape reports (CLRs; years 1981 to 2002). The VAMA Italian garden flora introductions date back to the Bard ownership in 1795, the Hosack and Langdon ownership beginning in 1830, and the Vanderbilt ownership beginning in 1902–03.

Leslie Mehrhoff, a former researcher in the Department of Ecology and Evolutionary Biology and former curator of the George Safford Torrey Herbarium, University of Connecticut was awarded the U.S. Environmental Protection Agency's highest honor in May 2011 earning a Lifetime Achievement Award for his contributions to understanding plant biodiversity. A fund entitled "Leslie J. Mehrhoff, PhD Conservation and Biodiversity Fund" has been established in his honor at the University of Connecticut. A pledge form is available from The University of Connecticut Foundation Inc., ATTN: Annual Giving, 2390 Alumni Drive, Unit 3206. Storrs, CT 06269-3206.

The lead author thanks the late Leslie Mehrhoff, curator of the University of Connecticut George Safford Torrey Herbarium, for his enthusiastic assistance and publications that were essential in identifying closely related species (University of Connecticut, 2010); Ann Rhoads and Tim Block of the Morris Arboretum for their timely publication (2000) of the Flora of Pennsylvania and William S. Curran, Professor of Weed Science at The Pennsylvania State University who sparked the lead author's interest in invasive species during her Master's Degree program in Weed Science in the Department of Crop and Soil Sciences.

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CULTURAL LANDSCAPE INVENTORY.

CLRs, formal garden plans, forest ecology studies (e.g., Auwaerter, 2009; Kane and Carruth, 1981; O'Donnell et al., 1992; Favretti and Rainey, 1988), and herbarium specimens (Hayes, 1992, 2002; ROVA NHS, 2002) were reviewed 1) to establish the relevance of the species to the "historical preservation time periods" for each estate for specific exotic introductions and 2) to find the location of plantings in the cultivated landscape for these NHS.

EXOTIC PLANT SURVEY. Field investigations of the 800-acre complex occurred from 14 May to 29 July 2002 and as necessary to complete the project through the end of Sept. 2002. Plant species that were targeted in the survey were identified from a review of the historical records, the cultural landscape inventory, and two invasive plant lists available at the time depicting 120 exotic plants as "known or potential invaders" of natural areas. The available invasive exotic plant lists were from the NPS (2002) and the Mid-Atlantic Exotic Plant Pest Council (MAEPPC, 2002). Six introduced native species (Mitchell, 1986; New York Flora Association, 1990) that are key species in the preservation time periods for these estates were also included in the survey and assessment. It is important to note, at the time of this study in 2002, New York State did not have a publicly available invasive plant list. However, since then a ranking system for evaluating non-native plant species for invasiveness in New York has been developed and relevant information included in this report (Jordan et al., 2010).

SURVEY METHODOLOGY. The survey methodology was similar to that used in other invasive plant investigations (e.g., Dewey and Anderson, 2004) and typical weed monitoring/ranking methods used in agricultural crop management in Pennsylvania and New York. Year 2000 U.S. Geological Survey true color aerial photographs (Hayes, 2002) were incorporated into the mapping software (Arc View 3.1; Esri, Redlands, CA). The ROVA

sites were divided into 200 × 200-m grids and superimposed on Year 2000 high-resolution color aerial photographs of the six parcels (VAMA, FDR, ELRO, and Top Cottage) further divided into blocks (VAMA—Block A1-H10, etc.), and printed. Site-specific searches were conducted at two scales as single point-in-time observations: 1) the absence or presence of each species for each parcel property and 2) the location within each parcel such as landscape beds, cultivated flower gardens, stone walls, hedgerows, rocky outcrops, riparian areas, open fields, forest edges, dumps, and intermittent streams and ponds. The survey was conducted by extensively walking through each estate until all areas had been visually assessed for the presence of targeted species and detailed field notes recorded (Bravo, 2002). Because of time constraints, recently mowed meadows (formerly crop fields maintained by mowing), inaccessible areas of specific blocks, and the interior flower beds of the FDR, VAMA, and Bellefield public flower gardens that contain thousands of annual and perennial forbs were not inventoried or surveyed. Because more than 400,000 trees were planted on the FDR estate from 1911 to Roosevelt's death in 1945 (Auwaerter, 2009), some exotic silvicultural species were also excluded. Exotic species identifications were made using taxonomic keys (Fernald, 1989; Peterson and McKenny, 1974; Petrides, 1986; Rhoads and Block, 2000; University of Connecticut, 2002), voucher herbarium specimens, identification fact sheets (U.S. Department of Agriculture, 2002), and as needed verification by taxonomic experts familiar with the flora of the region.

TERMS AND DEFINITIONS. For this study, a clear distinction between cultivated and uncultivated exotic plants was made before conducting the survey and assessment based on historical records, FLORA list, herbarium list, and CLRs. Species' abundance within ROVA either in the cultivated or uncultivated landscape

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.4047	acre(s)	ha	2.4711
0.3048	ft	m	3.2808
1.6093	mile(s)	km	0.6214

were defined for the purpose of prioritization in the ROVA invasive species management plan as rare (few individuals only), infrequently occurring (not yet common), frequently occurring, common, and/or widespread throughout and not ranked if no data had been collected. Naturalized is defined as existing, reproducing, and thriving in multiple locations in minimally managed habitats away from cultivation and not associated with any prior cultivated plantings. Lastly, for the purpose of the ROVA invasive species management plan, an invasive plant species is defined as an exotic (and includes “North American native” plant species not native to the ROVA landscape) that has colonized a habitat outside of its historical planting and is reproducing and spreading rapidly or has migrated into ROVA by other means and is displacing native flora in natural resource areas and or is detrimental to the historical preservation of the cultural landscape.

Results and discussion

HISTORICAL RECORDS REVIEW.

Review of available CLRs and other historical estate documents indicated that at least 147 (48% of 308 species) of ROVA's flora were known to be exotic before the start of this study. The last CLRs inventory was reported for FDR by Claeys and Coffin (1995), for VAMA by Glenn (1998), and for ELRO by O'Donnell et al. (1992). The most recent natural resource vascular plant inventories were reported by Rudnicki (1984) and Dutton (1998). The 2002 cultural landscape inventory and natural resource area survey added 16 undocumented exotics to the ROVA flora database bringing the total number of known exotics in the history of ROVA to at least 163.

CULTURAL LANDSCAPE AND NATURAL RESOURCE AREA SURVEY RESULTS. The CLR's review provided a total of 170 species that were searched for in the cultural landscape. The introduction dates/decade for 102 species (96 exotics and 6 introduced natives) are shown in Table 1. The 102 species surveyed for in the cultural landscape, are best described as ornamentals (65), garden forbs (19), common weeds (8), crops (5), groundcovers (3), and aquatics (2). In all, 93% of the species listed in Table 1 were found in the cultural landscape survey. Although the CLRs

provided information on another 68 species known to be present in ROVA at one point in time, they were not listed as invasive plants of concern on available (2002) invasive plant lists and as a means of targeting invasive species of most concern and relevancy to the NPS needs, they were excluded from the natural area assessment. Because of page constraints, 43 species listed on the available exotic plant lists that were surveyed for and not found described as aquatics (7), grasses (6), herbaceous plants (15), shrubs (3), trees (10), and woody/semi-woody vines (2) and the results for the 68 excluded species (surveyed for but not assessed) described as common weeds (38), crops (15), garden forbs (10), and ornamentals (5) are not included in this publication but are available upon request from the lead author as Appendix 1 and 2, respectively.

Relevant to the estates' interpretive period timelines, at least 65 species shown in Table 1 have one or more specimens that were introduced (as plantings or referenced as weeds) during the preservation time periods (1900–62) and even some dating to 1799. In fact, there are several trees, shrubs, and woody vines at ROVA at least 90 years of age. Based on the stem girth and “mature” appearance of some of the larger specimens of chinese trumpetvine (*Campsis grandiflora*), oriental bittersweet (*Celastrus orbiculatus*), wintercreeper (*Euonymus fortunei*), english ivy (*Hedera helix*), ‘Halleana’ japanese honeysuckle [*Lonicera japonica* (a 3-inch-diameter vine was found at the VAMA estate)], virginia creeper (*Parthenocissus quinquefolia*), and ‘Veitchii’ boston ivy (*Parthenocissus tricuspidata*), it is possible some could be the same plantings that James L. Greenleaf, the original architect of the VAMA Italian gardens, specified in the 1903 “Plan No. 63: Diagrams of Plantings for East Half of Gardens” or that Thomas Meehan and Sons suggested in the “1910 Garden Plan prepared for F.W. Vanderbilt Esq., Hyde Park, NY” (Favretti and Rainey, 1988). In fact, of all the exotic species mentioned in the 1903 plan and 1910 plan, only three exotic clematis (*Clematis* sp.) and chinese pear (*Pyrus pyrifolia*) were not documented as having been actually planted and were also not found in cultivation in 2002.

The most frequent landscape shrubs honeysuckle, mock orange,

and burning bush found in the ROVA cultural landscapes have over the years included plantings of several different species and cultivars. There are at least three cultivars of the introduced orange-flowered trumpetvine (*Campsis radicans*) at ROVA—one scarlet or deep-red scraggly bush (perhaps ‘Atropurpurea’ or Crimson Trumpet), the yellow ‘Flava’, and the introduced native orange-flowered vine. There are also at least two distinct cultivars of chocolate vine (*Akebia quinata*) at ROVA—one white and two purple flowering vines. Unfortunately, the available records used to conduct this study are not detailed enough to evaluate any invasive differences at the cultivar level for all species.

INVASIVE PLANT ASSESSMENT FINDINGS. Of the 102 (96 exotics and 6 introduced natives) introduced plant species, eight [three clematis species, chinese pear, bridalwreath spiraea (*Spiraea prunifolia*), thunberg's meadowsweet (*Spiraea thunbergii*), ‘Regal’ bukhara fleecflower (*Polygonum baldschuanicum*), and carolina fanwort (*Cabomba caroliniana*)] are not currently propagated and were not found in the landscape survey. The bukhara fleecflower was noted by Claeys and Coffin (1995) to be at least 50 years old in 1981 before its removal from ELRO. Vanhouttei spiraea (*Spiraea xvanhouttei*) is in cultivation at ROVA, but because of the presence of other similar native spiraeas in the natural resource areas, it was not assessed. All 90 species listed in Table 2 were assessed for the ROVA NHS invasive species management plan and are categorized in the assessment as “cultivated not escaped,” “cultivated and escaped,” or “not known from cultivation and found naturalized.”

CULTIVATED NOT ESCAPED. Thirty-six assessed species cultivated at ROVA (40%), including one introduced native were classified as not invasive within ROVA (Table 2). They are best described as introduced groundcovers (2), introduced garden forbs (1), and the rest [33 (92%)] were introduced as ornamentals. Ten exotic species in this category (28%) were considered invasive or potentially invasive in the 2002 MAEPPC and NPS listings, and 17 exotic species in this category (47%) are categorized as invasive in the 2010 New

Table 1. Year 2002 inventory and survey results for 102 Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY, introduced plants: 96 exotics and 6 introduced natives and their intended historical purpose and period of introduction.

Scientific name	Common name	Reference material: Yr or decade specimen(s) mentioned	Known Planted/introduced since: As mentioned in cultural landscape reports (CLR)	Intended historical purpose: Author assigned value	Found in survey: Singular plantings are denoted by (1)
<i>Acer palmatum</i>	Japanese maple	CLR (1991-2002) ^z	1940 or earlier	Ornamental	Yes
<i>Acer platanoides</i>	Norway maple	CLR (1991-2002)	1984	Ornamental	Yes
<i>Achillea millefolium</i>	Common yarrow	CLR (1991-2002)	1973	Garden Forb	Yes
<i>Ailanthus altissima</i>	Tree-of-heaven	CLR (1991-2002)	1900	Ornamental	Yes
<i>Akebia quinata</i>	Chocolate vine	1903 "Plan No. 63" ^{yy}	1903, 1930, 1991	Ornamental	Yes
<i>Alliaria petiolata</i>	Garlic mustard	CLR (1991-2002)	1984	Weed	Yes
<i>Ampelopsis brevipedunculata</i>	Amur peppervine	CLR (1991-2002)	1960, 2002	Ornamental	Yes in pots only
<i>Anthriscus sylvestris</i>	Wild chervil	CLR (1991-2002)	1960	Garden Forb	Yes
<i>Artemisia vulgaris</i>	Common wormwood	CLR (1991-2002)	1900	Garden Forb	Yes
<i>Asparagus officinalis</i>	Asparagus	CLR (1991-2002)	1940	Crop	Yes
<i>Berberis thunbergii</i>	Japanese barberry	1910 "Garden Plan" ^{xx}	1940, 1960	Ornamental	Yes
<i>Berberis vulgaris</i>	Common barberry	Bravo, 2002 ^w	1978, 1997 or earlier; 2002	Ornamental	Yes (1)
<i>Buddleja davidii</i>	Orange eye butterflybush	CLR (1991-2002)	1995 or earlier ^v , 2002	Ornamental	Yes (1)
<i>Cabomba caroliniana</i>	Carolina fanwort	CLR (1991-2002)	1978 ^v	Aquatic	Not found
<i>Campsis grandiflora</i>	Chinese trumpetvine ^u	1903 "Plan No. 63" ^z = <i>Bignonia grandiflora</i>	No data to confirm 1903, 1995	Ornamental	Yes
<i>Campsis radicans</i>	Orange-flowered trumpetvine (introduced native)	1903 "Plan No. 63" ^z	1900	Ornamental	Yes
<i>Campsis radicans</i>	Yellow-flowered trumpetvine 'Flava' ^s	Bravo, 2002	1995 ^v	Ornamental	Yes (1)
<i>Cardamine impatiens</i>	Narrowleaf bittercress	CLR (1991-2002)	1700-1900	Garden Forb	Yes
<i>Carduus nutans</i>	Musk thistle	Bravo, 2002	2002	Garden Forb	Yes
<i>Celastrus orbiculatus</i>	Oriental bittersweet	1903 "Plan No. 63" ^z	1900	Ornamental	Yes
<i>Centaurea stoebe</i>	Spotted knapweed	CLR (1991-2002)	1991	Weed	Yes
<i>Clematis lanuginosa</i>	Clematis	1903 "Plan No. 63" ^z	No data to confirm 1903	Ornamental	No
<i>Clematis terniflora</i>	Sweet autumn virginibower	1903 "Plan No. 63" ^z	No data to confirm 1903	Ornamental	No
<i>Clematis viticella</i>	Italian leather flower	1903 "Plan No. 63" ^z	No data to confirm 1903	Ornamental	No
<i>Convallaria majalis</i>	European lily of the valley	CLR (1991-2002)	1940	Garden Forb	Yes
<i>Cotinus coggygria</i>	European smoke tree	CLR (1991-2002)	1945	Ornamental	Yes
<i>Cynanchum louiseae</i>	Louise's swallowwort	Bravo, 2002	2002	Weed	Yes
<i>Elaeagnus multiflora</i>	Cherry silverberry	CLR (1991-2002)	1945	Ornamental	Yes (1)
<i>Elaeagnus umbellata</i>	Autumn olive	CLR (1991-2002)	1945	Ornamental	Yes (1)
<i>Eleutherococcus sieboldianus</i>	Five-leaf aralia	CLR (1991-2002)	1945	Ornamental	Yes
<i>Euonymus alatus</i>	Burning bush	CLR (1991-2002)	1945	Ornamental	Yes
<i>Euonymus fortunei</i>	Winter creeper	CLR (1991-2002)	1960, 2002	Ornamental	Yes
<i>Euonymus fortunei</i> Radicans	Winter creeper Radicans	1903 "Plan No. 63" ^z	1960, 1960	Groundcover	Removed in 1960
<i>Euphorbia cyparissias</i>	Cypress spurge	CLR (1991-2002)	1984	Groundcover Garden Forb	Yes (1) Yes

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Table 1. (Continued) Year 2002 inventory and survey results for 102 Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY, introduced plants: 96 exotics and 6 introduced natives and their intended historical purpose and period of introduction.

Scientific name	Common name	Reference material: Yr or decade specimen(s) mentioned	Known Planted/introduced since: As mentioned in cultural landscape reports (CLR)	Intended historical purpose: Author assigned value	Found in survey: Singular plantings are denoted by (1)
<i>Euphorbia esula</i>	Leafy spurge	Bravo, 2002	2002	Garden Forb	Yes
<i>Euphorbia lucida</i>	Shining spurge	Bravo, 2002	2002	Garden Forb	Yes
Forsythia sp.	Forsythia	CLR (1991-2002)	1945	Ornamental	Yes
<i>Ginkgo biloba</i>	Common ginkgo	CLR (1991-2002)	1799	Ornamental	Yes
<i>Gleditsia triacanthos</i>	Common honeylocust	CLR (1991-2002)	1973 or earlier	Ornamental	Yes
<i>Gymnocladus dioica</i>	Kentucky coffee tree (introduced native)	CLR (1991-2002)	1940	Crop	Yes
<i>Hedera helix</i>	English ivy	1903 "Plan No. 63"	1945	Ornamental	Yes
<i>Hedera helix</i> ssp. <i>canariensis</i>	Algerian ivy	1903 "Plan No. 63"	No data to confirm 1903, 2002	Ornamental	Yes
<i>Heliotropium arborescens</i>	Garden heliotrope	CLR (1991-2002)	1989	Garden Forb	Yes
<i>Hemerocallis fulva</i>	Orange daylily	Bravo, 2002	2002	Garden Forb	Yes
<i>Hesperis matronalis</i>	Dames rocket	CLR (1991-2002)	1984	Garden Forb	Yes
<i>Hibiscus syriacus</i>	Rose-of-sharon	Bravo, 2002	1995 or later	Ornamental	Yes (1)
Hosta sp.	Plantain lily	CLR (1991-2002)	1998	Garden Forb	Yes
<i>Hypericum perforatum</i>	Common st. johnswort	Bravo, 2002	2002	Garden Forb	Yes
<i>Iris pseudacorus</i>	Paleyellow iris	CLR (1991-2002)	1940	Garden Forb	Yes
<i>Laburnum anagyroides</i>	Golden chain tree	Bravo, 2002	1995 or later	Ornamental	Yes (1)
<i>Ligustrum japonicum</i>	Japanese privet	CLR (1991-2002)	1945 (recorded as "sharp-leaved privet")	Ornamental	Yes
<i>Ligustrum obtusifolium</i>	Border privet	1910 "Garden Plan"; CLR (1991-2002)	1945	Ornamental	Yes
<i>Ligustrum ovalifolium</i>	California privet	CLR (1991-2002)	1945	Ornamental	Yes
<i>Ligustrum vulgare</i>	European privet	CLR (1991-2002)	1945	Ornamental	Yes
<i>Lonicera japonica</i>	Japanese honeysuckle	1903 "Plan No. 63" 'Halleana'; Bravo, 2002	No data to confirm 1903, 1960, 2002	Ornamental	Yes
<i>Lonicera morrowii</i>	Morrow's honeysuckle	1910 "Garden Plan"	1945	Ornamental	Yes
<i>Lonicera tatarica</i>	Tatarian honeysuckle	CLR (1991-2002)	1945	Ornamental	Yes
<i>Lonicera xylosteoides</i>	European fly honeysuckle	CLR (1991-2002)	1950	Ornamental	Yes
<i>Lythrum salicaria</i>	Purple loosestrife	CLR (1991-2002)	1930	Garden Forb	Yes
<i>Magnolia tripetala</i>	Umbrella magnolia	CLR (1991-2002)	1930	Ornamental	Yes
<i>Morus alba</i>	White mulberry	CLR (1991-2002)	1940	Ornamental	Yes
<i>Ornithogalum umbellatum</i>	Star of Bethlehem	CLR (1991-2002)	1978 or earlier	Garden Forb	Yes
<i>Parthenocissus quinquefolia</i>	Virginia creeper (introduced native)	1903 "Plan No. 63"	1945	Ornamental	Yes
<i>Parthenocissus tricuspidata</i>	Boston ivy	CLR (1991-2002)	1945	Ornamental	Yes
<i>Parthenocissus tricuspidata</i> Veitchii	Boston ivy Veitchii	1903 "Plan No. 63"	No data to confirm 1903	Ornamental	No
<i>Philadelphus coronarius</i>	Sweet mock orange	1910 "Garden Plan"	1940, 1960	Ornamental	Yes
<i>Philadelphus inodorus</i>	Scentless mock orange	CLR (1991-2002)	1960	Ornamental	Yes

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Table 1. (Continued) Year 2002 inventory and survey results for 102 Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY, introduced plants: 96 exotics and 6 introduced natives and their intended historical purpose and period of introduction.

Scientific name	Common name	Reference material: Yr or decade specimen(s) mentioned	Known Planted/introduced since: As mentioned in cultural landscape reports (CLR)	Intended historical purpose: Author assigned value	Found in survey: Singular plantings are denoted by (1)
<i>Phragmites australis</i>	Common reed	CLR (1991-2002)	1978	Weed	Yes
<i>Physocarpus opulifolius</i>	Atlantic ninebark (introduced native)	CLR (1991-2002)	1945	Ornamental	Yes
<i>Polygonum baldschuanicum</i>	Bukhara fleecflower	CLR (1991-2002)	1930, 1981	Ornamental	No. (1) Removed since 1981
<i>Polygonum cuspidatum</i>	Japanese knotweed	Bravo, 2002	1980 or later	Weed	Yes
<i>Pyrus pyrifolia</i>	Chinese pear	1910 "Garden Plan"	No data to confirm	Ornamental	No
<i>Rhamnus cathartica</i>	Common buckthorn	CLR (1991-2002)	1984	Ornamental	Yes
<i>Rhodotypos scandens</i>	Jetbead	CLR (1991-2002)	1995	Ornamental	Yes
<i>Robinia pseudoacacia</i>	Black locust	CLR (1991-2002)	1700-1900	Crop	Yes
<i>Rosa foetida</i>	Austrian briar	CLR (1991-2002)	1995	Ornamental	Yes
<i>Rosa multiflora</i>	Multiflora rose	CLR (1991-2002)	1945	Crop(wildlife)	Yes
<i>Rosa rugosa</i>	Rugose rose	Bravo, 2002	1960 or earlier, 1995 or earlier, 2002	Ornamental	Yes
<i>Rubus phoenicolasius</i>	Wineberry	CLR (1991-2002)	No data	Crop	Yes
<i>Securigera varia</i>	Crown vetch	Bravo, 2002 ^v	1998 or earlier, 2002	Groundcover	Yes
<i>Sedum sarmentosum</i>	Stonecrop	Bravo, 2002	No data	Weed	Yes
<i>Solanum dulcamara</i>	Climbing nightshade	CLR (1991-2002)	1973	Weed	Yes
<i>Spiraea chamaedryfolia</i> ssp. <i>ulmifolia</i>	Germander meadowsweet	Bravo, 2002	1995 ^v or later	Ornamental	Yes
<i>Spiraea japonica</i>	Japanese meadowsweet	CLR (1991-2002)	1945, 1960	Ornamental	Yes
<i>Spiraea prunifolia</i>	Bridalwreath spiraea	1910 "Garden Plan"	No data to confirm	Ornamental	No
<i>Spiraea thunbergii</i>	Thunberg's meadowsweet	1910 "Garden Plan"	No data to confirm	Ornamental	No
<i>Spiraea xvanhouttei</i>	Vanhouthee spiraea	1910 "Garden Plan"; CLR (1991-2002)	1960, 2002	Ornamental	Unknown
<i>Symphoricarpos albus</i> ssp. <i>albus</i>	Common snowberry (introduced native)	1910 "Garden Plan"	1984	Ornamental	Yes
<i>Syringa reticulata</i>	Japanese tree lilac	CLR (1991-2002)	1995 or earlier	Ornamental	Yes. Killed in a storm in 2002
<i>Syringa vulgaris</i>	Common lilac	Bravo, 2002	2001 or earlier	Ornamental	Yes
<i>Syringa xchinensis</i>	Chinese lilac	CLR (1991-2002)	1945	Ornamental	Yes
<i>Taxus canadensis</i>	Canada yew (introduced native)	CLR (1991-2002)	1945	Ornamental	Yes
<i>Taxus cuspidata</i>	Japanese yew	CLR (1991-2002)	1960	Ornamental	Yes
<i>Tilia xeuropaea</i>	Common linden	CLR (1991-2002)	1995	Ornamental	Yes
<i>Trapa natans</i>	Water chestnut	CLR (1991-2002)	1960	Aquatic	Yes
<i>Tussilago farfara</i>	Coltsfoot	CLR (1991-2002)	1992	Weed	Yes
<i>Ulmus procera</i>	English elm	CLR (1991-2002)	1995	Ornamental	Yes

(Continued on next page)

Table 1. (Continued) Year 2002 inventory and survey results for 102 Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY, introduced plants: 96 exotics and 6 introduced natives and their intended historical purpose and period of introduction.

Scientific name	Common name	Reference material: Yr or decade specimen(s) mentioned	Known Planted/introduced since: As mentioned in cultural landscape reports (CLR)	Intended historical purpose: Author assigned value	Found in survey: Singular plantings are denoted by (1)
<i>Valeriana officinalis</i>	Garden valerian	CLR (1991–2002)	1984	Garden Forb	Yes
<i>Viburnum plicatum</i>	Japanese snowball	CLR (1991–2002)	1945	Ornamental	Yes
<i>Viburnum sieboldii</i>	Siebold arrowwood	1910 “Garden Plan”	1995	Ornamental	Yes
<i>Vinca minor</i>	Common periwinkle	1910 “Garden Plan”	1995	Garden Forb	Yes
<i>Wisteria floribunda</i>	Japanese wisteria	1903 “Plan No. 63”; CLR (1991–2002)	1900, 1945, 1968 ^r , 1995 ^r	Ornamental	Yes

^rCLR = Cultural landscape reports referenced in the literature cited section of this paper (Arwaerter, 2009; Baker and Curray, 1999; Claeys and Coffin, 1995; Dutton, 1998; Riley et al., 1988; Glenn, 1998; Kane and Carruth, 1981; O'Donnell et al., 1992; Rudnicki, 1984) and herbarium specimens (Hayes, 1992, 2002; Roosevelt-Vanderbilt National Historic Site, 2002).
^sJames L. Greenleaf, the original architect of the Vanderbilt Mansion Italian gardens, specified in the 1903 Plan No. 63 “Diagrams of Plantings for East Half of Gardens” (Riley et al., 1988).
^tThomas Meehan and Sons suggested in the 1910 “Garden Plan prepared for F.W. Vanderbilt Esq., Hyde Park, NY” (Riley et al., 1988).
^uPlants were found and first referenced in 2002 cultural landscape survey.
^vThese species were either listed in Roosevelt-Vanderbilt flora records as present but were not found in the 2002 survey or were found in the survey and were clearly established, landscape plantings missed or planted since the last cultural landscape report.
^wJames L. Greenleaf, 1903 Garden plan lists “*Bignonia grandiflora*” which is considered to be *Campsis grandiflora* (Thunb.) K. Schum. “Native to China and Korea, introduced to cultivation in 1800s and received an Award of Merit from the Royal Horticultural Society in 1949” (Raulston and Grant, 1994).
^xOrange-flowered trumpetvine is considered to be *Campsis radicans* (L.) Seem. “Native to southeastern United States (Florida to New Jersey and west to Missouri and Texas) and introduced to European cultivation in 1640” (Raulston and Grant, 1994).
^yYellow-flowered trumpetvine is considered to be *Campsis radicans* ‘Flava’ (Bossé) Rehder. “A color variant selected from the wild before 1842 with clear yellow flowers and received an Award of Merit from the Royal Horticultural Society in 1969” (Raulston and Grant, 1994).
^zThe CLR’s vary in identifying wisteria in the Roosevelt-Vanderbilt formal gardens as Japanese wisteria (*Wisteria floribunda*) and/or Chinese wisteria (*Wisteria sinensis*). Bolded common names indicate this is a native species in New York State (Mitchell, 1988; New York Flora Association, 1990) but not native to the ROVA landscape.

York rankings (Jordan et al., 2010). The vast majority of these exotics are rare or infrequently found in the cultural landscape and for this reason a few ambiguous detections were classified as not invasive now. For example, discarded clippings of chocolate vine were discovered in the compost dump at VAMA—there are only two old growth vines in the ROVA gardens and a 1991 restoration planting of this species elsewhere in ROVA. Other rarities such as common lilac (*Syringa vulgaris*), privet (*Ligustrum* sp.), Japanese spiraea, and the few locations of flower beds containing crown vetch (*Securigera varia*) were in the few instances of a detected escape, best described as abandoned plantings or discarded clippings and were not representative of the other cultural landscape plantings elsewhere in ROVA for the same species. However, the survey did reveal a lost planting (LP) of a five-leaf aralia (*Eleutherococcus sieboldianus*) on Bard Rock. The population was comprised of two to three primary shrubs surrounded by secondary shoots and sprouts numerous enough to form a dense thicket 10 ft wide by 20 ft long. The survey also revealed two juvenile shrubs of another five-leaf aralia planting sprouting adjacent to their regal looking mother plant at the FDR mansion. These shrubs demonstrated the same tendency for their canes to root as was observed for this species in the abandoned hedge on Bard Rock, a feature that was not observed in an old growth aralia bush at the ELRO estate. In 2002, very little information was available to determine if this species has invasive tendencies.

KNOWN FROM CULTIVATION AND ESCAPED. Forty species are present in the cultivated landscape of ROVA (44%), and escapes of the same species were found in uncultivated areas or beyond the intended area of cultivation (Table 2). They are best described as introduced for wildlife (1), groundcover (1), crops (4), garden forbs (14), and the rest [20 (50%)] as ornamentals. In this category, 17 species (43%) were considered invasive or potentially invasive in the 2002 listings and 21 (53%) are ranked in the 2010 New York listing. Tree-of-heaven (*Ailanthus altissima*), the introduced native orange-flowered trumpetvine, oriental bittersweet, honeylocust (*Gleditsia triacanthos*), black locust

Table 2. Year 2002 invasiveness assessment for 90 introduced plants currently found at the Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY: 84 exotics and six introduced native to New York State species and their abundance and invasive listing/ranking in available invasive plant lists.

Scientific name	Common name	Status in 2002 ^z	Status abundance (no. plants found)	Listed on 2002 invasive plant lists	Established in New York Natural Areas and invasiveness ranking ^y
<i>Acer palmatum</i>	Japanese maple	C	Frequent	Yes	M
<i>Acer plantanoides</i>	Norway maple	E	Common	Yes	VH
<i>Achillea millefolium</i>	Common yarrow	E	Frequent	No	Not ranked
<i>Ailanthus altissima</i>	Tree-of-heaven	E	Widespread	Yes	M
<i>Akebia quinata</i>	Chocolate vine	C	Rare (5)	No	M
<i>Alliaria petiolata</i>	Garlic mustard	NCN	Common	Yes	VH
<i>Ampelopsis brevipedunculata</i>	Amur peppervine	E	Rare	Yes	H
<i>Anthriscus sylvestris</i>	Wild chervil	E	Frequent	No	H
<i>Artemisia vulgaris</i>	Common wormwood	NCN	Frequent	Yes	H
<i>Asparagus officinalis</i>	Asparagus	E	Infrequent	No	Not ranked
<i>Berberis thunbergii</i>	Japanese barberry	E	Frequent	Yes	VH
<i>Berberis vulgaris</i>	Common barberry	C	Rare (1)	Yes	M
<i>Buddleja davidii</i>	Orange eye butterfly bush	C	Rare (1)	Yes	L
<i>Campsis grandiflora</i>	Chinese trumpetvine	C	Rare (1)	No	Not ranked
<i>Campsis radicans</i>	Orange-flowered trumpetvine (introduced native)	E	Widespread	No	Not ranked
<i>Campsis radicans</i>	Yellow-flowered trumpetvine 'Flava'	C	Rare (1)	No	Not ranked
<i>Cardamine impatiens</i>	Narrow leaf bittercress	E	Common	Yes	H
<i>Carduus nutans</i>	Musk thistle	NCN	Infrequent	No	Not ranked
<i>Celastrus orbiculatus</i>	Oriental bittersweet	E	Widespread	Yes	VH
<i>Centaurea stoepe</i> ssp. <i>micranthos</i>	Spotted knapweed	NCN	Infrequent	Yes	H
<i>Convallaria majalis</i>	European lily of the valley	E	Not ranked	No	Not ranked
<i>Cotinus coggygria</i>	European smoke tree	E	Rare (2)	No	Not ranked
<i>Cynanchum louiseae</i>	Louise's swallowwort	NCN	Infrequent—4 locations	Yes	VH
<i>Elaeagnus multiflora</i>	Cherry silverberry	C	Rare (1)	No	Not ranked
<i>Eleagnus umbellata</i>	Autumn olive	C	Rare (1)	Yes	VH
<i>Eleutherococcus sieboldianus</i>	Five-leaf aralia	C ^x , LP	Rare (7)	No	Not ranked
<i>Euonymus alatus</i>	Burning bush	E, LP	Frequent	Yes	H
<i>Euonymus fortunei</i>	Winter creeper	C, LP	Rare (2)	Yes	VH
<i>Euphorbia cyparissias</i>	Cypress spurge	NCN	Frequent	No	H
<i>Euphorbia esula</i>	Leafy spurge	C	Infrequent	No	H
<i>Euphorbia lucida</i>	Shining spurge	E	Frequent	No	Not ranked
<i>Forsythia</i> sp.	Forsythia	E	Frequent	No	Not ranked
<i>Ginkgo biloba</i>	Common ginkgo	C	Infrequent	No	Not ranked
<i>Gleditsia triacanthos</i>	Honeylocust	E	Frequent	No	Not ranked
<i>Gymnocladus dioica</i>	Kentucky coffee tree (introduced native)	E	Rare—2 patches	No	Not ranked
<i>Hedera helix</i>	English ivy	C	Infrequent	Yes	M
<i>Hedera helix</i> ssp. <i>canariensis</i>	Algerian ivy	C	Rare (1)	No	Not ranked
<i>Heliotropium arborescens</i>	Garden heliotrope	E	Infrequent	No	Not ranked
<i>Hemerocallis fulva</i>	Orange daylily	E	Common	Yes	L
<i>Hesperis matronalis</i>	Dames rocket	E	Common	No	M
<i>Hibiscus syriacus</i>	Rose-of-sharon	C	Rare (1)	No	Not ranked
<i>Hosta</i> sp.	Plantain lily	E	Common	No	Not ranked
<i>Hypericum perforatum</i>	Common st. johns wort	E	Common	No	L
<i>Iris pseudacorus</i>	Paleyellow iris	E	Common	Yes	H
<i>Laburnum anagyroides</i>	Golden chain tree	C	Rare (1)	No	Not ranked
<i>Ligustrum japonicum</i>	Japanese privet	C	Not ranked	No	Not ranked

(Continued on next page)

Table 2. (Continued) Year 2002 invasiveness assessment for 90 introduced plants currently found at the Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY: 84 exotics and six introduced native to New York State species and their abundance and invasive listing/ranking in available invasive plant lists.

Scientific name	Common name	Status in 2002 ^z	Status abundance (no. plants found)	Listed on 2002 invasive plant lists	Established in New York Natural Areas and invasiveness ranking ^y
<i>Ligustrum obtusifolium</i>	Border privet	C	Not ranked	No	H
<i>Ligustrum ovalifolium</i>	California privet	C	Not ranked	No	L
<i>Ligustrum vulgare</i>	European privet	C	Not ranked	No	M
<i>Lonicera japonica</i>	Japanese honeysuckle	E, LP	Common	Yes	VH
<i>Lonicera morrowii</i>	Morrow's honeysuckle	E	Frequent	Yes	VH
<i>Lonicera tatarica</i>	Tatarian honeysuckle	E	Common	Yes	VH
<i>Lonicera ×xylosteoides</i>	European fly honeysuckle	C	Infrequent	No	U
<i>Lythrum salicaria</i>	Purple loosestrife	E	Common	Yes	VH
<i>Magnolia tripetala</i>	Umbrella magnolia	E	Rare—3 patches	No	Not ranked
<i>Morus alba</i>	White mulberry	E	Rare (3)	Yes	M
<i>Ornithogalum umbellatum</i>	Star of bethlehem	E	Common	Yes	Not ranked
<i>Parthenocissus quinquefolia</i>	Virginia creeper (introduced native)	E	Widespread	No	Not ranked
<i>Parthenocissus tricuspidata</i>	Boston ivy	C	Rare	No	Not ranked
<i>Philadelphus coronarius</i>	Sweet mock orange	E	Frequent	No	Not ranked
<i>Philadelphus inodorus</i>	Scentless mock orange	E	Frequent	No	Not ranked
<i>Phragmites australis</i>	Common reed	NCN	6 locations	Yes	VH
<i>Physocarpus opulifolius</i>	Atlantic ninebark (introduced native)	E	Frequent	No	Not ranked
<i>Polygonum cuspidatum</i>	Japanese knotweed	NCN	18 locations	Yes	VH
<i>Rhamnus cathartica</i>	Common buckthorn	NCN	Widespread	Yes	VH
<i>Rhodotypos scandens</i>	Jetbead	C	Rare (1)	Yes	M
<i>Robinia pseudoacacia</i>	Black locust	E	Widespread	No	VH
<i>Rosa foetida</i>	Austrian briar	C	Rare (1)	No	Not ranked
<i>Rosa multiflora</i>	Multiflora rose	E	Common	Yes	VH
<i>Rosa rugosa</i>	Rugose rose	NCN	Rare	No	M
<i>Rubus phoenicolasius</i>	Wineberry	E	Common	Yes	VH
<i>Securigera varia</i>	Crown vetch	C	Infrequent	Yes	M
<i>Sedum sarmentosum</i>	Stonecrop	NCN	1 location	No	Not ranked
<i>Solanum dulcamara</i>	Climbing nightshade	NCN	Common	No	M
<i>Spiraea chamaedryfolia</i> ssp. <i>ulmifolia</i>	Germander meadowsweet	C	Rare (1)	No	Not ranked
<i>Spiraea japonica</i>	Japanese spiraea	C ^x	Infrequent	Yes	M
<i>Symphoricarpos albus</i> ssp. <i>albus</i>	Common snowberry (introduced native)	E	Common	No	Not ranked
<i>Syringa reticulata</i>	Japanese tree lilac	C	Rare (1)	No	Not ranked
<i>Syringa vulgaris</i>	Common lilac	C, LP	Rare	No	Not ranked
<i>Syringa ×chinensis</i>	Chinese lilac	C	Rare	No	Not ranked
<i>Taxus canadensis</i>	Canada yew (introduced native)	C	Infrequent	No	Not ranked
<i>Taxus cuspidata</i>	Japanese yew	C	Infrequent	No	Not ranked
<i>Tilia ×europaea</i>	European linden	C	Not ranked	No	Not ranked
<i>Trapa natans</i>	Water chestnut	NCN	2 locations	Yes	VH
<i>Tussilago farfara</i>	Coltsfoot	NCN	Not ranked	Yes	M
<i>Valeriana officinalis</i>	Garden valerian	E	Not ranked	No	Not ranked
<i>Viburnum plicatum</i>	Japanese snowball	C	Frequent	No	Not ranked
<i>Viburnum sieboldii</i>	Siebold arrowwood	C	Common	No	M
<i>Vinca minor</i>	Common periwinkle	E, LP	Infrequent	No	M
<i>Wisteria floribunda</i>	Japanese wisteria	C	Infrequent	Yes	M

^zC = cultivated but not escaped; E = cultivated and escaped; NCN = not known from cultivation and found naturalized; LP = found and appears to be a lost planting from a long ago era and not ranked = no data were collected to determine abundance.

^yNew York State Invasiveness Ranks: VH = very high, H = high, M = moderate, L = low, U = unknown (insufficient information) (Jordan et al., 2010).

^xFor the Roosevelt-Vanderbilt National Historic Sites as a whole these were classified as cultivated. Within individual estates however a singular observation of an escape was noted.

Bolded common names indicate this is a native species in New York State (Mitchell, 1988; New York Flora Association, 1990) but not native to the ROVA landscape.

Table 3. Select species present in the cultural landscape of the Roosevelt-Vanderbilt National Historic Sites, Hyde Park, NY, for at least 50–67 years if not longer at the Vanderbilt Mansion and Bark Rock (VAMA); Home of Franklin D. Roosevelt, Springwood Viewshed parcel and Bellefield estate (FDR); the Home of Eleanor Roosevelt and FDR’s Top Cottage Retreat (ELRO).

Scientific name	Common name	Cultivated (C) ^z vs. cultivated escaped (E) ^y		
		14(C) vs. 20(E)	17(C) vs. 17(E)	11(C) vs. 13(E)
		VAMA	FDR	ELRO
<i>Acer palmatum</i>	Japanese maple	C	C	<u>C</u>
<i>Acer plantanoides</i>	Norway maple	E	E	<u>E</u>
<i>Ailanthus altissima</i>	Tree-of-heaven	E	E	<u>E</u>
<i>Akebia quinata</i>	Chocolate vine	C	C	— ^x
<i>Berberis thunbergii</i>	Japanese barberry	E	E	E
<i>Campsis radicans</i>	Orange-flowered trumpetvine (introduced native)	E	E	—
<i>Celastrus orbiculatus</i>	Oriental bittersweet	E	E	<u>E</u>
<i>Cotinus coggygria</i>	European smoke tree	<u>C</u>	E	C
<i>Eleutherococcus sieboldianus</i>	Five-leaf aralia	<u>C</u>	E	C
<i>Euonymus alatus</i>	Burning bush	E	<u>C</u>	E
<i>Euonymus fortunei</i>	Wintercreeper	C	C	—
<i>Forsythia</i> sp.	Forsythia	<u>E</u>	<u>C</u>	<u>E</u>
<i>Ginkgo biloba</i>	Common ginkgo	<u>C</u>	—	—
<i>Gleditsia triacanthos</i>	Honeylocust	E	—	—
<i>Gymnocladus dioicus</i>	Kentucky coffee tree (introduced native)	E	E	<u>C</u>
<i>Hedera helix</i>	English ivy	C	C	<u>C</u>
<i>Hedera helix</i> ssp. <i>canariensis</i>	Algerian ivy	C	—	—
<i>Hibiscus syriacus</i>	Rose-of-sharon	—	—	C
<i>Ligustrum japonicum</i>	Japanese privet	C	—	—
<i>Ligustrum obtusifolium</i>	Border privet	E	C	<u>C</u>
<i>Ligustrum ovalifolium</i>	California privet	—	C	—
<i>Ligustrum vulgare</i>	European privet	C	E	—
<i>Lonicera japonica</i>	Japanese honeysuckle	E	E	E
<i>Lonicera morrowii</i>	Morrow’s honeysuckle	E	E	—
<i>Lonicera tatarica</i>	Tatarian honeysuckle	E	E	E
<i>Lonicera</i> × <i>xylosteoides</i>	European fly honeysuckle	C	C	<u>C</u>
<i>Magnolia tripetala</i>	Umbrella magnolia	E	E	—
<i>Morus alba</i>	White mulberry	E	E	E
<i>Parthenocissus tricuspidata</i>	Boston ivy	—	C	<u>C</u>
<i>Philadelphus</i> sp.	Mock orange species	E	E	<u>E</u>
<i>Physocarpus opulifolius</i>	Atlantic ninebark	E	<u>E</u>	—
<i>Robinia pseudoacacia</i>	Black locust	E	<u>E</u>	<u>E</u>
<i>Rosa foetida</i>	Austrian briar	—	C	—
<i>Rosa multiflora</i>	Multiflora rose	E	E	E
<i>Spiraea chamaedryfolia</i> ssp. <i>ulmifolia</i>	Germander spiraea	C	—	—
<i>Spiraea japonica</i>	Japanese meadowsweet	<u>C</u>	C	<u>E</u>
<i>Symphoricarpos albus</i> ssp. <i>albus</i>	Common snowberry (introduced native)	E	—	—
<i>Syringa reticulata</i>	Japanese tree lilac	—	C	—
<i>Syringa</i> × <i>chinensis</i>	Chinese lilac	—	C	—
<i>Taxus cuspidata</i>	Japanese yew	<u>C</u>	C	—
<i>Viburnum plicatum</i>	Japanese snowball	—	C	<u>C</u>
<i>Wisteria floribunda</i>	Japanese wisteria	C	C	<u>C</u>

^zCultivated not escaped. If underlined, this indicates the specimen was present in the cultural landscape and appeared to be of the age of similar 50- to 67-year-old specimens but the age of the planting was not recorded.

^yEscaped from cultivation. If underlined, this indicates the specimen was present in the cultural landscape and appeared to be of the age of similar 50- to 67-year-old specimens but the age of the planting was not recorded.

^xSpecimen not present in the cultural landscape for this estate.

Bolded common names indicate this is a native species in New York State (Mitchell, 1988; New York Flora Association, 1990) but not native to the ROVA landscape.

(*Robinia pseudoacacia*), and the introduced native virginia creeper are widespread (Table 2) in the natural resource areas with introductions dating

from 1900 to 1910 (Table 1). Burning bush, japanese barberry, morrow’s honeysuckle, tatarian honeysuckle, sweet mock orange (*Philadelphus coronarius*),

multiflora rose, and wine berry (*Rubus phoenicolasius*) are infrequent to common invaders (depending on estate) of the ROVA natural resource areas

(Table 2) with introductions dating from 1940 to 1945 (Table 1). While most are clearly escapes from cultivation and rampant (japanese barberry), quite a few old-growth shrubs can be classified as LPs such as the single, impressive, 6-ft-tall burning bush found at Bard Rock and another old growth shrub under the arched-bridge over Crum Elbow creek.

NOT KNOWN FROM CULTIVATION AND FOUND NATURALIZED. Fourteen exotic species (16%) were not associated with past or present cultivation in the landscape or formal gardens (Table 2) and based on location are assumed to have migrated into the parcels from adjoining properties, the railroad, the Hudson River, or via adjacent roadways. These species are best described as common weeds (8), garden forbs (3), ornamentals (2), and aquatic (1). Common buckthorn (*Rhamnus cathartica*) and garlic mustard (*Alliaria petiolata*) are widespread in the natural resource areas and it would be difficult to eradicate these two invaders. The time line of introduction for louse's swallowwort (*Cynanchum louiseae*) and japanese knotweed (*Polygonum cuspidatum*) is documented in the ROVA flora and are considered recent invaders. There were no CLR's or other historical documentation to suggest that common buckthorn was ever planted in the cultural landscape. Also, it is not possible to determine if the garden forbs in this category were purposefully introduced at ROVA as plantings or were considered common weeds at the time referenced. Nine species in this category (NCN) were included on the regional exotic invasive plant lists and 12 species were included in the 2010 NY ranking. It is important to note that in our study, 71% of the species excluded from the natural resource area invasive assessment (Appendix 2) could also be classified as common weeds or garden forbs but were for unknown reasons not listed as exotic plants of concern on the NPS and MAEEPC invasive plant lists. An invasive assessment of these species within ROVA was not determined in our 2002 study.

Conclusions

The intensity and extent of propagule pressure may be the single most

important determinant of invasive plant establishment (Von Holle and Simberloff, 2005) and this is clearly evident within ROVA. The invasive assessment revealed that the most widespread naturalized families at ROVA are the trumpetvine, bitter-sweet, pea, buckthorn, quassia, and grape all of which are prolific seed producers. The invasion of woody shrubs into closed canopy forests of the mid-Atlantic region of the United States is well advanced (Ehrenfeld, 1997) and although not yet common, species (families) such as atlantic nine bark (Rosaceae), burning bush (Celastraceae), forsythia (Oleaceae), japanese barberry (Berberidaceae), mock orange species (Philadelphaceae), morrow's honeysuckle, and tatarian honeysuckle (Caprifoliaceae) are well on their way to becoming so in the ROVA natural resource areas. Daehler (1998) found plant families with the highest naturalization levels globally were the pea, grass, and aster families (Fabaceae, Poaceae, and Asteraceae, respectively). Pemberton and Liu (2009) reported members of the arum, dogbane, mulberry, olive, spurge, and vervain families (Araceae, Apocynaceae, Moraceae, Oleaceae, Euphorbiaceae, and Verbenaceae, respectively) can be just as prevalent.

The contrasting results between these four studies emphasize the importance of specifying the landscape level (e.g., local, regional, national, or global) under consideration before interpreting and applying survey data and invasiveness assessment. That is because occurrences of escapes from cultivation vary by collection, by estate, by species, over time and one can infer, by management. By estate, and for the subset of assessed species found in cultivation for more than 50 years, slightly more species had escaped from cultivation at the VAMA and ELRO estates relative to non-escapes. However, at the FDR estate, the number of escaped vs. non-escaped species from cultivation was the same (Table 3). A comprehensive approach to evaluating the unique flora composition (crops, weeds, ornamentals, garden forbs, and aquatics) biodiversity, and nativity as well as a clear understanding of the historical significance and value of exotic trees, shrubs, and vines on display in the cultural landscape is recommended when developing future exotic plant inventories, surveys,

and natural area assessments at historical sites. The species-specific results of this study by estate (Bravo, 2002) are being used by the ROVA NHS to implement its invasive species management plan for the natural resource areas within ROVA. The lead author (MAB) has used a similar "100 plus club," "50 plus club," "25 plus club," "10 plus club," and "five plus club" grouping of exotics of concern to assist the Pennsylvania Invasive Species Council and the general public in understanding the history of the purposeful (aquatic, crop, common weed, garden forb, or ornamental) or unintentional introduction (invader) of exotic plants into Pennsylvania.

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