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Inventory of Non-Native Species: Final Report Submitted to the USDA Forest Service, Shawnee National Forest

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Summary

With continued introductions and spread, Non-Native Invasive Species (NNIS) are an ever-growing problem that threatens biodiversity of remaining natural areas in the landscape. A first step in addressing this problem is to identify the species that are present and determine their geographic locations so that managers can make sound and cost-effective decisions. The goal of this study was to catalogue NNIS in the Shawnee National Forest and surrounding landscape within the 11 southernmost counties of Illinois. We used existing records from herbaria, literature, and informants to compile a database that can then be queried for geographic, date of record, and general habitat information. We compiled a total of 8728 records representing 603 species in 345 genera from 93 plant families. The majority of the records (86%) were extracted from the herbaria of SIUC (40%), the Illinois Natural History Survey (INHS: 38%) and the Forest Service (8%). The top species in terms of records was *Lonicera japonica* (Japanese honeysuckle), a widespread and aggressive invader in many native communities. No tree or shrub species were in the top ten, and most species in general had few records. Of the 786 records we attempted to spatially resolve, we were able to determine locations within 2 km for 68% of them, making this a valuable and worthwhile exercise for pinpointing potential hotspots of invasion. Despite limitations and biases associated with these data collection methods, the NNIS database provides a valuable resource for investigating the occurrence of NNIS across the southern Illinois region.

Introduction

Non-native (alien, exotic) plant species are one of the biggest threats to the biodiversity of natural areas. To assist in management there is a need to compile data on the occurrence of non-native species. A number of programs to document non-native have been initiated such as the Global Invasive Species Information Network (GISIN, Simpson, 2004), the Global Organism Detection and Monitoring System (www.niiss.org), the IABIN Invasives Information Network, or 13N (http://www.iabin-us.org/projects/i3n/i3n_project.html), and NISBase and aquatic species database (http://www.nisbase.org/nisbase/index.jsp). Recent assessment report more than 300 existing non-native species datasets in the United States (Crall *et al.*, 2006), however, these programs do not currently include data from Illinois.

The number of non-native plant taxa in Illinois has been increasing rapidly in the last 150 years, with the latest estimate standing at 969 taxa, approximately 31% of the known species (Mohlenbrock, 2002). Earlier studies reported far fewer non-natives, 440 before 1922 but then rising to 811 by 1981 (Henry & Scott, 1981). Recent surveys suggest that non-natives account for 9% of the ground cover of forests statewide, with a non-native being the dominant ground cover species in 26% of forests surveyed (Spyreas *et al.*, 2004).

In the southern region of Illinois, the most common non-native species in the forest ground layer include *Rosa multiflora* (Multiflora rose), *Lonicera japonica* (Japanese honeysuckle), and *Lysimachia nummularia* (Moneywort) (Spyreas *et al.*, 2004). The full extent of non-native species invasion into the Shawnee National Forest is unknown. It is clear, however, that many non-native species are spreading and

compromising the native biodiversity. A list of 26 of the most problematic are provided by Olsen et al, (2004). Of these, some such as Japanese honeysuckle are long-established and generally regarded as being naturalized. Detailed research has been conducted on only a few, e.g., *Microstegium vimineum* (stilt grass) (Gibson *et al.*, 2002) and *Dioscorea oppositifolia* (Chinese Yam) (Thomas *et al.*, 2005a; Thomas *et al.*, 2006).

In this report, we present findings from a survey of non-native species. The objective of the study was to begin an inventory of Non-Native Invasive Species (NNIS) of plants in the Shawnee National Forest. To address this objective, we sought to establish a base inventory of known records of NNIS in the counties of southern Illinois in which the Shawnee National Forest occurs. This report is an update of the Preliminary Report on this project submitted in 2005 (Gibson & Battaglia, 2005).

Methods

We first drew up a master list of NNIS from Mohlenbrock's (2002) Flora, retaining NNIS listed as occurring in the southern counties of Illinois (Alexander, Gallatin, Hardin, Jackson, Johnson, Massac, Pope, Pulaski, Saline, Union, and Williamson; Fig 1). This list is available at: (http://www.science.siu.edu/plant-biology/Invasives/index.html). NNIS were defined as those species list by Mohlenbrock as being non-native to the southern counties of Illinois. These species include plants introduced from outside of the United States as well as plants introduced or

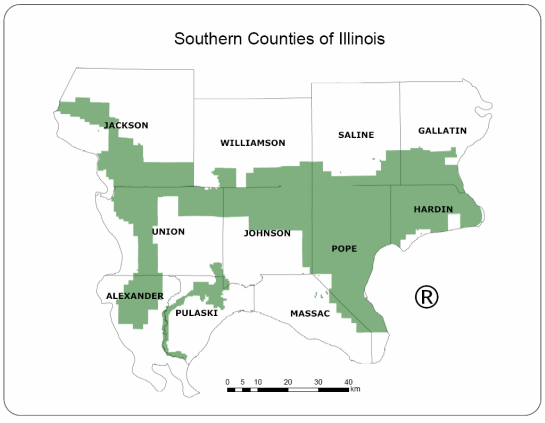

Figure 1. Map of 11 southern Illinois counties included in this study.

expanding their range from outside of the southern Illinois region. NNIS were also included in the master list where their distribution across the state was uncertain. We did not distinguish between records of species that are planted and those that are escaped from cultivation. The master list was updated with additions as they became known from subsequent investigations of herbaria and literature. Additional NNIS not on the master list were included as they were encountered. Nomenclatural synonymy was rectified according to the National Plants Database (USDA NRCS., 2005).

The Southern Illinois University Carbondale (> 250,000 specimens) and Illinois Natural History Survey (> 230,000 specimens) herbaria were searched for records of NNIS using the master list as a starting point. Label information of NNIS from the herbaria of the US Forest Service and Shawnne National Forest were obtained and entered into the database.

Records of NNIS from the Illinois Critical Trends Assessment Program (CTAP) surveys of 1997 – 2004 were searched online (http://ctap.inhs.uiuc.edu/data/data.asp) and verified by CTAP Staff (Greg Spyreas).

A project website was established (http://www.science.siu.edu/plant-biology/Invasives/index.html). The website provides background to the project, the master list of NNIS, a shorter list of 21 high priority NNIS (Appendix 1: established following recommendations from Steve Hupe, USDA Forest Service, Shawnee National Forest), informant forms, and links to other relevant websites.

Available literature was searched for records of NNIS. This search included 30 published journal articles, unpublished agency reports, and university theses and dissertations (Appendix 2).

A list of 38 potential experts (informants) was drawn up (Table 1). Each informant was contacted in May – June 2005 by email, letter or telephone and asked for information on NNIS in the study area. A follow up request was sent to non-respondents two months later. Several were reminded verbally too. The informants were directed to the project website to access the master list of NNIS and a shorter list of high priority NNIS. Forms were available for downloading on the website to assist informants with recording their observations. Copies of the forms were sent directly by mail to some of the informants that we knew did not have internet access. This service was offered to all informants. The SIUC Human Subjects Committee approved the involvement of informants for this study.

The database was entered and compiled in Microsoft Excel. Data for each record were entered into one of 25 fields (Appendix 2). In many cases, additional information was provided in the notes included with a record that could be used to determine more accurate geographical locations for the specimen. For a subset of these records that were in the top ten in the database, we extracted the information and used www.topozone.com to find locations on map. We used a system of resolution categories based on the estimated accuracy of the point. The Point category was considered to be almost exact (Range: 0 – 20m). All CTAP records were in the point category because coordinates had been recorded for each specimen. The Radius category indicated points in which our estimates were likely very close to the collection point (Range: 20m – 2km). The range of the Scene category was 2 – 8km, and the range of the Area category was 8 – 16km. In cases where we could not glean any additional information from the record, we recorded

the resolution at the County level. The database can be searched or summarized according to these fields. In this report we illustrate some important aspects of these data.

Table 1. List of informants contacted for information on NNIS.

Informant Name	Occupation, organization
Dr. Roger Anderson	Professor, Illinois State University
Dr. Clark Ashby	Emeritus Professor, SIUC
Scott Ballard	Natural Heritage Biologist, District 23, IDNR
Dr. Michael Baltz	Southern Illinois Projects Director, The Nature Conservancy
Dr. Mark Basinger	Assistant Professor, Barton College, NC
Dr. Loretta Battaglia	Assistant Professor, SIUC
Alice Brandon	Forest Preserve Project Director Friends of the Park, Chicago.
Shibi Chandy	Graduate Student, SIUC
Mike Delong	Graduate Student, SIUC
Dr. Joe Ely	Assistant Professor, CMSU, Missouri, Former graduate student, SIUC
Tracy Evans	Ecosystem Administrator, IDNR
Dr. Jim Fralish	Emeritus Professor, SIUC
Dr.David Gibson	Professor, SIUC
Dr.John Groninger	Associate Professor, SIUC
Dr.Yohanes Honu	Former graduate student, SIUC
Dr.Erik Hoyer	Former graduate student, SIUC
Max Hutchison	Retired FS botanist

Bob Lindsay	Natural Heritage Biologist, District 24
Mike Mibb	Herbarium curator, SIUC
Dr.Beth Middleton	Research Ecologist, USGA Wetlands Res Cntr
Richard Miller	District Conservationist, USDA-NRCS
Dr. Dan Nickrent	Professor, SIUC
Archana Pandy	Graduate Student, SIUC
Dr. Phil Robertson	Emeritus, Professor, SIUC
Dr.Charles Ruffner	Associate Professor, SIUC
John Schwegman	Retired IDNR botanist
Jody Shimp	IDNR
Elizabeth Shimp	Botanist, Shawnee National Forest, Vienna/Elizabethtown Ranger District
Greg Spyreas	Botanist, IL Nat. Hist Survey
Ellen Starr	USDA-NRCS
Paul Suchecki	Former, Graduate Student, SIUC
Jif Thomas	Graduate Student, SIUC
Chuck Walker	Graduate Student, SIUC
Natalie West	Graduate Student, SIUC
Dr. K Andrew West	Former Site Superintendent of Trail of Tears State Forest
Jim White	Private Consultant
Dr. Jim Zaczek	Associate Professor, SIUC

Results

We compiled a total of 8728 records (Table 2) representing 603 species in 345 genera from 93 plant families (Appendix 4). The majority of the records (86%) were extracted from the herbaria of SIUC (40%), the Illinois Natural History Survey (INHS: 38%) and the Forest Service (8%). Critical Trends Assessment Program (CTAP) data, provided to us by INHS, were also included. Although CTAP data represent relatively few records (~ 4%), they contain specific locations, including lat/long data, and are therefore very valuable for pinpointing problem spots. Records from the literature include published data in the primary literature, as well as information from unpublished theses and reports. The source with the fewest records is the Informant category. Despite repeated requests and reminders, response to our requests for information has been poor. Further, we received no unsolicited responses to our NNIS website.

Table 2. NNIS Records obtained by source.

Source	Number of NNIS records
Herbaria	
INHS	3285
SIUC	3465
US Forest Service, SNF	728
CTAP	344
Literature (from 30 sources consulted)	818
Informants (from 6 respondents of 36 contacted)	88
Total	8728

The most abundant plant families based upon number of records were the Poaceae (1864 records), Fabaceae (1034), Asteraceae (616), Brassicaceae (583), and Lamiaceae (522), with 88 other families each having less than 500 records. The most abundant

genera were *Trifolium* (316 records), *Bromus* (299), *Lonicera* (255), *Rumex* (255), and *Poa* (247), with 341 other genera being represented by less than 200 records each. Based on a tally of the number of records by species, we compiled a list of the top ten NNIS (Table 3) of which *Lonicera japonica* was top with the greatest number of records (207). The top ten group constituted approximately 15% of the records (i.e., 1325 records of 8728) and represented six of the 93 different plant families. Growth form varied, but no shrubs or trees were in this group. In addition to these top ten NNIS, eleven other species comprised > 1 % of the records (i.e., > 87 records, in descending order these were: *Rosa multiflora, Allium vineale, Commelina communis*, *Daucus carota, Trifolium pretense, Veronica arvensis, Barbarea vulgaris, Rumex crispus, Stellaria media, Dianthus armeria,* and *Rumex acetosella*). Of these species with > 1 % of the records, only *Lonicera japonica*, *Dioscorea oppositifolia*, *Schedonorus phoenix* (syn. *Festuca arundinacea), Melilotus officinalis*, and *Rosa multiflora* were also members of the priority list provided to us by USDA Forest Service (Appendix 1).

Table 3. Top ten NNIS, ranked by number of records.

Invasive Species	Number of Records	% of Records	Family	Growth Form
Lonicera japonica	207	2.4	Caprifoliaceae	Vine
Melilotus officinalis	158	1.8	Fabaceae	Forb
Bromus racemosus	138	1.6	Poaceae	Graminoid
Prunella vulgaris	137	1.6	Lamiaceae	Forb
Echinochloa crus-galli	131	1.5	Poaceae	Graminoid
Schedonorus phoenix	125	1.4	Poaceae	Graminoid
Dioscorea oppositifolia	117	1.3	Dioscoreaceae	vine
Poa pratensis	108	1.2	Poaceae	Graminoid
Dactylis glomerata	104	1.2	Poaceae	Graminoid
Achillea millefolium	100	1.1	Asteraceae	Forb

The oldest records were specimens of *Marrubium vulgare* and *Salvia splendens* collected from Jackson and Union counties, respectively, from 1870. Other records from that era included specimens of *Cirsium virginianum, Glechoma hederacea, Melissa officinalis, Ruta graveolans,* and *Veronica serpyllifolia,* all collected in 1871. Six of the oldest records of the top ten species were from the 1930s, with the oldest record being for *Prunella vulgaris* (1878), and the most recent oldest record being for *Dioscorea oppositifolia* (1966) (Table 3). The earliest records for species on the Forest Service priority list (Appendix 1) dated from 1927 (*Trifolium campestre*) through to 1988 (*Alliaria petiolata*).

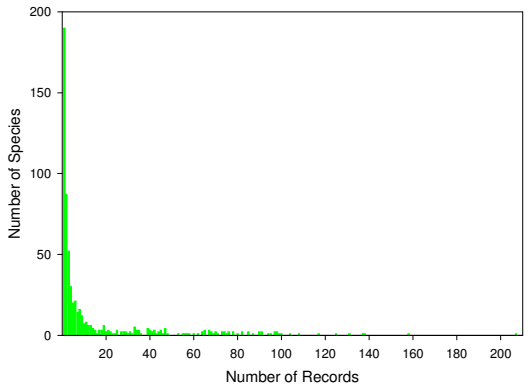

Figure 2. Frequency distribution of NNIS with respect to number of records.

The frequency distribution of species according to number of records was highly skewed. The majority of NNIS were represented in the database by few records (190 species by a single record), while a comparatively small group of NNIS had the bulk of records (Figure 2). Of the counties in southern Illinois, Jackson County had the largest number of records (2700), followed by Union (1239), Pope (1037), and Johnson (765) (Figure 3). Jackson County also had the largest number of NNIS (396), followed by Union (199) and Pope (172) (Figure 4). *Lonicera japonica*, which had the largest number of records of all NNIS, was the most frequent record in Pope, Union, Hardin and Johnson, and Saline counties. *Schenodorus phoenix*, another

member of the top ten, was most often recorded in Jackson County (29 records), and then in Hardin and Pope counties (17 records each) (Figure 5).

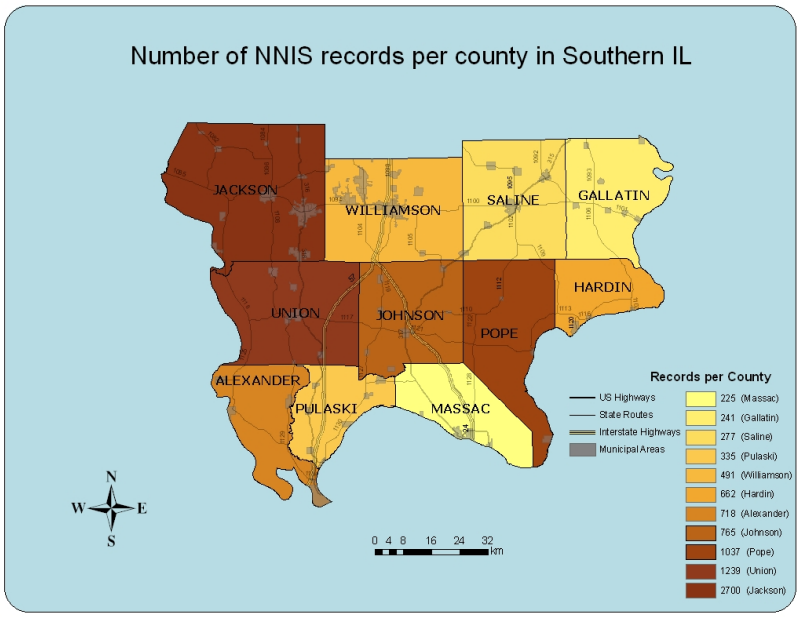

Figure 3. Number of records of NNIS by county in southern Illinois.

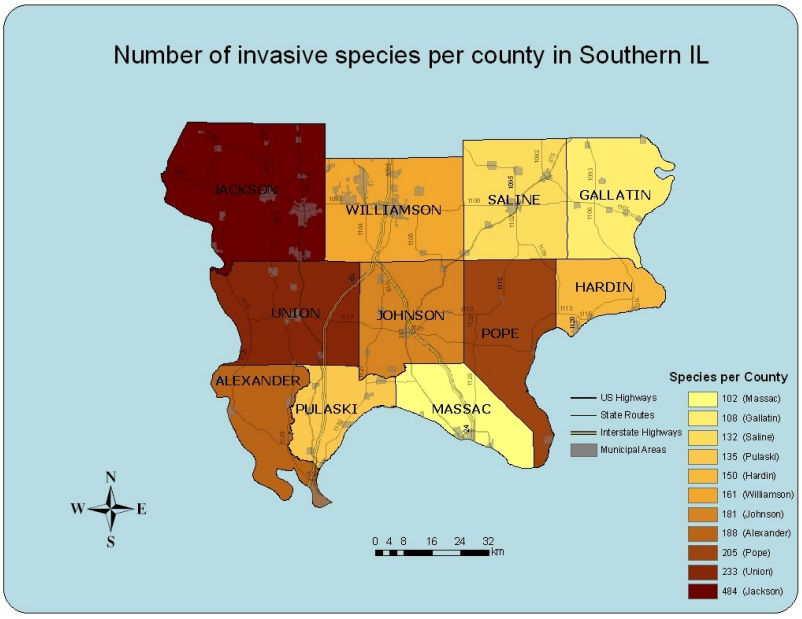

Figure 3. Number of NNIS by county in southern Illinois.

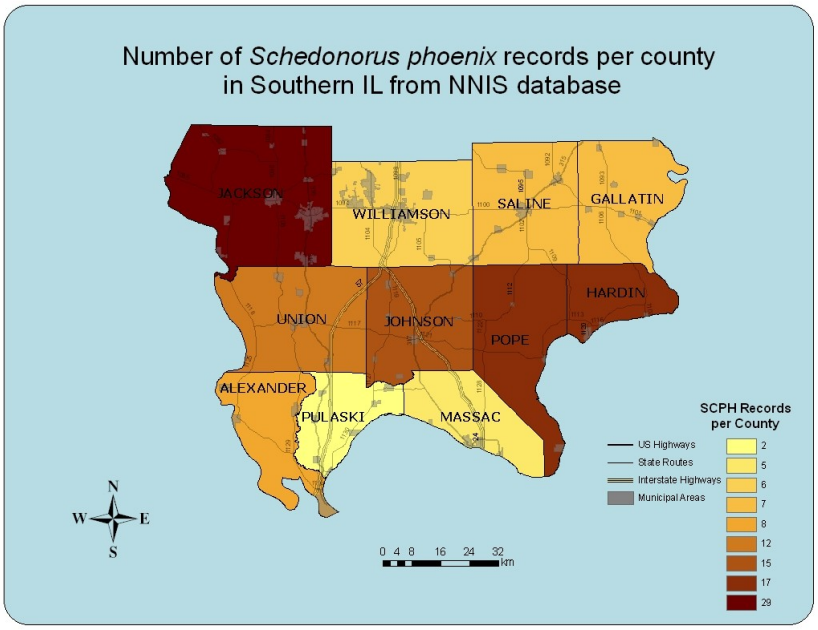

Figure 5. Distribution of *Schenodorus phoenix* in southern Illinois.

We determined the resolution category for 786 records in the top 10 NNIS (Fig 6). Of the 786 records, 186 were in the Point category (mostly from CTAP records). We placed 323 records in the Radius category, 223 in the Scene category, and 29 in the Area category. Twenty-four records could not be resolved beyond the County level of

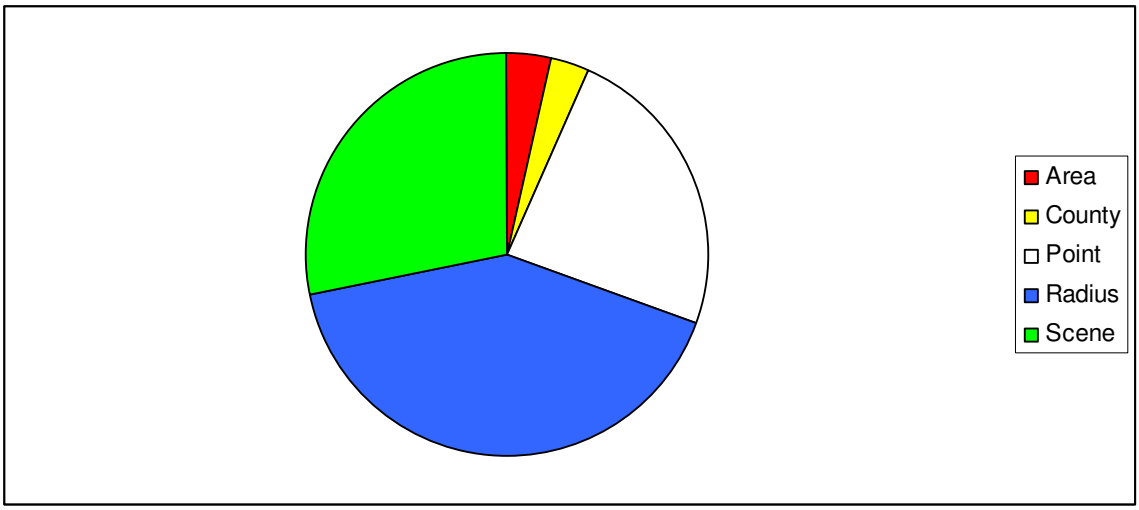

Figure 6. Spatial resolution categories for 786 records of top ten NNIS.

resolution. Overall, we were able to place 65 % of completed records within 2 km of their collection point.

Discussion

The 8728 records of NNIS (Table 2) indicate a substantial population of invasive species in southern Illinois. The 604 species of NNIS in the database for southern Illinois represents 19% of the 3,134 vascular species reported for the entire state (Mohlenbrock, 2002); and presumably represents an even higher proportion of the known flora for southern Illinois alone, but less than the 30% (969 NNIS species) reported for the entire state. Compared with other areas, 19% is comparable to the Great Smoky Mountains where 17 – 21% of the vascular flora is represented by NNIS, although much less than than reported for the worst affected areas globally such as the Hawaii Volcanoes (64%, Vitousek, 1988). The records for southern Illinois represent 66% of the 969 non-natives reported for the entire state (Mohlenbrock, 2002). Data collection is incomplete as we would expect to obtain many more records of NNIS from additional literature sources and additional verbal reports from informants that would increase these figures.

At this point, we do not have exact geographic coordinates for most NNIS records, so we do not know how many of these are from within the boundary of the Shawnee National Forest. Nevertheless, it is clear that the NNIS are unevenly distributed across the region. The majority of records and species are from Jackson and Union counties and likely reflects large numbers of planted ornamentals around Carbondale, and local collecting by students and staff at Southern Illinois University Carbondale.

The records of NNIS were strongly unimodal and skewed (Fig 1), with 31% of the species being limited to a single record. This distribution reflects the general axiom that most non-native species that are introduced to a new area, either accidentally or deliberately, fail to establish and spread (Rejmánek *et al.*, 2005). Nevertheless, 57 species had 50 or more records. The top ten most frequent NNIS records were from a diverse group of species including grasses, forbs, and vines from 6 plant families (Table 3).

The origin of these 10 species reflect agricultural introductions (*Dactylis glomerata, Melilotus officinalis, Poa pratensis, Schedonorus phoenix*), ornamental introductions (*Dioscorea oppositifolia, Lonicera japonica*), and widespread agricultural weeds (*Bromus racemosus, Echinochloa crus-galli, Prunella vulgaris*). *Achillea millefoium* (number 10 on top ten list), is a circumboreal species represented in North America by both native and introduced phases. The database contains records of both *A. millefolium* var. *occidentalis* (introduced, 4 records) and var. *millefolium* (native, 32 records) with the other 62 records in which the variety is not determined. It will be informative to interrogate our database in detail to look for patterns of life history, phylogenetic origin, and mode of introduction in relation to occurrence. There is only limited overlap between the most frequent NNIS in our database (Table 3) and the list of 21 most-problematic NNIS provided to us by the USDA Forest Service (Appendix 1). Only *Lonicera japonica*, *Dioscorea oppositifolia*, *Schedonorus phoenix,* and *Melilotus officinalis*, are common to both lists, with *Rosa multiflora* being included when we consider species with > 1% of the total records. Qualitative presence/absence records that form the basis of our database may underestimate the abundance of a species in the field; a locally abundant species may be represented by a single herbarium specimen, for

example. The few records for high profile NNIS such as *Ailanthus altissima, Carduus nutans, Pueraria lobata, Vinca minor,* and *Wisteria sinensis* (all < 20 records) suggests a degree of under-reporting of some NNIS. Systematic surveys of the occurrence of these NNIS across the region similar to those conducted for *Alliaria petiolata*, *Celastrus orbiculatus*, and *Dioscorea oppositifolia* (see Appendix 2) would be warranted.

Two of the most frequent records were for two vines, *Lonicera japonica* (Japanese honeysuckle) and *Dioscorea oppositifolia* (Chinese yam). Both are known to be problematic in southern Illinois (Spyreas *et al.*, 2004; Thomas *et al.*, 2005a; Thomas *et al.*, 2005b; West, 2005; Yates *et al.*, 2004). Whilst the largest number of records of *L. japonica* was from Pope County, it is widespread through the region, including within the Shawnee National Forest.

This survey has limitations. To provide a more complete assessment of NNIS in the Shawnee National Forest the following additional work is recommended:

- Obtain more verbal records from informants (response so far has been poor).
- Survey more literature (only 30 sources checked so far).
- Work out accurate geographic locations for each record where possible (i.e., 'point' and 'radius' locations such that we are confident within 20 m and 2 km, respectively, where the record is from). This information has been established for only 584 and 474 records, respectively. Obtaining these locations for records is a very difficult and time-consuming task given the incomplete location information provided for many records.
- Determine which records are from within the boundary of the Shawnee National Forest (only possible to the extent that the geographic information allows).

- Determine which species are invasive versus records from ornamental plantings.
- Assign a habitat type to each record (e.g., oak forest, grassland, trail).

Herbarium-based records (the majority of our records), including collection bias and temporal trends in collections, impose limitations on interpretation and conclusions that can be made from these types of data for reconstructing the spread of NNIS (Delisle *et al.*, 2003). As qualitative records (i.e., presence/absence for the most part), these data provide only limited information on the abundance of NNIS. Despite these caveats, datasets such as these allow floristic changes related to the spread of NNIS to be documented (e.g., Woods *et al.*, 2005). The database that we have built on NNIS provides a valuable resource for investigating the occurrence of NNIS across the southern Illinois region.

Acknowledgements

We thank Yohanes Honu and Laura Shirley for time spent in entering data and organizing the database, the informants who responded to our survey, Ken Robertson at the INHS and Greg Spyreas with CTAP for providing access to their data, and the USDA Forest Service for providing funding.

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Appendices

Appendix 1. USDA Forest Service Priority List of NNIS.

USDA CODE	SCIENTIFIC NAME	COMMON NAME	Number of records	Date of oldest record
AIAL	*Ailanthus altissima*	Tree-of-heaven	15	1931
ALPE4	*Alliaria petiolata*	Garlic Mustard	55	1988
BRTE	*Bromus tectorum*	Cheatgrass	60	1947
CANUL2	*Carduus nutans*	Nodding or Musk Thistle	11	1957
CHAL7	*Chenopodium album*	Lambsquarter	65	1930
CIVU	*Cirsium vulgare*	Bull Thistle	22	1931
SEVA4	*Securigera varia* (syn. *Coronilla varia*	Crown Vetch	18	1949
DIOP	*Dioscorea oppositifolia (batatas)*	Chinese Yam	117	1968
ELUM	*Elaeagnus umbellata*	Autumn Olive	78	1970
SCPH	*Schedonorus phoenix* (syn. *Festuca arundinacea/elatior*)	Tall Fescue	125	1952
LECU	*Lespedeza cuneata*	Sericea Lespedeza	75	1947
LOJA	*Lonicera japonica*	Japanese honeysuckle	207	1930
LOMA6	*Lonicera maackii*	Amur Honeysuckle	34	1975
MEOF	*Melilotus officinalis* (syn. *M. alba*)	Yellow Sweet Clover	158	1931
MIVI	*Microstegium vimineum*	Eulalia, Japanese Grass	42	1967
PULO	*Pueraria lobata*	Kudzu	19	1952
ROMU	*Rosa multiflora*	Multiflora	99	1949

SOHA	*Sorghum halepense*	Rose johnsongrass	82	1931
TRCA5	*Trifolium campestre*	Low Hop Clover	82	1927
VIMI2	*Vinca minor*	Periwinkle	13	1938
WISI	*Wisteria sinensis*	Chinese wisteria	1	1947

Appendix 2. Literature Sources used in compiling the NNIS database.

Source code number	Citation	Comments
1.	Mohlenbrock and Voigt. 1957. Contributions to the flora of Southern Illinois, Rhodora, 59: 125-128.	
2.	Mohlenbrock *et al.* 1962. Additions to the flora of Illinois, Rhodora, 64: 356-358.	
3.	Mohlenbrock & Evans. 1974. Illinois field and herbarium studies, Rhodora, 76: 459-470.	
4.	Mohlenbrock & Evans 1972. Illinois field and herbarium studies, Rhodora, 74: 142-151.	
5.	Stookey *et al.* 1964. Primary aquatic succession and floristics of Devil's Kitchen Lake, Illinois, Castanea, 29:150-155.	
6.	Cox, D.R. 2005. Documentation of occurrence of Garlic Mustard in eight Southern Illinois counties	IDNR Report.
7	Basinger, M.A. 2001. Distribution of *Dioscorea oppositifolia* L. (Chinese yam) in Illinois.	IDNR Report.
8.	McCall, R.K. & D. J. Gibson. 1999. The regeneration potential of a threatened southern Illinois shale barren. Journal of Torrey Botanical Society, 126: 226-233.	
9.	Spyreas, G., Gibson, D. J., & M. Basinger. 2001. Endophyte infection levels of native and naturalized fescues in Illinois and England. Torrey Botanical Society, 128: 25-34.	
10.	Environmental Consequences, Lusk Creek Watershed Analysis.	Forest Service report provided by Elizabeth Shimp.
11.	Lusk Creek Watershed Analysis: Botany Section.	Forest Service report provided by Elizabeth Shimp.
12.	Shimp, J.P. (1996). Vegetation analysis and vascular floras of three research natural areas (RNAs) Barker Bluff, Dennison Hollow, and Panther Hollow in southeastern Illinois. M.S. Thesis, Southern Illinois University at Carbondale, Carbondale, Illinois.	Thesis
13	Adams, E.D. (1999). Vegetation analysis and examination of beta diversity at Burke Branch and Ozark Hill Prairies Research Natural Areas in the Shawnee National Forest. M.S. Thesis, Southern Illinois University at Carbondale, Carbondale, Illinois.	Thesis
14	Grahame, A. (1996). The vegetation of Cavehill,	Thesis

	Stoneface, and Whoopie Cat Mountain Research Natural Areas in the Shawnee National Forest. M.S., Southern Illinois University at Carbondale, Carbondale.	
15	Suchecki, P.F. (1999). Vegetation analysis and succession at LaRue-Pine Hills/Otter Pond research natural area, Union County, Illinois. Southern Illinois University, Carbondale. M.S, University of Southern Illinois, Carbondale, Illinois.	Thesis.
16	Beyerl, T. 2001. Habitat and life history characteristics of *Dioscorea oppositifolia,* an invasive plant species in Southern Illinois.	Thesis.
17	Tracey, Evans. 2005. Informant notes	
18	Fessel, K. E. 2003. Effects of sedimentation, hydrology, and light intensity on the emergence of seedlings in a *Taxodium distichum* swamp.	Dissertation; see the dissertation for the map of the study site.
19	Campbell, J. E. & D. J. Gibson. 2001. The effects of exotic species transported via horse dung on vegetation along trail corridors. Plant Ecology, 157: 23-35.	See Campbell's MS Thesis for the map of the study site.
20	Basinger, M. 1994. Plant species distribution in Bald Cypress Swamps along the Cache River in southern Illinois.	Thesis.
21	Nash, K. E. 1991. The flora of Degognia Canyon, Jackson and Randolph counties.	Thesis.
22	Jones, K. A. 1990. A Survey of the flora of Big Creek Glade at Whoopie Cat Mountain RNA	Thesis. This is a small RNA in the SNF; location not provided.
23	Smith, R. G. 1988. A floristic survey of Jackson Hollow.	Thesis. #s in the note section of the spreadsheet are voucher specimen #s. Duplicate specimens were deposited in the herbarium at SIU & Carthage College, Kenosha, WI.
24	Ulaszek, E. F. 1988. The vascular flora of Devils Kitchen Lake Area, Williamson and Union Counties, Illinois.	Thesis. Voucher specimens were deposited in the herbarium at Illinois State Natural History, Champaign, Illinois.
25	Heikens, A. N. 1991. Classification of natural forest openings in Southern Illinois.	Dissertation.
26	Williams, C.L. 2005. Inventory of *Celastrus orbiculatus* invasions in southern Illinois.	Report to IDNR
27	Osborne, T.L. & Steffen, B.J. 2005. Occurrences of Garlic Mustard (*Alliaria petiolata*) in Eleven	Report to IDNR

	southern Illinois Counties 2005.	
28	Gibson, D.J., Adams, E.D., Ely, J.S., Gustafson, D.J., McEwen, D., & Evans, T.R. 2000. Eighteen years of herbaceous layer recovery of a recreation area in a mesic forest. *Journal of the Torrey Botanical Society,*127: 230-239.	
29	Ashby, W.C. & Weaver, G.T. 1970. Forest regeneration on two old fields in Southwestern Illinois. *American Midland Naturalist* 84: 90-104.	
30	Middleton, B.A. 2003. Soil seed banks and the potential restoration of forested wetlands after farming. *Journal of Applied Ecology* 40: 1025-1034. AND Middleton, B.A. 1995. *The role of flooding in seed dispersal: Restoration of Cypress swamps along the Cache river, IL*. Final Report to Water Resources Center, Urbana, IL.	

Appendix 3. Field codes in NNIS database. Empty cells in the database occur when information for a field code is not applicable for a record.

Field code	Explanation
Accession number	Herbarium accession number
Family	Plant Family
Genus	Plant Genus
Species	Plant specific epithet
Authority	Nomenclatural authority for species.
Plant Code	USDA database code. Plant codes ending in '99' are for names not in the USDA database
Subspecific epithet	Subspecies if applicable
Subspecific authority	Nomenclatural authority for subspecies if applicable.
Cultivar	Cultivar/race/variety if applicable.
Collector	Person/people who collected the specimen.
Collector number	Collectors' personal record number.
Date	Year plant observed in the field.
Determined by	Name of person assigning name to record if different to original collector of a herbarium specimen.
T/R/S	Township/range/section
Easting UTM	Universal Transverse Locator longitude zone 16 coordinate
Northing UTM	Universal Transverse Locator latitude coordinate
Lat / Long	Latitude and longitude
Resolution	Accuracy of location information: Point: 0 – 20 m, Radius: 20 m – 2 km, Scence: general location, 2 km – 8 km, Area: very broadly defined and centered around a landmark, 8 – 16 km, County: no location information apart from county.
County	Southern Illinois county in which plant was observed growing.
Locality	Details on location of the record.
Habitat	Information on the biotic and abiotic environment.
Source	Type of record: herbarium (SIUC, INHS, FS), CTAP, informant record, or literature record (numbered by source: Appendix 3.).
Synonym	Plant name on original record if different
Notes	Any other pertinent information

Appendix 4. Complete list of NNIS recorded from all sources in the southern counties of Illinois (Alexander, Gallatin, Hardin, Jackson, Johnson, Massac, Pope, Pulaski, Saline, Union, and Williamson counties). Where a subspecies or variety is not given then none was indicated in the original record.

Family	Species name	Subspecific epithet	Authority	Plant Code	Total
Aceraceae	*Acer campestre*		L.	ACCA5	1
	Acer ginnala		Maxim.	ACGI	3
	Acer palmatum		Thunb.	ACPA2	2
	Acer platanoides		L.	ACPL	2
Aceraceae Total					8
Acoraceae	*Acorus calamus*		L.	ACCA4	1
Acoraceae Total					1
Agavaceae	*Yucca filamentosa*		L.	YUFI	8
	Yucca flaccida		Haw.	YUFL2	3
	Yucca glauca	var. glauca	Nutt.	YUGLG2	2
Agavaceae Total					13
Amaranthaceae	*Amaranthus arenicola*		I. M. Johnston	AMAR	2
	Amaranthus blitoides		S. Wats.	AMBL	2
	Amaranthus caudatus		L.	AMCA3	1
	Amaranthus cruentus		L.	AMCR4	4
	Amaranthus hybridus		L.	AMHY	45
	Amaranthus retroflexus		L.	AMRE	31
	Amaranthus spinosus		L.	AMSP	21
Amaranthaceae Total					106
Amaryllidaceae	*Leucojum aestivum*		L.	LEAE	1
Amaryllidaceae Total					1
Anacardiaceae	*Cotinus coggygria*		Scop.	COCO10	3
	Toxicodendron pubescens		P. Mill	TOPU2	1

Anacardiaceae Total					4
Apiaceae	*Conium maculatum*		L.	COMA2	11
	Daucus carota		L.	DACA6	97
	Pastinaca sativa		L.	PASA2	3
	Torilis arvensis		(Huds.) Link	TOAR	9
	Torilis japonica		(Houtt.) DC.	TOJA	45
Apiaceae Total					165
Apocynaceae	*Vinca major*		L.	VIMA	1
	Vinca minor		L.	VIMI2	13
Apocynaceae Total					14
Aquifoliaceae	*Ilex crenata*		Thunb.	ILCR2	1
	Ilex montana		Torr. & Gray ex Gray	ILMO	1
Aquifoliaceae Total					2
Araceae	*Arum italicum*		P. Mill.	ARIT	4
	Dieffenbachia seguine		(Jacq.) Schott	DISE7	1
	Spathiphyllum sp.		Schott	SPATH	1
Araceae Total					6
Araliaceae	*Hedera helix*		L.	HEHE	1
Araliaceae Total					1
Asteraceae	*Achillea millefolium*	var. millefolium	L.	ACMIM2	32
	Ambrosia trifida	var. texana	L.	AMTRT	13
	Anthemis arvenis		L.	ANAR6	1
	Anthemis cotula		L.	ANCO2	29
	Arctium minus		Bernh.	ARMI2	24
	Artemisia annua		L.	ARAN3	44
	Artemisia biennis		Willd.	ARBI2	3
	Artemisia ludoviciana		Nutt.	ARLU	1
	Carduus nutans		L.	CANU4	11
	Centaurea cyanus		L.	CECY2	5
	Centaurea diffusa		Lam.	CEDI3	1
	Centaurea solstitialis		L.	CESO3	2
	Centaurea stoebe	ssp. micranthos	L.	CESTM	8

	Cichorium intybus		L.	CIIN	16
	Cirsium arvense		(L.) Scop.	CIAR4	2
	Cirsium virginianum		(L.) Michx.	CIVI	1
	Cirsium vulgare		(Savi) Ten.	CIVU	22
	Coreopsis grandiflora	var. grandiflora	Hogg. ex Sweet	COGRG	4
	Coreopsis tinctoria	ssp. tinctoria	Nutt.	COTIT	1
	Cosmos bipinnatus		Cav.	COBI2	1
	Crepis pulchra		L.	CRPU3	5
	Dyssodia papposa		(Vent.) A.S. Hitchc.	DYPA	1
	Erigeron tenuis		Torr. & Gray	ERTE7	2
	Galinsoga quadriradiata		Cav.	GAQU	3
	Helianthus annuus		L.	HEAN3	8
	Hypochaeris glabra		L.	HYGL2	1
	Lactuca saligna		L.	LASA	12
	Lactuca serriola		L.	LASE	78
	Leucanthemum vulgare		Lam.	LEVU	85
	Matricaria discoidea		DC.	MADI6	3
	Matricaria recutita		L.	MARE6	7
	Sonchus arvensis		L.	SOAR2	1
	Sonchus asper		(L.) Hill	SOAS	18
	Tagetes patula		L.	TAPA	1
	Tanacetum vulgare		L.	TAVU	3
	Taraxacum laevigatum		(Willd.) DC.	TALA2	6
	Taraxacum officinale		G.H. Weber ex Wiggers	TAOF	73
	Tragopogon dubius		Scop.	TRDU	10
	Tragopogon lamottei		Rouy	TRLA30	2
	Xanthium spinosum		L.	XASP2	1
Asteraceae Total					616
Berberidaceae	*Berberis julianae*		Schneid.	BEJU3	2
	Berberis thunbergii		DC.	BETH	6
Berberidaceae Total					8
Betulaceae	*Alnus glutinosa*		(L.) Gaertn.	ALGL2	3

	Betula pendula		Roth	BEPE3	3
Betulaceae Total					6
Bignoniaceae	*Catalpa bignonioides*		Walt.	CABI8	8
	Catalpa bignonioides Total				8
Bignoniaceae Total					8
Boraginaceae	*Buglossoides arvensis*		(L.) I.M. Johnston	BUAR3	27
	Cynoglossum officinale		L.	CYOF	2
	Heliotropium indicum		L.	HEIN	19
	Lithospermum officinale		L.	LIOF	2
Boraginaceae Total					50
Brassicaceae	*Alliaria petiolata*		(Bieb.) Cavara & Grande	ALPE4	55
	Alyssum alyssoides		L.	ALAL3	1
	Arabidopsis thaliana		(L.) Heynh.	ARTH	68
	Armoracia rusticana		P.G. Gaertn., B. Mey. & Scherb.	ARRU4	2
	Barbarea vulgaris		Ait. F.	BAVU	94
	Brassica juncea		(L.) Czern.	BRJU	6
	Brassica napus		L.	BRNA	3
	Brassica nigra		(L.) W.D.J. Koch	BRNI	5
	Brassica rapa	var. rapa	L.	BRRAR	3
	Camelina microcarpa		Andrz. ex DC.	CAMI2	7
	Capsella bursa-pastoris		(L.) Medik.	CABU2	70
	Cardamine hirsuta		L.	CAHI3	76
	Conringia orientalis		(L.) Dumort.	COOR	2
	Descurainia sophia		(L.) Webb ex Prantl	DESO2	2
	Draba verna		L.	DRVE2	44
	Erucastrum gallicum		(Willd.) O.E. Schulz	ERGA	1
	Erysimum repandum		L.	ERRE4	19
	Hesperis matronalis		L.	HEMA3	1
	Lepidium campestre		(L.) Ait. f.	LECA5	11
	Lepidium densiflorum		Schrad.	LEDE	12
	Lunaria annua		L.	LUAN	2
	Microthlaspi perfoliatum		(L.) F.K. Mey.	MIPE8	4

	Raphanus sativus		L.	RASA2	2
	Rorippa sylvestris		(L.) Bess.	ROSY	21
	Sinapis alba		L.	SIAL5	6
	Sinapis arvensis		L.	SIAR4	4
	Sisymbrium altissimum		L.	SIAL2	3
	Sisymbrium officinale		(L.) Scop.	SIOF	10
	Thlaspi arvense		L.	THAR5	35
Brassicaceae Total					583
Buddlejaceae	*Buddleja davidii*		Franch.	BUDA2	1
Buddlejaceae Total					1
Buxaceae	*Buxus microphylla*		Siebold & Zucc.	BUMI5	1
	Buxus sempervirens		L.	BUSE2	3
Buxaceae Total					4
Cactaceae	*Opuntia ficus-indica*		(L.) P. Mill.	OPFI	6
Cactaceae Total					6
Calycanthaceae	*Calycanthus floridus*		L.	CAFL22	3
Calycanthaceae Total					3
Cannabaceae	*Cannabis sativa*	ssp. sativa	L.	CASAS3	3
	Humulus japonicus		Sieb. & Zucc.	HUJA	1
	Humulus lupulus		L.	HULU	11
Cannabaceae Total					15
Capparidaceae	*Cleome hassleriana*		Chod.	CLHA	1
Capparidaceae Total					1
Caprifoliaceae	*Lonicera fragrantissima*		Lindl. & Paxton	LOFR	1
	Lonicera japonica	var. chinensis	Thunb.	LOJA	1
	Lonicera maackii		(Rupr.) Herder	LOMA6	34
	Lonicera sempervirens		L.	LOSE	9
	Lonicera tatarica		L.	LOTA	3
	Lonicera xbella		Zabel	LOBE	1
	Viburnum dentatum		L.	VIDE	2
	Viburnum dilatatum		Thunb.	VIDI80	1
	Viburnum opulus		L.	VIOP	1

Caprifoliaceae Total					259
Caryophyllaceae	*Agrostemma githago*		L.	AGGI	22
	Arenaria serpyllifolia		L.	ARSE2	15
	Cerastium brachypetalum		Desportes ex Pers.	CEBR2	5
	Cerastium fontanum	ssp. vulgare	Baumg.	CEFOV2	4
	Cerastium glomeratum		Thuill.	CEGL2	58
	Cerastium pumilum		W. Curtis	CEPU4	4
	Dianthus armeria		L.	DIAR	90
	Holosteum umbellatum		L.	HOUM	8
	Lychnis coronaria		(L.) Desr.	LYCO	1
	Saponaria officinalis		L.	SAOF4	27
	Silene latifolia		Poir.	SILA21	1
	Stellaria graminea		L.	STGR	2
	Stellaria media		(L.) Vill.	STME2	91
	Vaccaria hispanica		(P. Mill.) Rauschert	VAHI2	2
Caryophyllaceae Total					393
Celastraceae	*Celastrus orbiculatus*		Thunb.	CEOR7	47
	Euonymus alatus		(Thunb.) Sieb.	EUAL13	6
	Euonymus europaeus		L.	EUEU7	1
	Euonymus fortunei		(Turcz.) Hand.-Maz.	EUFO5	17
Celastraceae Total					71
Chenopodiaceae	*Atriplex patula*		L.	ATPA4	1
	Atriplex prostrata		Boucher ex DC.	ATPR	3
	Bassia scoparia		(L.) A.J. Scott	BASC5	1
	Chenopodium album		L.	CHAL7	65
	Chenopodium ambrosioides	ssp. ambrosioides	L.	CHAMA16	1
	Chenopodium botrys		L.	CHBO2	3
	Chenopodium glaucum		L.	CHGL3	2
	Chenopodium murale		L.	CHMU2	1
	Chenopodium polyspermum		L.	CHPO	3
	Chenopodium simplex		(Torr.) Raf.	CHSI2	1
	Chenopodium urbicum		L.	CHUR	1

	Salsola tragus		L.	SATR12	1
Chenopodiaceae Total					138
Clusiaceae	*Hypericum perforatum*		L.	HYPE	39
Clusiaceae Total					39
Commelinaceae	*Commelina communis*		L.	COCO3	98
	Commelina pallida		(blank)	COCO99	1
	Dichorisandra siebertii		Hort.ex L.H.Bailey	DISI99	1
Commelinaceae Total					100
Convolvulaceae	*Convolvulus arvensis*		L.	COAR4	25
	Ipomoea coccinea		L.	IPCO3	4
	Ipomoea hederacea		Jacq.	IPHE	25
	Ipomoea purpurea		(L.) Roth	IPPU2	9
	Ipomoea quamoclit		(L.) Moench.	IPQU	1
Convolvulaceae Total					64
Crassulaceae	*Hylotelephium telephium*	ssp. telephium	(L.) H. Ohba	HYTET2	3
	Sedum sarmentosum		Bunge	SESA	5
Crassulaceae Total					8
Cucurbitaceae	*Cucumis sativus*		L.	CUSA4	1
	Cucurbita pepo	ssp. ovifera	L.	CUPEO	1
	Lagenaria siceraria		(Molina) Standl.	LASI	1
Cucurbitaceae Total					4
Cupressaceae	*Chamaecyparis pisifera*		Sieb. & Zucc.	CHPI12	4
	Cupressus arizonica		Greene	CUAR	1
	Juniperus chinensis		L.	JUCH4	13
	Juniperus conferta		Parl.	JUCO12	2
	Juniperus excelsa		M. Bieb.	JUEX2	4
	Juniperus sabina		L.	JUSA5	4
	Juniperus squamata		D. Don.	JUSQ2	1
	Platycladus orientalis		(L.) Franco	PLOR80	4
Cupressaceae Total					33
Cyperaceae	*Carex complanata*		Torr. & Hook.	CACO9	2
	Carex pendula		Huds.	CAPE45	2

	Cyperus involucratus		Rottb.	CYIN6	1
	Cyperus iria		L.	CYIR	8
	Cyperus virens		Michx.	CYVI2	2
	Rhynchospora latifolia		(Baldw. ex Ell.) Thomas	RHLA7	1
	Schoenoplectus californicus		(C.A. Mey.) Palla	SCCA11	1
	Schoenoplectus mucronatus		(L.) Palla	SCMU10	4
Cyperaceae Total					21
Dioscoreaceae	*Dioscorea convolvulacea*		Cham. & Schldl.	DICO16	3
	Dioscorea densiflora		Hemsl.	DIDE99	1
	Dioscorea lutea		(blank)	DILU99	1
	Dioscorea macrostachya		Benth.	DIMA15	1
	Dioscorea oppositifolia		L.	DIOP	117
	Dioscorea rotundifolia		(blank)	DIRO99	1
	Dioscorea septemloba		Thunb.	DISE99	1
	Tamus communis		L.	TACO99	3
Dioscoreaceae Total					128
Dipsacaceae	*Dipsacus fullonum*		L.	DIFU2	5
	Dipsacus laciniatus		L.	DILA4	2
Dipsacaceae Total					7
Dryopteridaceae	*Olfersia cervina*		(L.) Kunze	OLCE	2
Dryopteridaceae Total					2
Elaeagnaceae	*Elaeagnus angustifolia*		L.	ELAN	5
	Elaeagnus umbellata	var. parvifolia	Thunb.	ELUMP	31
Elaeagnaceae Total					83
Euphorbiaceae	*Chamaesyce geyeri*	var. geyeri	(Engelm. & Gray) Small	CHGEG	2
	Chamaesyce hypericifolia		(L.) Millsp.	CHHY2	2
	Euphorbia cyparissias		L.	EUCY2	8
	Euphorbia heterophylla		L.	EUHE4	2
	Euphorbia marginata		Pursh	EUMA8	3
	Phyllanthus tenellus		Roxb.	PHTE5	1
	Phyllanthus urinaria		L.	PHUR	1
Euphorbiaceae Total					19

Fabaceae	*Albizia julibrissin*		Durazz.	ALJU	13
	Crotalaria spectabilis		Roth	CRSP2	2
	Glycine max		(L.) Merr.	GLMA4	6
	Kummerowia stipulacea		(Maxim.) Makino	KUST	85
	Kummerowia striata		(Thunb.) Schindl.	KUST2	68
	Lathyrus hirsutus		L.	LAHI2	7
	Lathyrus latifolius		L.	LALA4	11
	Lespedeza bicolor		Turcz.	LEBI2	7
	Lespedeza cuneata		(Dum.-Cours.) G. Don	LECU	75
	Lespedeza thunbergii		(DC.) Nakai	LETH4	4
	Lotus corniculatus		L.	LOCO6	10
	Medicago arabica		(L.) Huds.	MEAR	1
	Medicago lupulina	insert blank	L.	MELU	1
	Medicago sativa	ssp. sativa	L.	MESAS	5
	Melilotus lupulina		L.	MELU	5
	Melilotus officinalis		(L.) Lam.	MEOF	158
	Melilotus sp.		P. Mill.	MELIL	2
	Mimosa strigillosa		Torrey & Gray	MIST2	3
	Pueraria montana	var. lobata	(Lour.) Merr.	PUMOL	19
	Robinia hispida		L.	ROHI	2
	Robinia pseudoacacia		L.	ROPS	40
	Securigera varia		(L.) Lassen	SEVA4	18
	Trifolium arvense		L.	TRAR4	7
	Trifolium aureum		Pollich	TRAU2	1
	Trifolium campestre		Schreb.	TRCA5	82
	Trifolium dubium		Sibthorp	TRDU2	10
	Trifolium hybridum		L.	TRHY	39
	Trifolium incarnatum		L.	TRIN3	7
	Trifolium pratense		L.	TRPR2	97
	Trifolium repens		L.	TRRE3	73
	Vicia cracca		L.	VICR	3
	Vicia sativa	ssp. nigra	L.	VISAN2	22

	Vicia villosa	ssp. varia	Roth	VIVIV8	19
	Wisteria sinensis		(Sims) DC.	WISI	1
Fabaceae Total					1034
Fagaceae	*Castanea crenata*		Sieb. & Zucc.	CACR27	3
	Castanea mollissima		Blume	CAMO83	3
	Fagus sylvatica		L.	FASY	1
	Quercus robur		L.	QURO2	2
	Quercus virginiana		P. Mill.	QUVI	1
Fagaceae Total					10
Geraniaceae	*Erodium cicutarium*		(L.) L'Hér. ex Ait.	ERCI6	2
Geraniaceae Total					2
Ginkgoaceae	*Ginkgo biloba*		L.	GIBI2	1
Ginkgoaceae Total					1
Haemodoraceae	*Lachnanthes caroliniana*		(Lam.) Dandy	LACA5	7
	Lophiola aurea		Ker-Gawl.	LOAU	6
Haemodoraceae Total					13
Hamamelidaceae	*Corylopsis pauciflora*		Sieb. & Zucc.	CORYL99	1
Hamamelidaceae Total					1
Hydrangeaceae	*Hydrangea macrophylla*		(Thunb.) Ser.	HYMA7	1
	Hydrangea paniculata		Sieb.	HYPA	1
	Hydrangea quercifolia		Bartr.	HYQU3	1
	Philadelphus coronarius		L.	PHCO7	1
	Philadelphus inodorus		L.	PHIN5	6
Hydrangeaceae Total					10
Hydrocharitaceae	*Egeria densa*		Planch.	EGDE	6
Hydrocharitaceae Total					6
Iridaceae	*Belamcanda chinensis*		(L.) DC.	BECH	9
	Crocus vernus		(L.) Hill	CRVE4	3
	Freesia laxa		(Thunb.) Goldblatt & J.C. Manning	FRLA5	1
	Iris germanica	var. florentina	L.	IRGEF	1
	Iris hexagon		Walt.	IRHE2	1

	Iris missouriensis		Nutt.	IRMI	1
	Iris pseudacorus		L.	IRPS	2
	Iris pumila		L.	IRPU2	1
	Iris verna		L.	IRVE	1
	Sisyrinchium biforme		Bickn.	SIBI	2
	Trimezia glauca		(blank)	TRGL99	1
	Trimezia rupestris		(blank)	TRRU99	1
	Tritonia sp.		Ker-Gawl.	TRIT99	1
Iridaceae Total					29
Juncaceae	*Juncus paradox*		(blank)	JUPA99	1
Juncaceae Total					1
Lamiaceae	*Ajuga genevensis*		L.	AJGE	1
	Ajuga reptans		L.	AJRE	3
	Glechoma hederacea		L.	GLHE2	40
	Lamium amplexicaule		L.	LAAM	65
	Lamium purpureum		L.	LAPU2	57
	Leonurus cardiaca		L.	LECA2	19
	Marrubium vulgare		L.	MAVU	7
	Melissa officinalis		L.	MEOF	1
	Mentha aquatica		L.	MEAQ	7
	Mentha arvensis		L.	MEAR4	6
	Mentha spicata		L.	MESP3	12
	Mentha xgracilis		Sole	MEGR2	2
	Monarda russeliana		Nutt. ex Sims	MORU	40
	Nepeta cataria		L.	NECA2	6
	Perilla frutescens	var. frutescens	(L.) Britt.	PEFRF2	2
	Prunella vulgaris	ssp. vulgaris	L.	PRVU	6
	Pycnanthemum flexuosum		(Walt.) B.S.P.	PYFL	46
	Salvia splendens		Sellow ex Roemer & J.A. Schultes	SASP6	1
	Scutellaria galericulata		L.	SCGA	2
	Stachys palustris		L.	STPA	6

Lamiaceae Total					522
Lardizabalaceae	*Akebia quinata*		(Houtt.) Dcne.	AKQU	9
Lardizabalaceae Total					9
Liliaceae	*Allium ampeloprasum*		L.	ALAM	4
	Allium atroviolaceum		Boiss.	ALAT3	1
	Allium carolinianum		DC.	ALCA99	1
	Allium flavum		L.	ALFL99	1
	Allium sativum		L.	ALSA2	14
	Allium schoenoprasum		L.	ALSC	1
	Allium ursinum		L.	ALUR	2
	Allium vineale		L.	ALVI	98
	Amianthium muscitoxicum		(Walt.) Gray	AMMU	1
	Androstephium caeruleum		(Scheele) Greene	ANCA45	1
	Asparagus officinalis		L.	ASOF	64
	Calochortus gunnisonii		S. Wats.	CAGU	1
	Calochortus nuttallii		Torr. & Gray	CANU3	2
	Clintonia umbellulata		(Michx.) Morong	CLUM2	2
	Convallaria majalis		L.	COMA7	3
	Erythronium grandiflorum		Pursh	ERGR9	1
	Gagea villosa		(Bieb.) Duby.	GAVI9	1
	Hemerocallis fulva		(L.) L.	HEFU	47
	Hosta ventricosa		(Salisb.) Stearn	HOVE	1
	Hyacinthoides nonscripta		(L.) Chouard ex Rothm.	HYNO	2
	Leucocrinum montanum		Nutt. ex Gray	LEMO4	1
	Lilium canadense		L.	LICA3	2
	Lilium candidum		L.	LICA22	1
	Lilium catesbaei		Walt.	LICA4	1
	Lilium martagon		L.	LIMA99	1
	Lilium michauxii		Poir.	LIMI	1
	Lycoris radiata		(L'Hér.) Herbert	LYRA	1
	Maianthemum canadense		Desf.	MACA4	2
	Maianthemum dilatatum		(Wood) A. Nels. & J.F. Macbr.	MADI	1

Maianthemum trifolia		(L.) Sloboda	MATR4	1
Muscari botryoides		(L.) P. Mill.	MUBO	6
Muscari comosum		(L.) P. Mill.	MUCO2	1
Muscari neglectum		Guss. ex Ten.	MUNE	6
Narcissus poeticus		L.	NAPO	12
Narcissus pseudonarcissus		L.	NAPS	19
Ornithogalum umbellatum		L.	ORUM	33
Paris quadrifolia		L.	PAQU	1
Prosartes lanuginosa		(Michx.) D. Don	PRLA9	2
Scilla fraseri		(blank)	SCFR2	2
Smilax auriculata		Walt.	SMAU	1
Smilax laurifolia		L.	SMLA	2
Smilax pumila		Walt.	SMPU	2
Smilax smallii		Morong	SMSM	1
Smilax walteri		Pursh	SMWA	2
Streptopus amplexifolius		(L.) DC.	STAM2	1
Streptopus lanceolatus	var. roseus	(Ait.) Reveal	STLAR	1
Tofieldia calyculata		Wahl.	TOCA99	1
Tofieldia glabra		Nutt.	TOGL	2
Tofieldia pubens		Willd.	TOPU2	1
Tofieldia pusilla		(Michx.) Pers.	TOPU	1
Triantha racemosa		(Walt.) Small	TRRA6	2
Trillium catesbaei		Ell.	TRCA11	1
Trillium stylosum		Nutt.	TRST299	1
Trillium underwoodii		Small	TRUN2	1
Trillium undulatum		Willd.	TRUN	1
Tulipa gesneriana		L.	TUGE	2
Tulipa sylvestris		L.	TUSY	1
Uvularia perfoliata		L.	UVPE	4
Uvularia puberula		Michx.	UVPU2	1
Veratrum album		L.	VEAL3	2
Veratrum parviflorum		Michx.	VEPA3	2

	Zigadenus glaberrimus		Michx.	ZIGL	1
	Zigadenus nuttallii		(Gray) S. Wats.	ZINU	1
	Zigadenus venenosus	var. gramineus	S. Wats.	ZIVEG	1
Liliaceae Total					378
Linaceae	*Linum usitatissimum*		L.	LIUS	1
Linaceae Total					1
Lythraceae	*Lythrum salicaria*		L.	LYSA2	5
Lythraceae Total					5
Magnoliaceae	*Magnolia grandiflora*		L.	MAGR4	1
	Magnolia macrophylla		Michx.	MAMA2	1
	Magnolia purpurea		Curtis	MAPU99	1
	Magnolia tripetala		(L.) L.	MATR	1
Magnoliaceae Total					4
Malvaceae	*Abutilon theophrasti*		Medik.	ABTH	7
	Alcea rosea		L.	ALRO3	2
	Hibiscus syriacus		L.	HISY	4
	Hibiscus trionum		L.	HITR	1
	Malva neglecta		Wallr.	MANE	1
	Sida spinosa		L.	SISP	74
Malvaceae Total					89
Marsileaceae	*Marsilea quadrifolia*		L.	MAQU	3
Marsileaceae Total					3
Molluginaceae	*Mollugo verticillata*		L.	MOVE	47
Molluginaceae Total					47
Moraceae	*Broussonetia papyrifera*		(L.) L'Her. ex Vent.	BRPA4	9
	Maclura pomifera		(Raf.) Schneid.	MAPO	7
	Morus alba		L.	MOAL	42
Moraceae Total					58
Najadaceae	*Najas minor*		All.	NAMI	20
Najadaceae Total					20
Nyctaginaceae	*Bougainvillea sp.*		Comm. ex. Juss.	BOUGA	1
	Mirabilis nyctaginea		(Michx.) MacM.	MINY	29

Nyctaginaceae Total					30
Olacaceae	*Ximenia americana*		L.	XIAM	4
Olacaceae Total					4
Oleaceae	*Forsythia suspensa*		(Thunb.) Vahl	FOSU	2
	Forsythia viridissima		Lindl.	FOVI	1
	Forsythia x intermedia	suspensa x viridissima	Zabel	FOIN3	1
	Jasminum humile		L.	JAHU99	1
	Ligustrum japonicum		Thunb.	LIJA	1
	Ligustrum obtusifolium		Sieb. & Zucc.	LIOB	2
	Ligustrum vulgare		L.	LIVU	3
	Syringa vulgaris		L.	SYVU	3
Oleaceae Total					14
Onagraceae	*Gaura mollis*		James	GAMO5	1
	Oenothera speciosa		Nutt.	OESP2	33
Onagraceae Total					34
Oxalidaceae	*Oxalis corniculata*		L.	OXCO	2
	Oxalis grandis		Small	OXGR	1
Oxalidaceae Total					3
Papaveraceae	*Papaver dubium*		L.	PADU	1
Papaveraceae Total					1
Pinaceae	*Abies concolor*		(Gord. & Glend.) Lindl. Ex Hildebr.	ABCO	5
	Abies homolepis		Sieb. & Zucc.	ABHO	1
	Abies veitchii		Lindl.	ABVE2	4
	Calocedrus decurrens		(Torr.) Florin	CADE27	2
	Cedrus deodora		(Roxb.) G. Don f.	CEDE2	3
	Cedrus libani Total				2
	Larix decidua		P. Mill.	LADE2	1
	Picea abies		(L.) Karst.	PIAB	4
	Picea engelmannii		Parry ex. Engelm.	PIEN	2
	Picea glauca		(Moench) Voss	PIGL	1
	Picea polita		Siebold et Zucc.	PIPO99	1

	Picea pungens		Engelm.	PIPU	6
	Pinus banksiana		Lamb.	PIBA2	2
	Pinus bungeans		Zucc. ex Endl.	PIBU99	1
	Pinus densiflora		Siebold & Zucc.	PIDE2	1
	Pinus echinata		P. Mill.	PIEC2	36
	Pinus flexilis		James	PIFL2	1
	Pinus jeffreyi		Grev. & Balf.	PIJE	1
	Pinus mugo		Turra	PIMU80	2
	Pinus nigra		Arnold	PINI	3
	Pinus ponderosa		P. & C. Lawson	PIPO	2
	Pinus resinosa		Ait.	PIRE	3
	Pinus rigida		P. Mill.	PIRI	3
	Pinus strobus		L.	PIST	15
	Pinus sylvestris		L.	PISY	8
	Pinus taeda		L.	PITA	10
	Pseudotsuga menziesii	var. menziesii	(Mirbel) Franco	PSMEM	4
	Tsuga canadensis		(L.) Carr.	TSCA	8
Pinaceae Total					132
Plantaginaceae	*Plantago lanceolata*		L.	PLLA	76
	Plantago major		L.	PLMA2	11
	Plantago rhodosperma		Dcne.	PLRH	1
Plantaginaceae Total					88
Poaceae	*Aegilops cylindrica*		Host	AECY	3
	Agrostis gigantea		Roth	AGGI2	2
	Alopecurus pratensis		L.	ALPR3	2
	Andropogon repens		(Roxb.) Steud.	ANRE99	1
	Arrhenatherum elatius		(L.) Beauv. ex J. & K. Presl	AREL3	1
	Avena sativa		L.	AVSA	12
	Bothriochloa laguroides	ssp. torreyana	(D.C.) Herter	BOLAT	3
	Bromus arvensis		L.	BRAR5	30
	Bromus hordeaceus	ssp. hordeaceus	L.	BRHOH	2
	Bromus inermis	ssp. pumpellianus	Leyss.	BRINA	1

Bromus racemosus		L.	BRRA2	138
Bromus secalinus		L.	BRSE	21
Bromus sterilis		L.	BRST2	6
Bromus tectorum		L.	BRTE	60
Chloris verticillata		Nutt.	CHVE2	1
Cynodon dactylon		(L.) Pers.	CYDA	32
Dactylis glomerata		L.	DAGL	104
Dichanthelium consanguineum		(Kunth) Gould & C.A. Clark	DICO4	1
Dichanthelium xanthophysum		(Gray) Freckmann	DIXA	4
Digitaria ciliaris		(Retz.) Koel.	DICI	47
Digitaria ischaemum		(Schreb.) Schreb. ex Muhl.	DIIS	67
Digitaria sanguinalis		(L.) Scop.	DISA	42
Digitaria sp. (ischaemum/sanguinalis)		(Schreb.) Schreb. ex Muhl.	DIIS	1
Echinochloa colona		(L.) Link	ECCO2	1
Echinochloa crus-galli		(L.) Beauv.	ECCR	131
Echinochloa frumentacea		Link.	ECFR	2
Eleusine indica		(L.) Gaertn.	ELIN3	71
Elymus repens		(L.) Gould	ELRE4	8
Eragrostis cilianensis		(All.) Vign. ex Janchen	ERCI	65
Eragrostis minor		Host	ERMI5	8
Eragrostis pilosa		(L.) Beauv.	ERPI2	1
Eriochloa contracta		A.S. Hitchc.	ERCO8	6
Festuca brevipila		Tracey	FEBR7	3
Holcus lanatus		L.	HOLA	9
Lolium perenne	ssp. multiflorum	L.	LOPEM2	8
Lolium temulentum		L.	LOTE2	1
Microstegium vimineum		(Trin.) A. Camus	MIVI	42
Miscanthus sinensis		Anderss.	MISI	6
Pascopyrum smithii		(Rydb.) A. Love	PASM	1
Paspalum dilatatum		Poir.	PADI3	2
Pennisetum glaucum		(L.) R. Br.	PEGL2	3

	Phalaris arundinacea		L.	PHAR3	5
	Phalaris canariensis		L.	PHCA5	4
	Phleum pratense		L.	PHPR3	74
	Phragmites australis		(Cav.) Trin. ex Steud.	PHAU7	23
	Poa annua		L.	POAN	53
	Poa arnowiae		Soreng	POAR21	14
	Poa bulbosa		L.	POBU	3
	Poa compressa		L.	POCO	69
	Poa pratensis		L.	POPR	108
	Saccharum ravennae		(L.) L.	SARA3	1
	Schedonorus phoenix		(Scop.) Holub	SCPH	125
	Schedonorus pratensis		(Huds.) Beauv.	SCPR4	45
	Secale cereale		L.	SECE	14
	Setaria faberi		Herrm.	SEFA	87
	Setaria italica		(L.) Beauv.	SEIT	4
	Setaria pumila	ssp. pumila	(Poir.) Roemer & J.A. Schultes	SEPUP2	8
	Setaria viridis	var. major	(L.) Beauv.	SEVIM	4
	Sorghum bicolor	ssp. drummondii	(L.) Moench	SOBID	21
	Sorghum halepense		(L.) Pers.	SOHA	82
	Spartina cynosuroides		(L.) Roth	SPCY	1
	Sporobolus pyramidatus		(Lam.) A.S. Hitchc.	SPPY2	2
	Triticum aestivum		L.	TRAE	9
	Vulpia bromoides		(L.) S. F. Gray	VUBR	1
	Vulpia myuros		(L.) K.C. Gmel.	VUMY	5
	Zea mays		L.	ZEMA	1
	Zoysia japonica		Steud.	ZOJA	1
	Zoysia sp.		Willd.	ZOYSI	1
Poaceae Total					1864
Polygonaceae	*Brunnichia ovata*		(Walt.) Shinners	BROV4	2
	Fagopyrum esculentum		Moench.	FAES2	9
	Polygonum arenastrum		Jord. ex Boreau	POAR11	8
	Polygonum aviculare		L.	POAV	34

	Polygonum caespitosum	var. ?caespitosum	Blume	POCAC4	10
	Polygonum convolvulus	var. convolvulus	L.	POCOC2	16
	Polygonum cuspidatum		Sieb. & Zucc.	POCU6	10
	Polygonum hydropiper		L.	POHY	31
	Polygonum hydropiperoides		Michx.	POHY2	1
	Polygonum orientale		L.	POOR2	5
	Polygonum persicaria		L.	POPE3	28
	Polygonum virginianum		L.	POVI2	1
	Rumex acetosella		L.	RUAC3	90
	Rumex crispus		L.	RUCR	91
	Rumex obtusifolius		L.	RUOB	70
	Rumex patientia		L.	RUPA5	4
Polygonaceae Total					442
Portulacaceae	*Portulaca oleracea*		L.	POOL	17
Portulacaceae Total					17
Potamogetonaceae	*Potamogeton crispus*		L.	POCR3	1
Potamogetonaceae Total					1
Primulaceae	*Anagallis arvensis*		L.	ANAR	5
	Lysimachia nummularia		L.	LYNU	41
Primulaceae Total					46
Ranunculaceae	*Clematis terniflora*		DC.	CLTE4	3
	Consolida ajacis		(L.) Schur	COAJ	7
	Coptis trifolia		(L.) Salisb.	COTR2	1
	Nigella damascena		L.	NIDA	1
	Ranunculus acris		L.	RAAC3	2
	Ranunculus bulbosus		L.	RABU	13
	Ranunculus repens		L.	RARE3	4
	Ranunculus sardous		Crantz	RASA	12
Ranunculaceae Total					43
Rhamnaceae	*Colubrina arborescens*		(P. Mill.) Sarg.	COAR3	1
Rhamnaceae Total					1
Rosaceae	*Agrimonia striata*		Michx.	AGST	2

	Amelanchier canadensis		(L.) Medik.	AMCA4	19
	Chaenomeles japonica		(Thunb.) Lindl. ex Spach	CHJA2	2
	Chaenomeles speciosa		(Sweet) Nakai	CHSP12	5
	Cotoneaster horizontalis		Dcne.	COHO80	1
	Cydonia oblonga		P. Mill.	CYOB2	2
	Duchesnea indica		(Andr.) Focke.	DUIN	8
	Fragaria chiloensis		(L.) P. Mill.	FRCH	3
	Malus prunifolia		(Willd.) Borkh.	MAPR	2
	Malus pumila		P. Mill.	MAPU	4
	Potentilla canadensis		L.	POCA17	1
	Potentilla norvegica	ssp. monspeliensis	L.	PONOM	18
	Potentilla recta		L.	PORE5	43
	Prunus avium		(L.) L.	PRAV	2
	Prunus cerasus		L.	PRCE	2
	Prunus persica		(L.) Batsch	PRPE3	13
	Prunus triloba		Lindl.	PRTR3	1
	Pyracantha coccinea		M. Roemer	PYCO2	3
	Pyrus communis		L.	PYCO	11
	Rosa arkansana	var. suffulta	Porter	ROARS	1
	Rosa canina		L.	ROCA3	1
	Rosa ferruiginea		Vill.	ROFE5	1
	Rosa gallica		L.	ROGA	1
	Rosa multiflora		Thunb. ex Murr.	ROMU	99
	Rubus armeniacus		Focke	RUAR9	1
	Rubus idaeus		L.	RUID	1
	Rubus laciniatus		Willd.	RULA	1
	Rubus ostryifolius		Rydb.	RUOS	2
	Spiraea alba	var. latifolia	Du Roi	SPALL	1
	Spiraea chamaedryfolia		L.	SPCH3	1
	Spiraea japonica		L. f.	SPJA	1
	Spiraea prunifolia		Sieb. & Zucc.	SPPR	7
Rosaceae Total					277

Rubiaceae	*Sherardia arvensis*		L.	SHAR2	3
Rubiaceae Total					3
Rutaceae	*Ruta graveolens*		L.	RUGR3	1
Rutaceae Total					1
Salicaceae	*Populus alba*		L.	POAL7	10
	Populus nigra		L.	PONI	1
	Salix alba		L.	SAAL2	4
	Salix babylonica		L.	SABA2	3
	Salix cordata		Michx.	SACO3	1
	Salix fragilis		L.	SAFR	11
	Salix phylicifolia		(blank)	SAPH	1
Salicaceae Total					31
Sapindaceae	*Cardiospermum halicacabum*		L.	CAHA13	4
Sapindaceae Total					4
Saxifragaceae	*Heuchera americana*	var. hispida	L.	HEAMH2	1
Saxifragaceae Total					1
Scrophulariaceae	*Chaenorhinum minus*		(L.) Lange	CHMI	3
	Kickxia elatine		(L.) Dumort.	KIEL	5
	Linaria vulgaris		P. Mill.	LIVU2	7
	Mazus pumilis		(Burm. f.) Steenis	MAPU7	1
	Paulownia tomentosa		(Thunb.) Sieb. & Zucc. ex Steud.	PATO2	14
	Penstemon fremontii		Torr. & Gray ex Gray	PEFR	2
	Scrophularia nodosa		L.	SCNO2	2
	Verbascum blattaria		L.	VEBL	33
	Verbascum thapsus		L.	VETH	67
	Veronica arvensis		L.	VEAR	95
	Veronica hederaefolia		L.	VEHE99	3
	Veronica polita		Fries.	VEPO	8
	Veronica serpyllifolia		L.	VESE	2
	Veronica sp.		L.	VERON	1
Scrophulariaceae Total					243
Simaroubaceae	*Ailanthus altissima*		(P. Mill.) Swingle	AIAL	15

Simaroubaceae Total					15
Solanaceae	*Datura stramonium*		L.	DAST	41
	Lycium barbarum		L.	LYBA4	6
	Nicandra physalodes		(L.) Scop.	NIPH	3
	Petunia sp.		Juss.	PETUN	1
	Physalis angulata		L.	PHAN5	19
	Physalis longifolia	var. subglabrata	Nutt.	PHLOS	15
	Physalis philadelphica	var. immaculata	Lam.	PHPHI	1
	Solanum dimidiatum		Raf.	SODI	1
	Solanum dulcamara	var. villosissimum	L.	SODUV	1
	Solanum nigrum		L.	SONI	25
	Solanum rostratum		Dunal	SORO	4
Solanaceae Total					138
Tamaricaceae	*Tamarix gallica*		L.	TAGA	1
Tamaricaceae Total					1
Taxaceae	*Taxus baccata*		L.	TABA80	6
	Taxus cuspidata		Sieb. & Zucc.	TACU	9
	Taxus hunnewelliana		Rehd.	TAHU99	2
	Taxus x media		Rehder	TAME2	9
Taxaceae Total					26
Taxodiaceae	*Cryptomeria japonica*		(L. f.) D. Don	CRJA3	3
	Cunninghamia lanceolata		(Lamb.) Hook.	CULA	5
	Metasequoia glyptostroboides		Hu & W. C. Cheng	MEGL8	1
	Taxodium ascendens		Brongn.	TAAS	1
Taxodiaceae Total					10
Typhaceae	*Typha angustifolia*		L.	TYAN	4
Typhaceae Total					4
Ulmaceae	*Ulmus procera*		Salisb.	ULPR	1
	Ulmus pumila		L.	ULPU	1
Ulmaceae Total					2
Verbanaceae	*Verbena officinalis*		L.	VEOF	9
Verbanaceae Total					9

Violaceae	*Viola tricolor*		L.	VITR	1
Violaceae Total					1
Vitaceae	*Ampelopsis aconitifolia*		Bunge	AMCA3	3
Vitaceae Total					3
Zygophyllaceae	*Tribulus terrestris*		L.	TRTE	5
Zygophyllaceae Total					5