
Forest Preserves of Cook County Seed Source Policy and Guidelines

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Need for a Seed Source Policy and Guidelines

Many of the natural areas held by the Forest Preserves of Cook County (FPCC) are altered to the point that management practices like removal of invasive species, burning, and hydrological re-engineering are not sufficient to restore the desired diversity and relative abundances of plant species. Augmentation by planting seeds or other materials¹ of native species is also required to achieve this goal.

Proper selection of seeds can have a major influence on restoration success. Obviously, introduction of species not suited to the site's ecology or not appropriate to the plant community being restored will not achieve the desired outcome. But even if the species is appropriate, the geographic source of the seeds may not be suitable. For example, seeds from geographically or ecologically distant sources may produce plants that are not adapted to local conditions and therefore do not survive; time and money will have been wasted from using these sources. Cultivars and sometimes wild forms from outside the region may be too successful, displacing other native species. If the species being introduced is already present at the site or nearby, plants derived from seeds brought from too far away may not interbreed with the local plants, or if they do interbreed they may sometimes reduce overall reproductive success (the phenomenon of outbreeding depression). Perhaps more often, local populations may have become so small, inbred, or genetically depauperate that use of only locally produced seed results in poor repro-

duction (inbreeding depression). Identification of inbreeding depression may be difficult, but general indicators may include small populations of plants, and failure to produce sufficient viable seed to support on-site restoration activities. Although details likely vary among species, populations of fewer than 100 individuals may be at high risk of inbreeding depression, whereas those with greater than 1,000 unique individuals may be at low risk of inbreeding. Ensuring diverse genetic resources is expected to become increasingly important to address the impacts of climate change on the native flora.

This seed source policy and the accompanying guidelines are needed to maximize the likelihood that augmentation is successful at restoring the desired diversity and relative abundance of native species while protecting native biodiversity at the genetic level and allowing flexibility to adapt to climate change. Specific goals include maintaining local adaptation, avoiding inbreeding and outbreeding depression, and preserving genetic diversity. This policy and guidelines document aims to achieve the stated goals in a cost-effective way. It is also important that they can be applied consistently across a variety of projects undertaken by FPCC staff, contractors, partners, and volunteer stewards. Importantly, site-specific desired outcomes (and definitions of restoration success) are likely to differ, and details about suitable seed sources are likely to vary among sites and species. This document is intended to outline the overarching principles guiding FPCC projects, whereas those more specific details will be provided in site-specific management plans.

¹The same principles apply for all types of plant material. For simplicity, this document will use "seed" to refer to any type of plant material used for augmentation.

Species Selection

When adding seed or other plant material has been deemed necessary to achieve ecological goals, the species chosen must be appropriate to the plant community type being restored or reconstructed, the soils and hydrologic conditions of the site, and the geographic location of the site. A project-specific species list should be generated based on these considerations. Importantly, each site may have its own unique composition of species based on site-specific conditions and numerous other factors. The goal should not be to include all species that could possibly occur at a location, but to focus on ecological integrity and appropriate native plant communities. Guidance regarding representative plant communities in each region can be found in publications such as Critical Trends Assessment Program Regional Assessment Area reports that include Cook County (Appendix 2), The Natural Communities of Cook County (Thomas 1998), Plants of the Chicago Region (Swink and Wilhelm 1994), FPCC resources, and other site-specific documents that record the species historically present at the site (Wilhelm and Rericha 2017). Extreme caution should be exercised when introducing species to sites without historical evidence of their occurrence. Appendix 3 provides a list of known plant species for Cook County. FPCC resource management staff must approve the list of species and collection sites to be used for augmentation.

Seed Sources

The choice to select seed from local versus regional sources is based on the assumption that seed from local sources has evolved under similar environmental conditions and therefore will perform better in restoration projects (Plant Conservation Alliance 2015). In addition, the use of local seed sources has been advocated to avoid the incorporation of maladapted genes into the local gene pool (Breed et al. 2013) and conserve local genetic diversity. Ideally, it would be possible to say that seeds must always come from sources within a certain distance of the project site. Several factors make that impossible. Research has shown that plant species differ considerably in their genetic structure, and therefore in their degree of local adaptation and distances required for manifestation of outbreeding depression, depending on such things as the continuity of their habitat and the average dispersal distances of their pollen and seeds

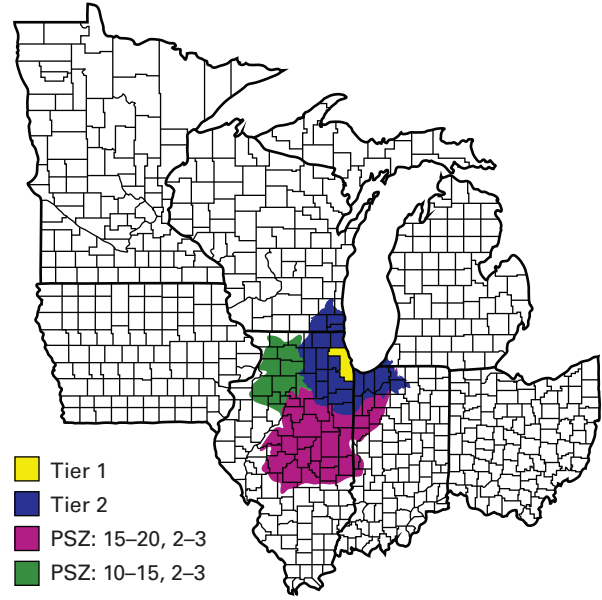








FIGURE 1 Seed sources for FPCC projects. Tier 1—Cook County, Tier 2—within Chicago Wilderness, and Tier 3—Provisional Seed Zones (PSZ 15-20, 2-3 and PSZ 10-15, 2-3; Bower et al. 2014).

(for example, see Caruso et al. 2015; Hufford et al. 2012; Raabová et al. 2007). In general, large populations (>1,000 genetically distinct individuals) are more likely to be locally adapted to site conditions than small populations (Leimu and Fischer 2008). Moreover, large populations are less susceptible to losing genetic variation due to drift and better retain capacity for responding to environmental change. Although we can make some such generalizations, we know too little about most plant species to say with much precision what the appropriate seed source distance should be. Furthermore, genetic depletion in small populations may dictate that seeds from more distant sources are needed to increase genetic diversity and thus likelihood of survival. More generally, mixing of seed sources may also enhance genetic variation and evolutionary resilience of species (Jones 2013) and could be a strategy for dealing with predicted climate change conditions within a region (Krauss et al. 2013). However, in an attempt to understand the effects of introduced seed, limiting the source to a single large population (e.g., >1,000 individuals) is one advisable approach. The benefit of this approach is to allow documentation and isolation of the impact of specific source populations. In addition, economic considerations of cost and availability of seed from local versus regional

TABLE 1 Description and seed source tier of seed source strategies that could be implemented by the FPCC. Seed source strategies arranged from local to regional. ● = site, ● =Tier 1, ● =Tier 2, ● and ● =Tier 3. Circle color represents genetic similarity of potential seed source to the restoration site. Circle size represents relative contribution of seed source to the restoration seed mix. Recreated and modified from Havens et al 2015 and Williams et al 2014.

SEED SOURCE STRATEGY	DEFINITION	SEED SOURCE TIER	SEED SOURCE MIXTURE
LOCAL (L)	Using seed only from the site where restoration is occurring or populations within normal gene flow distance	Tier 1*	LOCAL SOURCE 
RELAXED LOCAL 1 (RL1)	Using seed from a single geographically close population with a focus on matching environment of source and recipient sites	Tier 1*	
RELAXED LOCAL (RL)	Mixing seed from geographically close populations with a focus on matching environment of source and recipient sites	Tier 1*	
COMPOSITE (C)	Mixing seed from two or more populations of close and intermediate distance (or environmental match) to mimic long distance gene flow	Tiers 1 & 2	
ADMIXTURE (A)	Mixing seed from two or more populations of varying distances throughout the range of the species	Tiers 1, 2 & 3	
PREDICTIVE (P)	Using genotypes adapted to predicted conditions (e.g., 2050 climate projections) based on models and transplant experiments	Tiers 1, 2 & 3	REGIONAL SOURCE 

* Under some circumstances, such as sites on county boundaries, sources from adjacent counties may be more suitable than those from other sites within Tier 1.

sources often must be balanced with the potential risks of using seed from distant sources. Regardless of source, there are many considerations during the collection of seeds and propagation of plants at new sites or in nurseries that may affect genetic diversity. Appendix 4 outlines best practices for collecting and propagating plant material (Basey et al. 2015).

To ensure that its staff, contractors, partners, and volunteer stewards have the flexibility to address the specific goals of each project while considering genetic concerns, seed availability, and climate change, the FPCC has adopted a tiered approach to selecting seed sources. Three seed source tiers have been defined, based on administrative boundaries and distance from the project site (Figure 1).

TIER 1—Cook County: Under most circumstances,

seed obtained from Tier 1 areas will be used because it comes from local sources. Seed will come from on-site material when possible, where site in this case refers to the boundaries of the relevant Landscape Unit as defined in FPCC’s conservation prioritization document (“Prioritizing Conservation Areas in the Forest Preserves of Cook County”; see map in Appendix 7) or for areas outside of the landscape units, similarly connected or clustered areas. The boundaries of these additional “sites” will be mapped and appended to an updated version of this document. It must first be determined that the source population is not suffering inbreeding depression, is large enough (hundreds of plants), and is producing good seed; if not, sources will be other appropriate FPCC sites and/or other local remnants, especially those that are ecologically similar to the project site. In some circumstances, such as adjacent natural areas

along county boundaries, this may include material from adjacent counties.

TIER 2—The Chicago Wilderness region: If using seed sourced from within Tier 1 areas is not feasible, seed sources from within the Chicago Wilderness region will be considered. These sources will all be from within 100 miles of any project site, from areas with similar climate, ecology, and soils, and from within the same or adjacent major watersheds. For more information about the Chicago Wilderness region, see the Atlas of Biodiversity (Chicago Wilderness 2011). If possible, seed to be introduced at a particular site should be sourced from a single large population.

TIER 3—Provisional seed zones within the north-eastern Illinois ecoregion: Researchers with the U.S. Forest Service recently developed generalized provisional seed zones to guide seed sourcing for restoration projects (Bower et al. 2014). These zones were defined using the intersection of winter minimum temperature and an annual heat:moisture index (based on the mean annual temperature and mean annual precipitation); seed from within one of these climatically defined areas are not likely to be maladapted to conditions throughout the zone. Overlaying the provisional seed zones with Omernik’s (1987) level III ecoregions results in areas that are coherent both climatically and ecologically, and that are consistent with empirical seed zones based on common garden studies of individual plant species (Bower et al. 2014). Cook County lies within two provisional seed zones; these fall in different minimum winter temperature classes (10–15°F versus 15–20°F; Figure 1) but within the same heat:moisture class. See Appendix 5 for a more detailed map showing where the boundary of the two provisional seed zones occurs within Cook County. When it is not feasible to use seed from Tier 1 or 2 areas, it may be acceptable to use seed from Tier 3 areas because the resulting

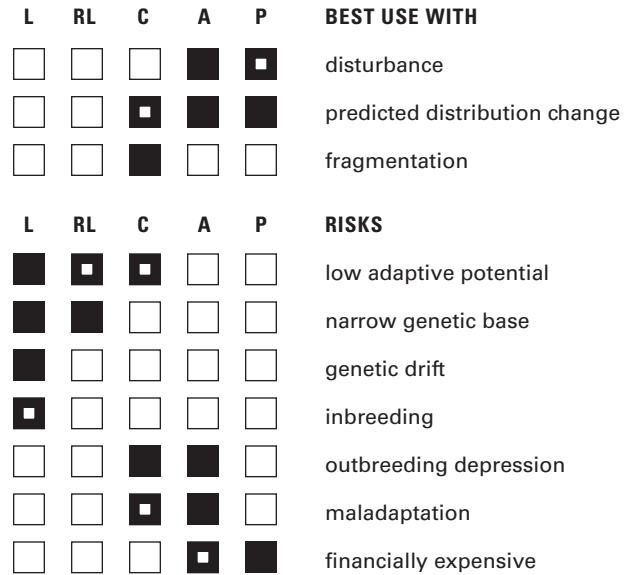


FIGURE 2 Best site conditions for using seed source strategies and the risks involved (modified from Havens et al 2015). L = Local, RL = Relaxed Local, C = Composite, A = Admixture, P = Predictive. ■ = high, ■ = moderate, □ = low.

plants probably will be climatically and ecologically adapted to the site; because locations may be distant from the site this should be the last resort and used with caution. If possible, seed to be introduced at a particular site should be sourced from a single large population.

When sourcing seed from any of these three tiers, published research studies on seed origin should be consulted. Studies of the species to be planted may be available and provide more specific guidance on appropriate source distances or habitats. Studies of closely related species, particularly if they share population structure, pollinators, and seed dispersal mechanisms, may also be informative.

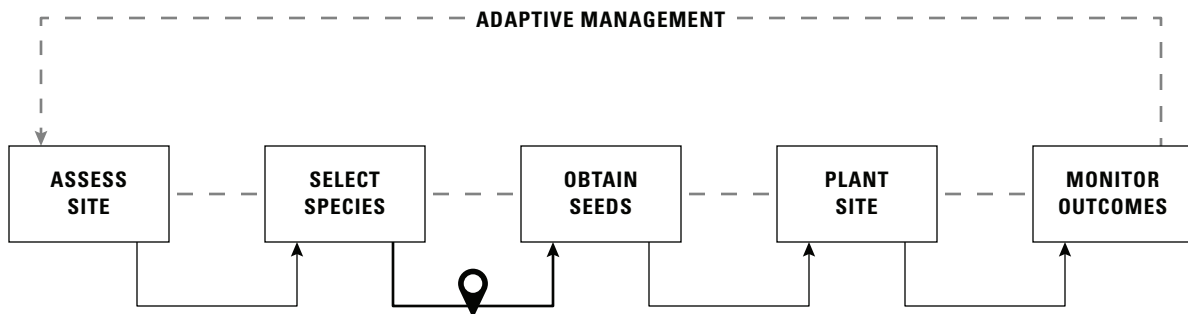


FIGURE 3 Project evaluation flowchart for FPCC. Recreated from Hufford and Meador 2014.

Seed Source Strategies

Different seed source strategies may be appropriate for different site conditions and restoration goals (Havens et al. 2015; Williams et al. 2014). Table 1 provides descriptions of some seed source strategies. Figure 2 illustrates the appropriate site conditions and the risk levels associated with each of these strategies. Projects using seeds exclusively from Tier 1 (or if needed, Tier 2) areas can be developed using the local, relaxed local (RL1 or RL), or composite strategies, whereas projects using seeds from Tier 2 or 3 areas will use the admixture or predictive strategies (Table 1; Figure 2). Choosing which strategy to use will depend on balancing project goals, including emphasizing current vs. future ecological conditions (under climate change), maintaining current genetic diversity versus enhancing diversity (especially when depleted through small population sizes and inbreeding), and tolerating risks for outbreeding depression and maladaptation, and may be constrained by economic resources.

Importantly, the scale of planned restoration activities on FPCC sites may result in considerable demand for native plant material. Care should be taken not to negatively impact existing native plant populations through overharvesting, as frequent harvesting has been shown to have adverse impacts on native plant communities (especially short-lived or non-clonal species; Meissen et al. 2015). In some cases, the potential for overharvesting may influence decisions about the origin of seeds for restoration projects. Additionally, there are risks inherent in using seed produced in a nursery setting that should be considered, such as genetics of the seed sources, changes to genetic structure after several generations in an off-site location, and selection based on new growth conditions (Basey et al. 2015; Appendix 4).

Project Implementation

To assure the success of projects at FPCC sites, the steps outlined in Figure 3 should be followed (Hufford and Meador 2014). The processes for selecting species and seed sources were discussed above. It is also critical to document seed sources (provenance, location and, if relevant, vendor; Appendix 6 provides guidelines for vendors) to assess success of the current project and inform future projects. Recording detailed information on seed source location and detailed location of seed introduction for each

seed origin is critically important; this is especially true in cases where seed from multiple sources is used at a site. In such cases where multiple sources are used, efforts should be made to introduce seed from each source to distinct locations rather than mixing the seed to allow for evaluation of results. Furthermore, monitoring emergence, establishment, and long term success are extremely important to determine project success. Only by setting realistic expectations, having an implementation plan, maintaining proper records, and monitoring outcomes can the FPCC learn, adjust if needed, and conduct adaptive management.

Guidelines for FPCC Sites

In the process of choosing species and seed sources, the following principles should be considered.

- Site condition: Species choice and seed source are most important for high quality sites and less critical for more altered sites.
- Site location: Other things being equal, seed source is most important for sites that are close to other sites, especially those that are close to high quality sites, because of the greater opportunity for mixing of genes between the augmentation site and the nearby site; source is less critical for isolated sites.
- Site type: The site must be suitable for the species, considering the plant community, hydrologic regime, and soil type. The seed source and project site should share these characteristics to increase the likelihood that appropriate plant material is selected. Ideally there would be historical evidence that the species actually occurred at the site or nearby sites, or minimally evidence that current site conditions could support the species. The plant community type found at the site prior to European settlement can provide valuable guidance, particularly for common species.
- Species status: Threatened, endangered, or locally rare species require special care to protect the seed source and the augmentation site; federally listed species require federal and state permits. Monitoring data from the Plants of Concern program should be sought out to inform these decisions.

- Population trajectory: When the species is present but declining at the site, disturbance or other factors (e.g., pollinator limitation, hydrology alteration, woody plant encroachment) that may account for the decline should be addressed before investing in augmentation. If no disturbance or other limiting factors are evident, then the decline may be an indication of inbreeding depression due to loss of genetic diversity, which augmentation from another source may improve. Again, care should be taken to achieve augmentation without adversely impacting the source population(s). Efforts to introduce seed into former agricultural areas should be monitored to ensure success can be achieved and that seed is not failing due to soil conditions or other causes.

FPCC projects involving augmentation can be categorized into four groups: (1) Dedicated Nature Preserves, (2) Other Remnants, (3) Agricultural Lands and Other Disturbed Soils, and (4) Green Infrastructure. Dedicated Nature Preserves protect the best quality natural communities remaining on the FPCC property and are some of the best of their kind in Illinois. Protecting their quality is the FPCC's highest management priority. Activities in Nature Preserves are regulated by the Illinois Nature Preserves Commission (INPC). Other Remnants also contain relatively intact native plant communities, often of high quality, although some of the property may contain patches of invasive plants that have thoroughly degraded the plant community, leaving bare or species-depauperate zones that may need to be seeded to recover. Agricultural lands, both active and fallow, that have had native plants removed and either row crops or hay grown on them and properties with highly disturbed soils, such as those with fly ash spoil or a history of excavation, will require native seed to restore them. Native seed is also used for a variety of green infrastructure projects such as parking lot swales, walkway edges or gardens, and demonstration gardens at nature centers. Applying the principles listed above, together with the seed source considerations discussed previously, to FPCC sites belonging to these four categories results in the following guidelines.

Nature Preserves

- a. No removal of seed or augmentation without an INPC permit and FPCC management plan.
- b. Sourcing seed within the Nature Preserve is very

strongly preferred (i.e., Local strategy; Table 1) when it is clear that inbreeding is not a major consideration.

- c. Seed sourced from outside the Nature Preserve should come from one adjacent area for each species whenever possible, and should very rarely be from outside Tier 1 (i.e., Relaxed Local 1 strategy; Table 1).
- d. Regardless of source, augmentation should be made only after careful consideration and documentation of the need (for example, rescue of an endangered species).
- e. Movement out of the Nature Preserve may be used to satisfy nearby project needs but must be limited to sustainable quantities.
- f. The source of all seed moved out of or into the Nature Preserve, as well as the destination of that seed, must be documented.

Other Remnants

- a. Remnant sites deemed to be of Nature Preserve quality should be managed as Nature Preserves using guidelines listed above.
- b. No removal of seed or augmentation without an FPCC management plan.
- c. Sourcing seed within the site is preferred. In this case, site refers to contiguous natural community.
- d. Seed sourced outside the site should come from one nearby area for each species (see Appendix 4) whenever possible; a more distant source, especially those outside Tier 1, should be used only after careful consideration and documentation of the need.
- e. The source of all seed moved out of or into remnant, as well as the precise destination of that seed, must be documented.

Agricultural Fields and Other Disturbed Soils

- a. Sourcing seed from adjacent sites is best, followed by other sources within Tier 1, and sources within Tier 2, especially if they fall within a seed area defined in Appendix 7.
- b. Seed sourced from outside Tier 2 may be used, especially if the restoration site is isolated from other areas with native plant communities; all such seed must come from Tier 3 and should be used only after careful consideration and documentation of the need.
- c. Cultivars and species not native to Cook County

- may not be used.
- d. Special care must be taken when moving seed from the site to other locations. If seed used to restore the species at the site was not sourced from adjacent locations, moving seed of that species from the site is strongly discouraged.
 - e. The source of each species of seed and destination of that seed, including the original source of seed from nurseries, must be documented.

Green Infrastructure

- a. Sourcing seed from adjacent sites is best, followed by other sources within Tier 1 and sources within Tier 2.
- b. Seed sourced from outside Tier 2 may be used, especially if the green infrastructure site is isolated from other areas with native plant communities; all such seed must come from Tier 3.
- c. If the site is adjacent to or within a remnant, the seed source must be considered carefully, following the same source guidelines as for Other Remnants.
- d. The source of all seed, including the original source of seed from nurseries, must be documented; seed from the green infrastructure site may be considered at a future time as a seed source.
- e. Seed sourcing should not include cultivars.

Policy and Guidelines Updates

This document shall be reviewed and updated periodically, not exceeding five (5) years. These future updates will be especially crucial given projected changes in site conditions and with climate change considerations and will help to account for changes in scientific information.

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APPENDIX 1 Glossary of terms.

Adaptive potential: The ability of a species to adapt (become better suited) if the environment where the species occurs is changing. This could be achieved via phenotypic plasticity and/or genetic adaptation.

Augmentation: The addition of individuals from the same species to existing populations within an area.

Cultivar: A plant selected for horticulturally desirable traits (characteristics) via selective breeding.

Genetic drift: A change in the relative frequency of genotypes in a population due to chance or random events resulting in the disappearance of particular genes as individuals die or do not reproduce.

Inbreeding depression: The reduction in biological fitness (fertility and survival) of offspring from crosses between closely related individuals in a given population.

Local adaptation: A population of individuals that has genetically responded to natural selection in their specific habitat, leading to higher fitness (fertility and survival) in their local environment or geographic area relative to individuals introduced from a different local environment or geographic area.

Maladaptation: A species with traits that have become more harmful (i.e., poorly adapted) than helpful in the environment where they live.

Native: A species that naturally occurs in a particular area and habitat without direct or indirect human actions.

Outbreeding depression: The reduction in biological fitness (fertility and survival) of offspring from crosses between individuals from different populations (i.e., distant relative).

Reconstruct: To re-plant (re-establish) native plant communities at a site where such communities have been eradicated due to anthropogenic activities and/or extreme environmental disturbance.

Remnant: An original native plant community that has persisted at a site to this day, but that was once part of a larger original native landscape.

Restore: Reverse the degree of degradation of a remnant via management activities such as adding seeds, planting plugs, conducting prescribed burns, removing invasive species, restoring hydrology, etc.

APPENDIX 2 List of Critical Trends Assessment Program Regional Assessment Area reports that include Cook County species list by habitat and community type. A link to each on-line resource is provided.

REGIONAL ASSESSMENT AREA	LINK TO ON-LINE RESOURCE
Chicago River/Lake Shore	https://www.ideals.illinois.edu/handle/2142/13892
Du Page River	https://www.ideals.illinois.edu/handle/2142/13879
Fox River	https://www.ideals.illinois.edu/handle/2142/13881
Lake Calumet	https://www.ideals.illinois.edu/handle/2142/13877
Lower Des Plaines River	https://www.ideals.illinois.edu/handle/2142/13894
Prairie Parklands	https://www.ideals.illinois.edu/handle/2142/13867
Thorn Creek	https://www.ideals.illinois.edu/handle/2142/14423
Upper Des Plaines River	https://www.ideals.illinois.edu/handle/2142/14424

APPENDIX 3 Native plant species list for Cook County. This plant species list was generated by using the web-based database Illinois Plants (<http://www.inhs.illinois.edu/data/plantdb/>; Pearse et al 2015) and refined by Laura Anchor.

<i>Acalypha rhomboidea</i>	<i>Apios americana</i>	<i>Aster sericeus</i>
<i>Acer negundo</i>	<i>Aplectrum hyemale</i>	<i>Aster shortii</i>
<i>Acer rubrum</i>	<i>Apocynum androsaemifolium</i>	<i>Aster urophyllum</i>
<i>Acorus americanus</i>	<i>Apocynum cannabinum</i>	<i>Aster × amethystinus</i>
<i>Actaea pachypoda</i>	<i>Aquilegia canadensis</i>	<i>Astragalus canadensis</i>
<i>Actaea rubra</i>	<i>Arabidopsis lyrata</i>	<i>Athyrium filix-femina</i> var. <i>angustum</i>
<i>Adiantum pedatum</i>	<i>Arabis glabra</i>	<i>Aureolaria flava</i>
<i>Agalinis auriculata</i>	<i>Arabis hirsuta</i>	<i>Aureolaria grandiflora</i>
<i>Agalinis gattingeri</i>	<i>Arabis laevigata</i>	<i>Aureolaria pedicularia</i>
<i>Agalinis paupercula</i>	<i>Arabis shortii</i>	<i>Baptisia lactea</i>
<i>Agalinis purpurea</i>	<i>Aralia nudicaulis</i>	<i>Baptisia leucophaea</i>
<i>Agalinis tenuifolia</i>	<i>Aralia racemosa</i>	<i>Baptisia tinctoria</i>
<i>Agastache nepetoides</i>	<i>Arisaema dracontium</i>	<i>Beckmannia syzigachne</i>
<i>Agastache scrophulariaefolia</i>	<i>Arisaema triphyllum</i>	<i>Berula erecta</i>
<i>Ageratina altissima</i>	<i>Aristida oligantha</i>	<i>Bidens aristosa</i>
<i>Agrimonia gryposepala</i>	<i>Aristida purpurascens</i>	<i>Bidens bipinnata</i>
<i>Agrimonia parviflora</i>	<i>Arnoglossum atriplicifolium</i>	<i>Bidens cernua</i>
<i>Agrimonia pubescens</i>	<i>Arnoglossum plantaginea</i>	<i>Bidens connata</i>
<i>Agrimonia rostellata</i>	<i>Aronia melanocarpa</i>	<i>Bidens coronata</i>
<i>Agrostis gigantea</i>	<i>Aronia prunifolia</i>	<i>Bidens frondosa</i>
<i>Agrostis hyemalis</i>	<i>Artemisia campestris</i>	<i>Bidens polylepis</i>
<i>Agrostis perennans</i>	<i>Asarum canadense</i>	<i>Bidens tripartita</i>
<i>Agrostis stolonifera</i> var. <i>palustris</i>	<i>Asclepias amplexicaulis</i>	<i>Bidens vulgata</i>
<i>Aletris farinosa</i>	<i>Asclepias exaltata</i>	<i>Blephilia ciliata</i>
<i>Alisma subcordatum</i>	<i>Asclepias hirtella</i>	<i>Blephilia hirsuta</i>
<i>Alisma triviale</i>	<i>Asclepias incarnata</i>	<i>Boehmeria cylindrica</i>
<i>Allium burdickii</i>	<i>Asclepias ovalifolia</i>	<i>Bolboschoenus fluviatilis</i>
<i>Allium canadense</i>	<i>Asclepias purpurascens</i>	<i>Boltonia asteroides</i>
<i>Allium cernuum</i>	<i>Asclepias sullivantii</i>	<i>Botrychium dissectum</i>
<i>Allium tricoccum</i>	<i>Asclepias syriaca</i>	<i>Botrychium virginianum</i>
<i>Alopecurus aequalis</i>	<i>Asclepias tuberosa</i>	<i>Bouteloua curtipendula</i>
<i>Alopecurus carolinianus</i>	<i>Asclepias verticillata</i>	<i>Brachyelytrum erectum</i>
<i>Amaranthus tuberculatus</i>	<i>Asclepias viridiflora</i>	<i>Brickellia eupatorioides</i>
<i>Amelanchier humilis</i>	<i>Asimina triloba</i>	<i>Bromus ciliatus</i>
<i>Amelanchier interior</i>	<i>Asplenium platyneuron</i>	<i>Bromus kalmii</i>
<i>Amelanchier laevis</i>	<i>Asplenium rhizophyllum</i>	<i>Bromus latiglumis</i>
<i>Amelanchier sanguinea</i>	<i>Aster drummondii</i>	<i>Bromus nottowayanus</i>
<i>Ammannia robusta</i>	<i>Aster dumosus</i>	<i>Bromus pubescens</i>
<i>Amorpha canescens</i>	<i>Aster ericoides</i>	<i>Bulbostylis capillaris</i>
<i>Amorpha fruticosa</i>	<i>Aster firmus</i>	<i>Calamagrostis canadensis</i>
<i>Amphicarpaea bracteata</i>	<i>Aster laevis</i>	<i>Calamagrostis stricta</i> ssp. <i>inexpansa</i>
<i>Andropogon gerardii</i>	<i>Aster lanceolatus</i>	<i>Calamintha arkansana</i>
<i>Anemone canadensis</i>	<i>Aster lateriflorus</i>	<i>Calamovilfa longifolia</i>
<i>Anemone cylindrica</i>	<i>Aster linariifolius</i>	<i>Callitriche heterophylla</i>
<i>Anemone quinquefolia</i>	<i>Aster novae-angliae</i>	<i>Callitriche palustris</i>
<i>Anemone virginiana</i>	<i>Aster ontarionis</i>	<i>Calopogon tuberosus</i>
<i>Angelica atropurpurea</i>	<i>Aster oolentangiensis</i>	<i>Caltha palustris</i>
<i>Antennaria neglecta</i>	<i>Aster pilosus</i>	<i>Calystegia spithamea</i>
<i>Antennaria parlinii</i> ssp. <i>fallax</i>	<i>Aster praealtus</i>	<i>Camassia scilloides</i>
<i>Antennaria parlinii</i> ssp. <i>parlinii</i>	<i>Aster puniceus</i>	<i>Campanula americana</i>
<i>Antennaria plantaginifolia</i>	<i>Aster sagittifolius</i>	<i>Campanula aparinoides</i>

APPENDIX 3 [Contd.]

<i>Campanula rotundifolia</i>	<i>Carex lupulina</i>	<i>Cicuta maculata</i>
<i>Cardamine bulbosa</i>	<i>Carex meadii</i>	<i>Cinna arundinacea</i>
<i>Cardamine concatenata</i>	<i>Carex molesta</i>	<i>Circaea canadensis</i>
<i>Cardamine douglassii</i>	<i>Carex muehlenbergii</i>	<i>Cirsium altissimum</i>
<i>Cardamine parviflora</i>	<i>Carex muskingumensis</i>	<i>Cirsium discolor</i>
<i>Cardamine pennsylvanica</i>	<i>Carex normalis</i>	<i>Cirsium hillii</i>
<i>Carex aggregata</i>	<i>Carex oligocarpa</i>	<i>Cirsium muticum</i>
<i>Carex albicans</i> var. <i>albicans</i>	<i>Carex pellita</i>	<i>Cladium mariscoides</i>
<i>Carex albursina</i>	<i>Carex pennsylvanica</i>	<i>Claytonia virginica</i>
<i>Carex alopecoidea</i>	<i>Carex prairea</i>	<i>Clematis virginiana</i>
<i>Carex amphibola</i>	<i>Carex rosea</i>	<i>Coeloglossum viride</i>
<i>Carex annectens</i>	<i>Carex sartwellii</i>	<i>Collinsia verna</i>
<i>Carex aquatilis</i>	<i>Carex scoparia</i>	<i>Comandra umbellata</i>
<i>Carex atherodes</i>	<i>Carex shortiana</i>	<i>Comarum palustre</i>
<i>Carex aurea</i>	<i>Carex siccata</i>	<i>Comptonia peregrina</i>
<i>Carex bebbii</i>	<i>Carex sparganioides</i>	<i>Conopholis americana</i>
<i>Carex bicknellii</i>	<i>Carex sprengeii</i>	<i>Corallorhiza maculata</i>
<i>Carex blanda</i>	<i>Carex squarrosa</i>	<i>Coreopsis lanceolata</i>
<i>Carex brevior</i>	<i>Carex sterilis</i>	<i>Coreopsis palmata</i>
<i>Carex bromoides</i>	<i>Carex stipata</i>	<i>Coreopsis tripteris</i>
<i>Carex buxbaumii</i>	<i>Carex stricta</i>	<i>Cornus alternifolia</i>
<i>Carex cephaloidea</i>	<i>Carex suberecta</i>	<i>Cornus obliqua</i>
<i>Carex cephalophora</i>	<i>Carex swanii</i>	<i>Cornus racemosa</i>
<i>Carex comosa</i>	<i>Carex tenera</i>	<i>Cornus sericea</i>
<i>Carex conjuncta</i>	<i>Carex tetanica</i>	<i>Corydalis flavula</i>
<i>Carex conoidea</i>	<i>Carex tribuloides</i>	<i>Corydalis sempervirens</i>
<i>Carex crawei</i>	<i>Carex trichocarpa</i>	<i>Corylus americana</i>
<i>Carex crinita</i>	<i>Carex tuckermanii</i>	<i>Crataegus calpodendron</i>
<i>Carex cristatella</i>	<i>Carex umbellata</i>	<i>Crataegus crus-galli</i>
<i>Carex crus-corvi</i>	<i>Carex vesicaria</i>	<i>Crataegus holmesiana</i>
<i>Carex cryptolepis</i>	<i>Carex viridula</i>	<i>Crataegus macrosperma</i>
<i>Carex davisii</i>	<i>Carex vulpinoidea</i>	<i>Crataegus mollis</i>
<i>Carex digitalis</i>	<i>Carex woodii</i>	<i>Crataegus pruinosa</i>
<i>Carex festucacea</i>	<i>Carpinus caroliniana</i>	<i>Crataegus punctata</i>
<i>Carex gracilescens</i>	<i>Carya cordiformis</i>	<i>Crataegus succulenta</i>
<i>Carex gracillima</i>	<i>Carya ovata</i>	<i>Cryptotaenia canadensis</i>
<i>Carex granularis</i>	<i>Castilleja coccinea</i>	<i>Cuscuta cephalanthi</i>
<i>Carex gravida</i>	<i>Caulophyllum thalictroides</i>	<i>Cuscuta coryli</i>
<i>Carex grayi</i>	<i>Ceanothus americanus</i>	<i>Cuscuta glomerata</i>
<i>Carex grisea</i>	<i>Celastrus scandens</i>	<i>Cuscuta gronovii</i>
<i>Carex haydenii</i>	<i>Celtis occidentalis</i>	<i>Cuscuta pentagona</i>
<i>Carex hirsutella</i>	<i>Cephalanthus occidentalis</i>	<i>Cuscuta polygonorum</i>
<i>Carex hirtifolia</i>	<i>Ceratophyllum demersum</i>	<i>Cycloloma atriplicifolium</i>
<i>Carex hitchcockiana</i>	<i>Chaerophyllum procumbens</i>	<i>Cyperus bipartitus</i>
<i>Carex hystericina</i>	<i>Chamaecrista fasciculata</i>	<i>Cyperus diandrus</i>
<i>Carex intumescens</i>	<i>Chamaecrista nictitans</i>	<i>Cyperus erythrorhizos</i>
<i>Carex jamesii</i>	<i>Chelone glabra</i>	<i>Cyperus esculentus</i>
<i>Carex lacustris</i>	<i>Chenopodium pratericola</i>	<i>Cyperus lupulinus</i>
<i>Carex laevivaginata</i>	<i>Chenopodium simplex</i>	<i>Cyperus odoratus</i>
<i>Carex lasiocarpa</i>	<i>Chenopodium standleyanum</i>	<i>Cyperus schweinitzii</i>
<i>Carex leptalea</i>	<i>Chimaphila maculata</i>	<i>Cyperus squarrosus</i>
<i>Carex lupuliformis</i>	<i>Cicuta bulbifera</i>	<i>Cyperus strigosus</i>

APPENDIX 3 [Contd.]

<i>Cypripedium acaule</i>	<i>Eleocharis engelmannii</i>	<i>Floerkea proserpinacoides</i>
<i>Cypripedium candidum</i>	<i>Eleocharis erythropoda</i>	<i>Fragaria vesca</i> ssp. <i>americana</i>
<i>Cypripedium parviflorum</i>	<i>Eleocharis intermedia</i>	<i>Fragaria virginiana</i>
<i>Cypripedium parviflorum</i> var. <i>pubescens</i>	<i>Eleocharis obtusa</i>	<i>Frasera caroliniensis</i>
<i>Cypripedium reginae</i>	<i>Eleocharis olivacea</i>	<i>Fraxinus americana</i>
<i>Cypripedium</i> × <i>andrewsii</i>	<i>Eleocharis palustris</i>	<i>Fraxinus nigra</i>
<i>Cystopteris bulbifera</i>	<i>Eleocharis quinqueflora</i>	<i>Fraxinus pennsylvanica</i>
<i>Cystopteris protrusa</i>	<i>Eleocharis rostellata</i>	<i>Fraxinus quadrangulata</i>
<i>Dalea purpurea</i>	<i>Eleocharis verrucosa</i>	<i>Galearis spectabilis</i>
<i>Danthonia spicata</i>	<i>Ellisia nyctelea</i>	<i>Galium aparine</i>
<i>Dasiphora fruticosa</i>	<i>Elodea canadensis</i>	<i>Galium asprellum</i>
<i>Dasistoma macrophylla</i>	<i>Elodea nuttallii</i>	<i>Galium boreale</i>
<i>Deparia acrostichoides</i>	<i>Elymus canadensis</i>	<i>Galium circaezans</i>
<i>Deschampsia caespitosa</i> ssp. <i>glauca</i>	<i>Elymus hystrix</i>	<i>Galium concinnum</i>
<i>Desmodium canadense</i>	<i>Elymus riparius</i>	<i>Galium obtusum</i>
<i>Desmodium cuspidatum</i>	<i>Elymus trachycaulus</i>	<i>Galium pilosum</i>
<i>Desmodium cuspidatum</i> var. <i>longifolium</i>	<i>Elymus villosus</i>	<i>Galium tinctorium</i>
<i>Desmodium illinoense</i>	<i>Elymus virginicus</i>	<i>Galium trifidum</i>
<i>Desmodium paniculatum</i>	<i>Enemionium biternatum</i>	<i>Galium triflorum</i>
<i>Desmodium perplexum</i>	<i>Epilobium ciliatum</i>	<i>Gaultheria procumbens</i>
<i>Dicentra canadensis</i>	<i>Epilobium coloratum</i>	<i>Gaura longiflora</i>
<i>Dicentra cucullaria</i>	<i>Epilobium leptophyllum</i>	<i>Gaylussacia baccata</i>
<i>Dichantherium boreale</i>	<i>Equisetum arvense</i>	<i>Gentiana alba</i>
<i>Dichantherium latifolium</i>	<i>Equisetum fluviatile</i>	<i>Gentiana andrewsii</i>
<i>Dichantherium leibergii</i>	<i>Equisetum hyemale</i>	<i>Gentiana puberulenta</i>
<i>Dichantherium lindheimeri</i>	<i>Equisetum laevigatum</i>	<i>Gentiana saponaria</i>
<i>Dichantherium perlongum</i>	<i>Eragrostis capillaris</i>	<i>Gentianella quinquefolia</i> ssp. <i>occidentalis</i>
<i>Dichantherium praecocius</i>	<i>Eragrostis frankii</i>	<i>Gentianopsis crinita</i>
<i>Dichantherium pseudopubescens</i>	<i>Eragrostis hypnoides</i>	<i>Gentianopsis virgata</i>
<i>Dichantherium scribnerianum</i>	<i>Eragrostis spectabilis</i>	<i>Geranium bicknellii</i>
<i>Diervilla lonicera</i>	<i>Erigenia bulbosa</i>	<i>Geranium carolinianum</i>
<i>Digitaria cognata</i>	<i>Erigeron philadelphicus</i>	<i>Geranium maculatum</i>
<i>Dioscorea villosa</i>	<i>Erigeron pulchellus</i>	<i>Geum aleppicum</i>
<i>Dirca palustris</i>	<i>Erigeron strigosus</i>	<i>Geum canadense</i>
<i>Dodecatheon meadia</i>	<i>Eriophorum angustifolium</i>	<i>Geum laciniatum</i>
<i>Doellingeria umbellata</i>	<i>Eryngium yuccifolium</i>	<i>Geum triflorum</i>
<i>Draba reptans</i>	<i>Erythronium albidum</i>	<i>Geum vernum</i>
<i>Drosera intermedia</i>	<i>Erythronium americanum</i>	<i>Glyceria borealis</i>
<i>Drymocallis arguta</i>	<i>Euonymus atropurpureus</i>	<i>Glyceria septentrionalis</i>
<i>Dryopteris carthusiana</i>	<i>Euonymus obovatus</i>	<i>Glyceria striata</i>
<i>Dryopteris cristata</i>	<i>Eupatorium perfoliatum</i>	<i>Gnaphalium obtusifolium</i>
<i>Dulichium arundinaceum</i>	<i>Eupatorium sessilifolium</i>	<i>Goodyera pubescens</i>
<i>Echinacea pallida</i>	<i>Euphorbia corollata</i>	<i>Gratiola aurea</i>
<i>Echinacea purpurea</i>	<i>Eurybia macrophylla</i>	<i>Gratiola neglecta</i>
<i>Echinochloa muricata</i>	<i>Euthamia graminifolia</i>	<i>Gratiola virginiana</i>
<i>Echinochloa walteri</i>	<i>Euthamia gymnospermoides</i>	<i>Hamamelis virginiana</i>
<i>Echinocystis lobata</i>	<i>Eutrochium maculatum</i>	<i>Hedeoma hispida</i>
<i>Eleocharis acicularis</i>	<i>Eutrochium purpureum</i>	<i>Hedeoma pulegioides</i>
<i>Eleocharis compressa</i>	<i>Festuca subverticillata</i>	<i>Helenium autumnale</i>
<i>Eleocharis elliptica</i>	<i>Filipendula rubra</i>	<i>Helianthemum bicknellii</i>
	<i>Fimbristylis autumnalis</i>	<i>Helianthemum canadense</i>
	<i>Fimbristylis puberula</i> var. <i>puberula</i>	

APPENDIX 3 [Contd.]

<i>Helianthus decapetalus</i>	<i>Juncus biflorus</i>	<i>Lithospermum canescens</i>
<i>Helianthus divaricatus</i>	<i>Juncus brachycarpus</i>	<i>Lithospermum caroliniense</i>
<i>Helianthus giganteus</i>	<i>Juncus brachycephalus</i>	<i>Lithospermum incisum</i>
<i>Helianthus grosseserratus</i>	<i>Juncus bufonius</i>	<i>Lithospermum latifolium</i>
<i>Helianthus hirsutus</i>	<i>Juncus canadensis</i>	<i>Lobelia cardinalis</i>
<i>Helianthus mollis</i>	<i>Juncus dudleyi</i>	<i>Lobelia inflata</i>
<i>Helianthus occidentalis</i>	<i>Juncus effusus</i>	<i>Lobelia kalmii</i>
<i>Helianthus pauciflorus</i>	<i>Juncus greenei</i>	<i>Lobelia siphilitica</i>
<i>Helianthus strumosus</i>	<i>Juncus marginatus</i>	<i>Lobelia spicata</i>
<i>Helianthus tuberosus</i>	<i>Juncus nodosus</i>	<i>Lonicera dioica</i>
<i>Helianthus × luxurians</i>	<i>Juncus tenuis</i>	<i>Lonicera reticulata</i>
<i>Heliopsis helianthoides</i>	<i>Juncus torreyi</i>	<i>Ludwigia alternifolia</i>
<i>Hepatica nobilis</i> var. <i>acuta</i>	<i>Juniperus communis</i>	<i>Ludwigia palustris</i>
<i>Hepatica nobilis</i> var. <i>obtusata</i>	<i>Justicia americana</i>	<i>Ludwigia peploides</i> ssp. <i>glabrescens</i>
<i>Heracleum maximum</i>	<i>Koeleria macrantha</i>	<i>Ludwigia polycarpa</i>
<i>Hesperostipa spartea</i>	<i>Krigia biflora</i>	<i>Lupinus perennis</i>
<i>Heuchera richardsonii</i>	<i>Krigia virginica</i>	<i>Luzula multiflora</i>
<i>Hibiscus laevis</i>	<i>Lactuca biennis</i>	<i>Lycopus americanus</i>
<i>Hibiscus moscheutos</i> ssp. <i>lasiocarpus</i>	<i>Lactuca canadensis</i>	<i>Lycopus rubellus</i>
<i>Hibiscus moscheutos</i> ssp. <i>moscheutos</i>	<i>Lactuca floridana</i>	<i>Lycopus uniflorus</i>
<i>Hieracium canadense</i>	<i>Laportea canadensis</i>	<i>Lycopus virginicus</i>
<i>Hieracium gronovii</i>	<i>Lathyrus ochroleucus</i>	<i>Lysimachia ciliata</i>
<i>Hieracium longipilum</i>	<i>Lathyrus palustris</i>	<i>Lysimachia lanceolata</i>
<i>Hieracium scabrum</i>	<i>Lathyrus venosus</i>	<i>Lysimachia quadriflora</i>
<i>Houstonia caerulea</i>	<i>Lechea mucronata</i>	<i>Lysimachia quadrifolia</i>
<i>Huperzia lucidula</i>	<i>Lechea pulchella</i>	<i>Lysimachia terrestris</i>
<i>Hydrastis canadensis</i>	<i>Leersia oryzoides</i>	<i>Lysimachia thyriflora</i>
<i>Hydrophyllum appendiculatum</i>	<i>Leersia virginica</i>	<i>Lythrum alatum</i>
<i>Hydrophyllum virginianum</i>	<i>Lemna aequinoctialis</i>	<i>Maianthemum canadense</i>
<i>Hylodesmum glutinosum</i>	<i>Lemna minor</i>	<i>Maianthemum racemosa</i>
<i>Hypericum canadense</i>	<i>Lemna perpusilla</i>	<i>Maianthemum stellata</i>
<i>Hypericum gentianoides</i>	<i>Lemna trisulca</i>	<i>Malus coronaria</i>
<i>Hypericum gymnanthum</i>	<i>Lespedeza capitata</i>	<i>Malus ioensis</i>
<i>Hypericum majus</i>	<i>Lespedeza frutescens</i>	<i>Medeola virginiana</i>
<i>Hypericum mutilum</i>	<i>Lespedeza hirta</i>	<i>Melampyrum lineare</i> var. <i>latifolium</i>
<i>Hypericum prolificum</i>	<i>Lespedeza leptostachya</i>	<i>Melica nitens</i>
<i>Hypericum punctatum</i>	<i>Lespedeza virginica</i>	<i>Menispermum canadense</i>
<i>Hypericum pyramidatum</i>	<i>Leucospora multifida</i>	<i>Mertensia virginica</i>
<i>Hypericum sphaerocarpum</i>	<i>Liatris aspera</i>	<i>Micranthes pensylvanica</i>
<i>Hypopitys monotropa</i>	<i>Liatris cylindracea</i>	<i>Mimulus ringens</i>
<i>Hypoxis hirsuta</i>	<i>Liatris pycnostachya</i>	<i>Minuartia patula</i>
<i>Ilex verticillata</i>	<i>Liatris scariosa</i> var. <i>nieuwlandii</i>	<i>Minuartia stricta</i>
<i>Impatiens capensis</i>	<i>Liatris spicata</i>	<i>Mitchella repens</i>
<i>Impatiens pallida</i>	<i>Lilium michiganense</i>	<i>Mitella diphylla</i>
<i>Iodanthus pinnatifidus</i>	<i>Lilium philadelphicum</i>	<i>Moehringia lateriflora</i>
<i>Ipomoea pandurata</i>	<i>Lindera benzoin</i>	<i>Monarda fistulosa</i>
<i>Iris virginica</i>	<i>Lindernia dubia</i>	<i>Monarda punctata</i>
<i>Jeffersonia diphylla</i>	<i>Linum sulcatum</i>	<i>Monotropa uniflora</i>
<i>Juglans cinerea</i>	<i>Liparis liliifolia</i>	<i>Morus rubra</i>
<i>Juglans nigra</i>	<i>Liparis loeselii</i>	<i>Muhlenbergia frondosa</i>
<i>Juncus acuminatus</i>	<i>Lipocarpa drummondii</i>	<i>Muhlenbergia glomerata</i>
<i>Juncus balticus</i>	<i>Lipocarpa micrantha</i>	<i>Muhlenbergia mexicana</i>

APPENDIX 3 [Contd.]

<i>Muhlenbergia schreberi</i>	<i>Persicaria amphibia</i>	<i>Populus tremuloides</i>
<i>Muhlenbergia sylvatica</i>	<i>Persicaria careyi</i>	<i>Potamogeton amplifolius</i>
<i>Muhlenbergia tenuiflora</i>	<i>Persicaria hydropiperoides</i>	<i>Potamogeton foliosus</i>
<i>Myriophyllum sibiricum</i>	<i>Persicaria pensylvanica</i>	<i>Potamogeton gramineus</i>
<i>Najas flexilis</i>	<i>Persicaria punctata</i>	<i>Potamogeton illinoensis</i>
<i>Najas guadalupensis</i>	<i>Persicaria virginianum</i>	<i>Potamogeton nodosus</i>
<i>Nuphar advena</i>	<i>Phegopteris hexagonoptera</i>	<i>Potamogeton pusillus</i>
<i>Nuphar variegata</i>	<i>Phlox bifida</i>	<i>Potamogeton robbinsii</i>
<i>Nuttallanthus canadensis</i>	<i>Phlox divaricata</i>	<i>Potamogeton strictifolius</i>
<i>Nymphaea odorata</i> ssp. <i>odorata</i>	<i>Phlox glaberrima</i> ssp. <i>interior</i>	<i>Potamogeton zosteriformis</i>
<i>Nymphaea odorata</i> ssp. <i>tuberosa</i>	<i>Phlox pilosa</i>	<i>Potentilla anserina</i>
<i>Nyssa sylvatica</i>	<i>Phryma leptostachya</i>	<i>Potentilla norvegica</i>
<i>Oenothera biennis</i>	<i>Phyla lanceolata</i>	<i>Potentilla simplex</i>
<i>Oenothera clelandii</i>	<i>Physalis heterophylla</i>	<i>Prenanthes alba</i>
<i>Oenothera laciniata</i>	<i>Physalis virginiana</i>	<i>Prenanthes aspera</i>
<i>Oenothera perennis</i>	<i>Physocarpus opulifolius</i>	<i>Prenanthes crepidinea</i>
<i>Oenothera pilosella</i>	<i>Physostegia virginiana</i>	<i>Prenanthes racemosa</i>
<i>Onoclea sensibilis</i>	<i>Phytolacca americana</i>	<i>Proserpinaca palustris</i>
<i>Ophioglossum pusillum</i>	<i>Pilea fontana</i>	<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>
<i>Opuntia humifusa</i>	<i>Pilea pumila</i>	<i>Prunus americana</i>
<i>Orobanche uniflora</i>	<i>Pinus strobus</i>	<i>Prunus nigra</i>
<i>Osmorhiza claytonii</i>	<i>Piptatherum racemosum</i>	<i>Prunus pensylvanica</i>
<i>Osmorhiza longistylis</i>	<i>Plantago rugelii</i>	<i>Prunus serotina</i>
<i>Osmunda claytoniana</i>	<i>Platanthera aquilonis</i>	<i>Prunus virginiana</i>
<i>Osmunda spectabilis</i>	<i>Platanthera ciliaris</i>	<i>Psoralidium tenuiflorum</i>
<i>Osmundastrum cinnamomea</i>	<i>Platanthera clavellata</i>	<i>Ptelea trifoliata</i>
<i>Ostrya virginiana</i>	<i>Platanthera flava</i> var. <i>herbiola</i>	<i>Pteridium aquilinum</i> var. <i>latiusculum</i>
<i>Oxalis dillenii</i>	<i>Platanthera hookeri</i>	<i>Pycnanthemum pilosum</i>
<i>Oxalis stricta</i>	<i>Platanthera lacera</i>	<i>Pycnanthemum tenuifolium</i>
<i>Oxalis violacea</i>	<i>Platanthera leucophaea</i>	<i>Pycnanthemum virginianum</i>
<i>Oxyypolis rigidior</i>	<i>Platanthera orbiculata</i>	<i>Pyrola elliptica</i>
<i>Panax quinquefolius</i>	<i>Platanthera psycodes</i>	<i>Quercus alba</i>
<i>Panicum capillare</i>	<i>Platanus occidentalis</i>	<i>Quercus bicolor</i>
<i>Panicum dichotomiflorum</i>	<i>Poa palustris</i>	<i>Quercus coccinea</i>
<i>Panicum flexile</i>	<i>Poa sylvestris</i>	<i>Quercus ellipsoidalis</i>
<i>Panicum rigidulum</i>	<i>Podophyllum peltatum</i>	<i>Quercus imbricaria</i>
<i>Panicum virgatum</i>	<i>Pogonia ophioglossoides</i>	<i>Quercus macrocarpa</i>
<i>Parietaria pensylvanica</i>	<i>Polemonium reptans</i>	<i>Quercus muhlenbergii</i>
<i>Parnassia glauca</i>	<i>Polygala polygama</i>	<i>Quercus palustris</i>
<i>Paronychia canadensis</i>	<i>Polygala sanguinea</i>	<i>Quercus rubra</i>
<i>Paronychia fastigiata</i>	<i>Polygala senega</i>	<i>Quercus velutina</i>
<i>Parthenium integrifolium</i>	<i>Polygala verticillata</i>	<i>Ranunculus abortivus</i>
<i>Parthenocissus quinquefolia</i>	<i>Polygonatum biflorum</i>	<i>Ranunculus cymbalaria</i>
<i>Pedicularis canadensis</i>	<i>Polygonatum pubescens</i>	<i>Ranunculus fascicularis</i>
<i>Pedicularis lanceolata</i>	<i>Polygonum tenue</i>	<i>Ranunculus flabellaris</i>
<i>Pellaea glabella</i>	<i>Polymnia canadensis</i>	<i>Ranunculus longirostris</i>
<i>Peltandra virginica</i>	<i>Polypodium virginianum</i>	<i>Ranunculus pensylvanicus</i>
<i>Penstemon calycosus</i>	<i>Polystichum acrostichoides</i>	<i>Ranunculus recurvatus</i>
<i>Penstemon digitalis</i>	<i>Polytaenia nuttallii</i>	<i>Ranunculus sceleratus</i>
<i>Penstemon hirsutus</i>	<i>Pontederia cordata</i>	<i>Ranunculus septentrionalis</i>
<i>Penthorum sedoides</i>	<i>Populus deltoides</i>	<i>Ratibida pinnata</i>
<i>Perideridia americana</i>	<i>Populus grandidentata</i>	<i>Rhamnus lanceolata</i>

APPENDIX 3 [Contd.]

<i>Rhexia virginica</i>	<i>Schoenoplectus acutus</i>	<i>Solidago uliginosa</i>
<i>Rhus copallinum</i>	<i>Schoenoplectus pungens</i>	<i>Solidago ulmifolia</i>
<i>Rhus glabra</i>	<i>Schoenoplectus tabernaemontani</i>	<i>Sorghastrum nutans</i>
<i>Rhus typhina</i>	<i>Scirpus atrovirens</i>	<i>Sparganium emersum</i>
<i>Rhynchospora capillacea</i>	<i>Scirpus cyperinus</i>	<i>Sparganium eurycarpum</i>
<i>Rhynchospora capitellata</i>	<i>Scirpus georgianus</i>	<i>Spartina pectinata</i>
<i>Ribes americanum</i>	<i>Scirpus hattorianus</i>	<i>Sphenopholis intermedia</i>
<i>Ribes cynosbati</i>	<i>Scirpus pedicellatus</i>	<i>Sphenopholis obtusata</i>
<i>Ribes hirtellum</i>	<i>Scirpus pendulus</i>	<i>Spiraea alba</i>
<i>Ribes missouriense</i>	<i>Scleria triglomerata</i>	<i>Spiraea tomentosa</i>
<i>Rorippa palustris</i>	<i>Scleria verticillata</i>	<i>Spiranthes cernua</i>
<i>Rorippa palustris</i> ssp. <i>hispida</i>	<i>Scrophularia lanceolata</i>	<i>Spiranthes lacera</i>
<i>Rorippa palustris</i> ssp. <i>palustris</i>	<i>Scrophularia marilandica</i>	<i>Spiranthes lucida</i>
<i>Rorippa sessiliflora</i>	<i>Scutellaria galericulata</i>	<i>Spiranthes magnicamporum</i>
<i>Rosa blanda</i>	<i>Scutellaria lateriflora</i>	<i>Spirodela polyrrhiza</i>
<i>Rosa carolina</i>	<i>Scutellaria leonardii</i>	<i>Sporobolus cryptandrus</i>
<i>Rosa setigera</i>	<i>Scutellaria parvula</i>	<i>Sporobolus heterolepis</i>
<i>Rotala ramosior</i>	<i>Selaginella eclipes</i>	<i>Sporobolus neglectus</i>
<i>Rubus allegheniensis</i>	<i>Senecio aureus</i>	<i>Sporobolus vaginiflorus</i> var. <i>vaginiflorus</i>
<i>Rubus flagellaris</i>	<i>Senecio pauperculus</i>	<i>Stachys hispida</i>
<i>Rubus hispidus</i>	<i>Senecio plattensis</i>	<i>Stachys pilosa</i>
<i>Rubus occidentalis</i>	<i>Senna hebecarpa</i>	<i>Staphylea trifolia</i>
<i>Rubus pubescens</i>	<i>Senna obtusifolia</i>	<i>Stellaria longifolia</i>
<i>Rudbeckia hirta</i>	<i>Sicyos angulatus</i>	<i>Strophostyles helvola</i>
<i>Rudbeckia laciniata</i>	<i>Silene antirrhina</i>	<i>Strophostyles leiosperma</i>
<i>Rudbeckia subtomentosa</i>	<i>Silene stellata</i>	<i>Stuckenia pectinata</i>
<i>Rudbeckia triloba</i>	<i>Silene virginica</i>	<i>Symphoricarpos occidentalis</i>
<i>Rumex altissimus</i>	<i>Silphium laciniatum</i>	<i>Symplocarpus foetidus</i>
<i>Rumex mexicanus</i>	<i>Silphium perfoliatum</i>	<i>Taenidia integerrima</i>
<i>Rumex verticillatus</i>	<i>Silphium terebinthinaceum</i>	<i>Tephrosia virginiana</i>
<i>Sagittaria brevirostra</i>	<i>Sisyrinchium albidum</i>	<i>Teucrium canadense</i> var. <i>canadense</i>
<i>Sagittaria cuneata</i>	<i>Sisyrinchium angustifolium</i>	<i>Teucrium canadense</i> var. <i>occidentale</i>
<i>Sagittaria graminea</i>	<i>Sisyrinchium campestre</i>	<i>Thalictrum dasycarpum</i>
<i>Sagittaria latifolia</i>	<i>Sisyrinchium montanum</i>	<i>Thalictrum dioicum</i>
<i>Salix amygdaloides</i>	<i>Sium suave</i>	<i>Thalictrum revolutum</i>
<i>Salix bebbiana</i>	<i>Smilax ecirrhata</i>	<i>Thalictrum thalictroides</i>
<i>Salix discolor</i>	<i>Smilax hispida</i>	<i>Thaspium trifoliatum</i>
<i>Salix eriocephala</i>	<i>Smilax illinoensis</i>	<i>Thelypteris palustris</i> var. <i>pubescens</i>
<i>Salix humilis</i>	<i>Smilax lasioneura</i>	<i>Tilia americana</i>
<i>Salix interior</i>	<i>Solidago caesia</i>	<i>Toxicodendron radicans</i>
<i>Salix myricoides</i>	<i>Solidago canadensis</i>	<i>Tradescantia ohiensis</i>
<i>Salix nigra</i>	<i>Solidago flexicaulis</i>	<i>Triadenum fraseri</i>
<i>Salix petiolaris</i>	<i>Solidago gigantea</i>	<i>Triantha glutinosa</i>
<i>Sambucus canadensis</i>	<i>Solidago juncea</i>	<i>Trichostema brachiatum</i>
<i>Samolus parviflorus</i>	<i>Solidago missouriensis</i>	<i>Trientalis borealis</i>
<i>Sanguinaria canadensis</i>	<i>Solidago nemoralis</i>	<i>Trifolium reflexum</i>
<i>Sanicula canadensis</i>	<i>Solidago ohioensis</i>	<i>Triglochin maritima</i>
<i>Sanicula marilandica</i>	<i>Solidago patula</i>	<i>Triglochin palustris</i>
<i>Sanicula odorata</i>	<i>Solidago ptarmicoides</i>	<i>Trillium cernuum</i>
<i>Sassafras albidum</i>	<i>Solidago riddellii</i>	<i>Trillium flexipes</i>
<i>Saururus cernuus</i>	<i>Solidago rigida</i>	<i>Trillium grandiflorum</i>
<i>Schizachyrium scoparium</i>	<i>Solidago speciosa</i>	

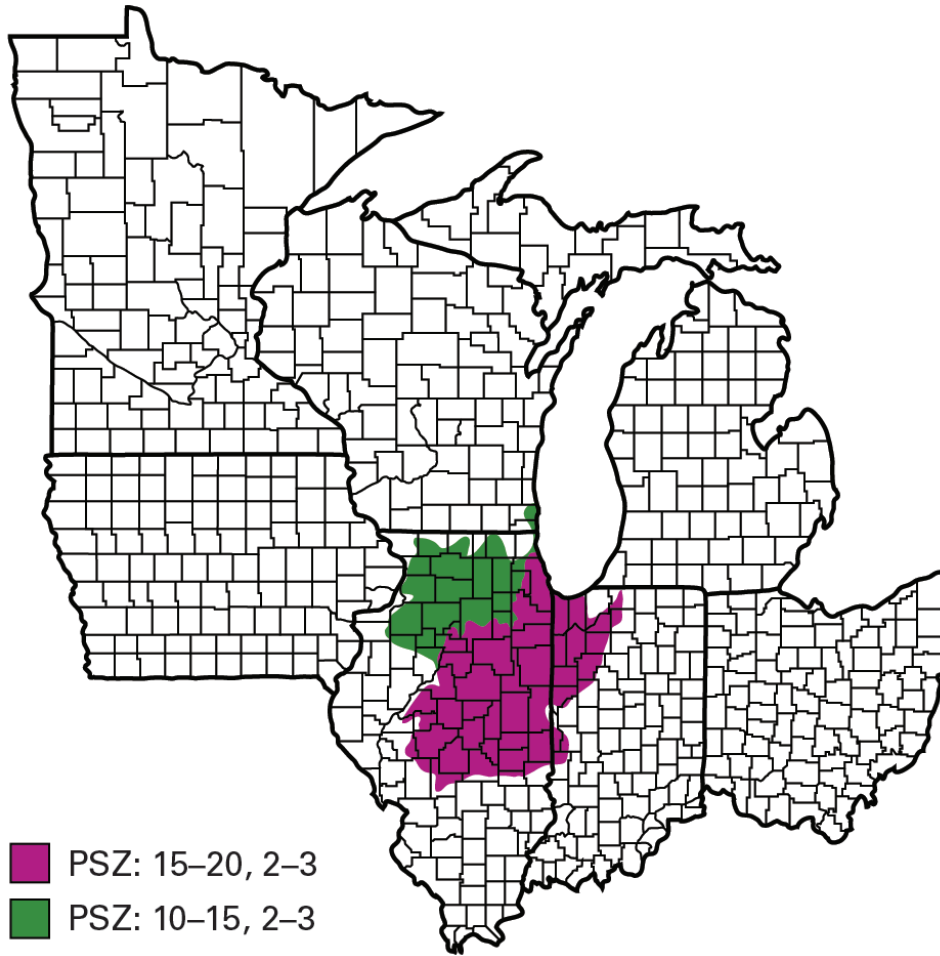
APPENDIX 3 [Contd.]

<i>Trillium nivale</i>	<i>Verbena hastata</i>	<i>Viola missouriensis</i>
<i>Trillium recurvatum</i>	<i>Verbena simplex</i>	<i>Viola pallens</i>
<i>Trillium sessile</i>	<i>Verbena stricta</i>	<i>Viola pedata</i>
<i>Triodanis perfoliata</i>	<i>Verbena urticifolia</i>	<i>Viola pedatifida</i>
<i>Triosteum aurantiacum</i>	<i>Verbesina alternifolia</i>	<i>Viola pubescens</i>
<i>Triosteum aurantiacum</i> var. <i>illinoiense</i>	<i>Vernonia fasciculata</i>	<i>Viola sagittata</i>
<i>Triosteum perfoliatum</i>	<i>Vernonia gigantea</i>	<i>Viola sororia</i>
<i>Triphora trianthophoros</i>	<i>Vernonia missurica</i>	<i>Viola striata</i>
<i>Triplasis purpurea</i>	<i>Veronica catenata</i>	<i>Viola subsinuata</i>
<i>Typha latifolia</i>	<i>Veronica peregrina</i>	<i>Vitis aestivalis</i>
<i>Ulmus americana</i>	<i>Veronicastrum virginicum</i>	<i>Vitis riparia</i>
<i>Ulmus rubra</i>	<i>Viburnum acerifolium</i>	<i>Vulpia octoflora</i>
<i>Utricularia gibba</i>	<i>Viburnum lentago</i>	<i>Wolffia braziliensis</i>
<i>Utricularia intermedia</i>	<i>Viburnum prunifolium</i>	<i>Wolffia columbiana</i>
<i>Utricularia vulgaris</i>	<i>Viburnum rafinesquianum</i>	<i>Xyris torta</i>
<i>Uvularia grandiflora</i>	<i>Viola affinis</i>	<i>Zizania aquatica</i>
<i>Vaccinium angustifolium</i>	<i>Vicia americana</i>	<i>Zizania palustris</i>
<i>Vaccinium macrocarpon</i>	<i>Vicia caroliniana</i>	<i>Zizia aptera</i>
<i>Vaccinium pallidum</i>	<i>Viola canadensis</i>	<i>Zizia aurea</i>
<i>Valeriana edulis</i> var. <i>ciliata</i>	<i>Viola cucullata</i>	<i>Zosterella dubia</i>
<i>Vallisneria americana</i>	<i>Viola labradorica</i>	
<i>Verbena bracteata</i>	<i>Viola lanceolata</i>	

APPENDIX 4 Rules for maintaining genetic diversity during the collection and propagation of native plants, taken and modified from Basey et al. (2015).

1. Identify sources with conditions similar to potential restoration sites.
2. Collect from sites with large populations.
3. Leave no genetic stone unturned – strategically collect seeds to ensure broad representation of individuals in the population.
4. Prevent loss of viable seeds during cleaning.
5. Use optimal storage conditions.
6. Diversify seed germination conditions.
7. Lessen the impacts of plant maintenance.
8. Minimize unintended hybridization.
9. Vary timing of seed harvest.
10. Limit the number of generations grown in production.

APPENDIX 5 Provisional seed zones (Bower et al. 2014) proposed for Tier 3 seed sourcing.



APPENDIX 6 A description of the sales quote, its format, and instructions for prospective bidders to properly respond. Any bid proposals received with responses that are inconsistent with these instructions may be rejected. Contact the project manager with any questions.

SALES QUOTE COLUMN	DESCRIPTION
Species	List of species for which the FPCC desires seed. Note that all species are being requested on a pure live seed (PLS) basis, and many on a de-fluffed (DF) or de-hulled (DH) basis.
Tier	Indicate seed source level. 1 = Cook County; 2 = Chicago Wilderness region outside Cook County; 3 = Provisional Seed Zones in the northeast Illinois ecoregion outside the Chicago Wilderness region.
Notes	Bidders shall use this column to report any discrepancies between their seed and what the FPCC is requesting for each species including information required (state, county, and distance from Cook County). Another example, "not PLS," "not DF," or "not tested". Bidders may attach a separate sheet to their response if more space is needed, or there are additional notes/comments that Bidders wish to make.
Quantity Desired	The absolute quantities of seed for each species that the FPCC is looking to acquire. Again, note that all species are being requested on a PLS basis, many on a DH or DF basis.
Quantity Available	Bidders shall enter the quantity of seed that they will have available by the stated deadline. If bidders have the full quantity desired by the FPCC, simply enter "All" here. If only partial quantities are available, bidders shall enter them in the same weight format as that given in the QUANTITY DESIRED column, i.e. if pounds are being requested, enter the quantity available in pounds, even if it is fractional, not in ounces. For any species that bidders do not have available, simply leave all columns blank.
Price per Unit	Bidders shall enter the cost per pound or cost per ounce, whichever unit is requested in the QUANTITY DESIRED column. Do not enter per ounce prices when pounds are being requested, and vice-versa. If there are any additional costs (e.g., shipping), they must be integrated into this unit price, do not list additional costs separately.
Extension Price	Bidders shall calculate and enter QUANTITY AVAILABLE multiplied by PRICE PER UNIT in this column. This number is the total cost for the seed available for that particular line item, including any additional costs (e.g., shipping).

APPENDIX 6 [Contd.]

Instructions to Vendors

1. Any seed received by the FPCC that does not meet Seed Policy and Guidelines specifications will be rejected and returned at the Vendor's expense.
2. All seed shall be guaranteed by the Vendor to be true to species name and variety.
3. Seed source origin must be guaranteed within the three-tiered approach explain in the Seed Policy and Guidelines. Seed origin preference is as follows: Tier 1, Tier 2, and then Tier 3. Forest Preserve staff may indicate that seed for some projects must come from within one or more tiers.
4. All seed shall meet the following PLS and quality requirements:
 - A. All species are requested on a PLS basis. PLS shall be defined as (purity) × (total germination). Total germination is defined as (germination + hard seeds + dormant seeds). TZ can be substituted in lieu of total germination if necessary. Vendors must indicate in their response if their seed is not available on a PLS basis. Copies of original seed tests from independent seed testing laboratories must be attached to the exterior of seed packaging when received by the FPCC.
 - B. Any seed that is not available by Vendors as PLS must still be tested for purity. The pure weight must total the amount ordered, with additional seed being supplied to meet 100% purity by bulk weight (e.g., 1.11 bulk pounds at 90% purity equals 1.00 pure pounds).
 - C. All species with a pappus (e.g., *Asclepias*, *Aster*, *Liatris*, *Solidago*, etc.) are being requested on a "de-fluffed" (DF) basis. Vendor must indicate in their response if their seed is not available on a de-fluffed basis. Preference will be given to de-fluffed seed rather than bulk seed.
 - D. All "hulled" species (e.g., *Desmodium*, *Lespedeza*, *Petalostemum*, etc.) are being requested on a de-hulled (DH) basis. Vendor must indicate in their response if their seed is not available on a de-hulled basis. Preference will be given to de-hulled seed rather than bulk seed.
5. Packaging for all species shall be clearly labeled on the outside with the following information:
 - A. Scientific name of species;
 - B. PLS value, PLS weight, and bulk weight;
 - C. Pure weight and bulk weight if seed is not available as PLS;
 - D. Seed tests must be attached to the packaging for all species at time of delivery;
 - E. Year of seed production and date of seed tests.
 - F. Clearly mark seed packages that require refrigerated/freezer storage.
6. All shipments shall include a PickTicket.
7. The Vendor shall provide (upon request) the FPCC a written description of the seed materials provided by the Vendor. This description shall include any or all of the following:
 - A. Origin of the various species of seed;

- B. Name and location of seed supplier, if not from Vendor's nursery;
 - C. Certificate of compliance from appropriate regulatory agencies indicating approval of seeds;
8. All legume species shall have the appropriate inoculants supplied with them.
 9. All seed and associated seed tests as outlined above are due no later than the date listed under the "Schedule (of seed delivery) Start Date" section of this Invitation to Bid.
 10. Vendor shall require signature upon delivery. The FPCC is not responsible for unsigned deliveries. No deliveries on weekends, Fridays, or holidays. No deliveries accepted after 2:00 P.M. Deliveries shall include picking slip and the FPCC's purchase order number and project name if provided.
 12. All deliveries of seeds shall be packaged and delivered to ensure the viability of the seed material upon delivery to the FPCC. All seed shall be packed and covered in such a manner as to insure adequate protection against leakage, damage and to maintain dormancy while in transit. Species requiring refrigeration shall be labeled as such on the package. The FPCC does not recommend shipping via freight (i.e., semi-trailer) due to spatial limitations of the delivery address.
 13. Any delivery/shipping costs shall be integrated into the seed price per oz./lb. and the itemized cost. Do not give both a seed cost and a separate shipping/delivery cost.
 14. Invoices shall directly reflect the quantities, price per unit, and itemized cost submitted to the Vendor in the form of Purchase Order and/or Attachment.

APPENDIX 7 Preferred seed source areas for FPCC regions*

REGION 1: Projects on Agricultural Lands or Other Disturbed Soils in this region may use seed from the seed sharing network led by the Citizens for Conservation, which sources seed from parts of northwestern Cook, Lake, and McHenry counties. Projects on remnant lands should follow the standards set in this policy and guidelines document.

REGION 2: Paul Douglas and the non-Nature-Preserve portions of Baker's Lake can be included within the Agricultural Lands network used in Region 1 above. Seed movement for other sites in these regions should be done following the guidelines in this document.

REGION 3: Seed movement within this region will follow this document's guidelines. Because the north end of the region runs immediately adjacent to natural areas in Lake County, seed movement between counties may be appropriate for augmentation with proper investigation and permission.

REGION 4: A regional seed policy has been in place and, in association with restoration activities, seed movement has been extensive in this region for over 25 years; consequently, the original species within remnant plant communities cannot be determined with certainty. As in other regions, seeds from within a site generally are preferred, especially for currently unmanaged remnants, such as Chipilly Woods and Spicebush. Outside of these unmanaged remnants, because of prior mixing, seed sourced from throughout this region may be used in existing restoration sites without additional consideration.

REGION 5: Seed movement within this region will follow this document's guidelines. Despite the continuous geography of the region, some natural communities are highly fragmented. Seed movement between disjunct communities between sites may be necessary and should be documented.

REGION 6: Some small areas have seed introduced from nurseries. Maps of these sites should be consulted and the guidelines in this document applied. Seed movement between remnant areas should be done following this document's guidelines.

REGIONS 7 AND 8: Seed for Bartel Grasslands and Orland Grasslands, prairie restorations on former agricultural land, came from a nursery 150+ miles from the site. Seed from these sites should not be moved off-site, but can be moved within each site. Seed movement for other sites in these regions should be done following this document's guidelines.

REGION 9: Because the sites in this region are highly fragmented, this region has been divided into five areas referred to as Kickapoo, Dune-and-Swale, Thorn Creek, Sauk Trail, and Plum Creek. Two of these areas, Kickapoo and Plum Creek, have very small remnant areas and projects there generally will need to obtain seed from other areas in Region 9 and possibly from elsewhere. Each of the three other areas generally should contain sufficient seed either within the preserve itself or within the area to provide any seed needed. Both Plum Creek and Sauk Trail are connected to natural areas in Will County, and seed from these natural areas may be appropriate for augmentation with proper investigation and permission.

* All dedicated Illinois Nature Preserves and registered Land and Water Reserves must follow the Illinois Nature Preserve Commission's Translocation Guidelines in addition to those found in this policy.

APPENDIX 7 [Contd.] Map showing location of FPCC regions, properties, and Landscape Units.

