Forest Preserves of Cook County
Seed Source Policy and Guidelines

Brenda Molano-Flores and Geoffrey A. Levin

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 materials 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 reproduction (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.

The 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 (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 of positive or negative effects of augmentation 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. Local = 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.

<table>
<thead>
<tr>
<th>Seed Source Strategy</th>
<th>Definition</th>
<th>Seed Source Tier</th>
<th>Seed Source Mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCAL (L)</td>
<td>Using seed only from the site where restoration is occurring or populations within normal gene flow distance</td>
<td>Tier 1*</td>
<td>Local Source</td>
</tr>
<tr>
<td>RELAXED LOCAL 1 (RL1)</td>
<td>Using seed from a single geographically close population with a focus on matching environment of source and recipient sites</td>
<td>Tier 1*</td>
<td></td>
</tr>
<tr>
<td>RELAXED LOCAL (RL)</td>
<td>Mixing seed from geographically close populations with a focus on matching environment of source and recipient sites</td>
<td>Tier 1*</td>
<td></td>
</tr>
<tr>
<td>COMPOSITE (C)</td>
<td>Mixing seed from two or more populations of close and intermediate distance (or environmental match) to mimic long distance gene flow</td>
<td>Tiers 1 &amp; 2</td>
<td></td>
</tr>
<tr>
<td>ADMIXTURE (A)</td>
<td>Mixing seed from two or more populations of varying distances throughout the range of the species</td>
<td>Tiers 1, 2 &amp; 3</td>
<td>Regional Source</td>
</tr>
<tr>
<td>PREDICTIVE (P)</td>
<td>Using genotypes adapted to predicted conditions (e.g., 2050 climate projections) based on models and transplant experiments</td>
<td>Tiers 1, 2 &amp; 3</td>
<td></td>
</tr>
</tbody>
</table>

* 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 mal-adapted 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 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 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.

---

**FIGURE 3** Project evaluation flowchart for FPCC. Recreated from Hufford and Mealor 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 (Huford and Mealor 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.

**Acknowledgments**

Numerous individuals contributed to the content and presentation of this seed source policy and guidelines document. Danielle Ruffatto contributed to the content, design, and editing of the document including designing tables and figures. Earlier versions of this document benefitted from comments and suggestions from Laura Anchor, John Balaban, Tim Bell, Becky Collings, Mary-Claire Glasenhardt, Sean Hoban, Dan Kirk, John Kolar, Andrea Kramer, Juli Mason, John McCabe, Kelly Neal, Chip O’Leary, Kelly Schultz, Greg Spyreas, Eric Ulaszek, Stuart Wagenius, and Jerry Wilhelm. The process of revising this document also benefitted from the contributions of Brittany Baumer, Tari Tweddale, and Kathy Wurster.

**Citations**


Jones, T.A. 2013. When Local Isn’t Best. Evolutionary Applications 6:1109–1118.


Omernik, J. M. 1987. Ecoregions of the Conterminous...
Thomas, S. 1998. The Natural Communities of Cook County: An Ecological Classification System for Terrestrial Communities. Forest Preserve District of Cook County, Conservation Department. pp 198.
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.

<table>
<thead>
<tr>
<th>REGIONAL ASSESSMENT AREA</th>
<th>LINK TO ON-LINE RESOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago River/Lake Shore</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/13892">https://www.ideals.illinois.edu/handle/2142/13892</a></td>
</tr>
<tr>
<td>Du Page River</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/13879">https://www.ideals.illinois.edu/handle/2142/13879</a></td>
</tr>
<tr>
<td>Fox River</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/13881">https://www.ideals.illinois.edu/handle/2142/13881</a></td>
</tr>
<tr>
<td>Lake Calumet</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/13877">https://www.ideals.illinois.edu/handle/2142/13877</a></td>
</tr>
<tr>
<td>Lower Des Plaines River</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/13894">https://www.ideals.illinois.edu/handle/2142/13894</a></td>
</tr>
<tr>
<td>Prairie Parklands</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/13867">https://www.ideals.illinois.edu/handle/2142/13867</a></td>
</tr>
<tr>
<td>Thorn Creek</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/14423">https://www.ideals.illinois.edu/handle/2142/14423</a></td>
</tr>
<tr>
<td>Upper Des Plaines River</td>
<td><a href="https://www.ideals.illinois.edu/handle/2142/14424">https://www.ideals.illinois.edu/handle/2142/14424</a></td>
</tr>
</tbody>
</table>
APPENDIX 3  Native plant species list for Cook County. This plant species list was generated by using the web-based database Illinois Plants (http://wwx.inhs.illinois.edu/data/plantdb/; Pearse et al 2015) and refined by Laura Anchor.

Acalypha rhomboidea
Acer negundo
Acer rubrum
Acorus americanus
Actaea pachypoda
Actaea rubra
Adiantum pedatum
Agalinis auriculata
Agalinis gattingeri
Agalinis paupercula
Agalinis purpurea
Agalinis tenuifolia
Agastache nepetoides
Agastache scrophulariaefolia
Ageratina altissima
Agrimonia gryposepala
Agrimonia parviflora
Agrimonia pubescens
Agrimonia rostellata
Agrostis gigantea
Agrostis hyemalis
Agrostis stolonifera var. palustris
Alopecurus aequalis
Alopecurus carolinianus
Amaranthus tuberculatus
Amelanchier humilis
Amelanchier interior
Amelanchier laevis
Amelanchier sanguinea
Ammannia robusta
Ammophila arenaria
Amorpha canescens
Amorpha fruticosa
Amphicarpaea bracteata
Andropogon gerardii
Anemone canadensis
Anemone cylindrica
Anemone quinquefolia
Anemone virginiana
Angelica atropurpurea
Antennaria neglecta
Antennaria parlinii ssp. fallax
Antennaria parlinii ssp. parlinii
Antennaria plantaginifolia
Apios americana
Aplectrum hyemale
Apocynum androsaemifolium
Apocynum cannabinum
Aquilegia canadensis
Arabidopsis lyrata
Arabis glabra
Arabis laevigata
Arabis shortii
Aralia nudicaulis
Aralia racemosae
Arisaema draconatum
Arisaema triphyllum
Aristida oligantha
Aristida purpurascens
Arnomglossum atriplicifolium
Arnonossomum plantaginea
Aronia melanocarpa
Aronia prunifolia
Artemisia campestris
Asarum canadense
Asclepias amplexicaulis
Asclepias exaltata
Asclepias hirtella
Asclepias purpurascens
Asclepias sullivantii
Asclepias syriaca
Asclepias tuberosa
Asclepias verticillata
Asclepias viridiflora
Asimina triloba
Asplenium platyneuron
Asplenium rhizophyllum
Aster amethystinus
Aster dumasus
Aster ericoides
Aster firmus
Aster laevis
Aster lanceolatus
Aster lateriflorus
Aster linarifolius
Aster novae-angliae
Aster oolentangiensis
Aster pilosus
Aster praecox
Aster praealtus
Aster puniceus
Aster sagittifolius
Astragalus canadensis
Asplenium filix-femina var. angustum
Athyrium canadense
Athyrium filix-femina var. angustum
Athyrium plantaginea
Baptisia lactea
Baptisia leucophaea
Baptisia tinctoria
Beckmannia syzigachne
Berula erecta
Bidens aristosa
Bidens bipinnata
Bidens cernua
Bidens connata
Bidens coronata
Bidens frondosa
Bidens multiflora
Bidens polylepis
Bidens tripartita
Bidens vulgata
Blephilia ciliata
Blephilia hirsuta
Boehmeria cylindrica
Boboschosnoes fluviatilis
Boltonia asteroides
Botrychium dissectum
Botrychium virginianum
Bouteloua curtipendula
Brachylytrum erectum
Breckilla eupatorioides
Bromus ciliatus
Bromus kalmii
Bromus latifolius
Bromus notowayanus
Bromus pubescens
Bulbostylis capillaris
Calamagrostis canadensis
Calamagrostis stricta ssp. inexpansa
Calamintha arakensa
Calamovilfa longifolia
Callitriches heterophylla
Callitriches palustris
Calopogon tuberosus
Caltha palustris
Calystegia spithamaea
Camassia scilloides
Campanula americana
Campanula aparinaeas
APPENDIX 3 [Contd.]

Campanula rotundifolia  Carex lupulina  Cicutula maculata  Cicuta maculata
Cardamine bulbosa  Carex meadii  Cinna arundinacea
Cardamine concatenata  Carex molesta  Circaea canadensis
Cardamine douglasi  Carex muehlenbergii  Cirsium altissimum
Cardamine parviflora  Carex muskingumensis  Cirsium discolor
Cardamine pensylvanica  Carex normalis  Cirsium hillii
Carex aggregata  Carex oligocarpa  Cirsium muticum
Carex albicans var. albicans  Carex pellita  Cladium mariscoides
Carex alburnsina  Carex pensylvanica  Claytonia virginica
Carex alopecoidea  Carex praiea  Clematis virginiana
Carex amphibola  Carex rosea  Coeloglossum viride
Carex annectens  Carex sartwellii  Collinsia verna
Carex aquatilis  Carex scoparia  Comandra umbellata
Carex atherodes  Carex shortiana  Comarum palustre
Carex aurea  Carex siccata  Comptonia peregrina
Carex bebbii  Carex sparganioides  Conopholis americana
Carex bicknellii  Carex sprengelii  Corallorhiza maculata
Carex blanda  Carex squarrosa  Coreopsis lanceolata
Carex brevior  Carex sterilis  Coreopsis palmata
Carex bromoides  Carex stipata  Coreopsis tripteris
Carex buxbaumii  Carex stricta  Cornus alternifolia
Carex cephaloidea  Carex sub erecta  Cornus obliqua
Carex cephalophora  Carex swanii  Cornus racemosa
Carex comosa  Carex tenera  Cornus sericea
Carex conjuncta  Carex tetanica  Corydalis flavula
Carex conoidea  Carex tribuloides  Corydalis sempervirens
Carex crawei  Carex trichocarpa  Corylus americana
Carex crinata  Carex tuckermanii  Crataegus calpodendron
Carex cristatella  Carex umbellata  Crataegus crus-galli
Carex crus-corvi  Carex vescaria  Crataegus holmesiana
Carex cryptolepis  Carex viridula  Crataegus macroserpem
Carex davisi  Carex vulpinoidea  Crataegus mollis
Carex digitalis  Carex woodii  Crataegus pruinosa
Carex festucacea  Carpinus caroliniana  Crataegus punctata
Carex gracilesens  Carya cordiformis  Crataegus succulenta
Carex gracilima  Carya ovata  Cryptotaenia canadensis
Carex granularis  Castilleja coccinea  Cuscuta cephalanthi
Carex gravida  Caulophyllum thalictroides  Cuscuta coryli
Carex grayi  Ceanothus americanus  Cuscuta glomerata
Carex grisea  Celastrus scandens  Cuscuta gronovii
Carex haydenii  Celtis occidentalis  Cuscuta pentagona
Carex hirsutella  Cephalanthus occidentalis  Cuscuta polygonorum
Carex hirtifolia  Ceratophyllum demersum  Cycloloma atripsilicifolium
Carex hitchcockiana  Chaerophyllum procumbens  Cyperus bipartitus
Carex hystericina  Chamaecrista fasciculata  Cyperus diandrus
Carex intumescens  Chamaecrista nictitans  Cyperus erythrorhizos
Carex jamesii  Chelone glabra  Cyperus esculentus
Carex lacustris  Chenopodium pratericola  Cyperus lupulinus
Carex laevigatinata  Chenopodium simplex  Cyperus odoratus
Carex lasiocarpa  Chenopodium standleyanum  Cyperus schweinitzii
Carex leptalea  Chimaphila maculata  Cyperus squarrosus
Carex lupuliformis  Cicuta bulbifera  Cyperus strigosus
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cypripedium acaule</td>
<td></td>
</tr>
<tr>
<td>Cypripedium candidum</td>
<td></td>
</tr>
<tr>
<td>Cypripedium parviflorum</td>
<td></td>
</tr>
<tr>
<td>Cypripedium parviflorum var. pubescens</td>
<td></td>
</tr>
<tr>
<td>Cypripedium reginae</td>
<td></td>
</tr>
<tr>
<td>Cypripedium × andrewsii</td>
<td></td>
</tr>
<tr>
<td>Cystopteris bulbifera</td>
<td></td>
</tr>
<tr>
<td>Cystopteris protrusa</td>
<td></td>
</tr>
<tr>
<td>Dalea purpurea</td>
<td></td>
</tr>
<tr>
<td>Danthonia spicata</td>
<td></td>
</tr>
<tr>
<td>Dasiphora fruticosa</td>
<td></td>
</tr>
<tr>
<td>Dasistoma macrophylla</td>
<td></td>
</tr>
<tr>
<td>Deparia acrostichoides</td>
<td></td>
</tr>
<tr>
<td>Deschampsia caespitosa ssp. glauca</td>
<td></td>
</tr>
<tr>
<td>Desmodium canadense</td>
<td></td>
</tr>
<tr>
<td>Desmodium cuspidatum</td>
<td></td>
</tr>
<tr>
<td>Desmodium cuspidatum var. longifolium</td>
<td></td>
</tr>
<tr>
<td>Desmodium illinoense</td>
<td></td>
</tr>
<tr>
<td>Desmodium paniculatum</td>
<td></td>
</tr>
<tr>
<td>Desmodium perplexum</td>
<td></td>
</tr>
<tr>
<td>Dicentra canadensis</td>
<td></td>
</tr>
<tr>
<td>Dicentra cucullaria</td>
<td></td>
</tr>
<tr>
<td>Dichantherium boreale</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium latifolium</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium leibergii</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium lindheimeri</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium perlongum</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium praecox</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium pseudopubescens</td>
<td></td>
</tr>
<tr>
<td>Dichanthelium scriberianum</td>
<td></td>
</tr>
<tr>
<td>Diervilla lonicera</td>
<td></td>
</tr>
<tr>
<td>Digitaria cognata</td>
<td></td>
</tr>
<tr>
<td>Dioscorea vilosa</td>
<td></td>
</tr>
<tr>
<td>Dirca palustris</td>
<td></td>
</tr>
<tr>
<td>Dodecatheon meadia</td>
<td></td>
</tr>
<tr>
<td>Doellingeria umbellata</td>
<td></td>
</tr>
<tr>
<td>Draba reptans</td>
<td></td>
</tr>
<tr>
<td>Drosera intermedia</td>
<td></td>
</tr>
<tr>
<td>Drymocallis arguta</td>
<td></td>
</tr>
<tr>
<td>Dryopteris carthusiana</td>
<td></td>
</tr>
<tr>
<td>Dryopteris cristata</td>
<td></td>
</tr>
<tr>
<td>Dulichium arundinaceum</td>
<td></td>
</tr>
<tr>
<td>Echinacea pallida</td>
<td></td>
</tr>
<tr>
<td>Echinacea purpurea</td>
<td></td>
</tr>
<tr>
<td>Echinochloa muricata</td>
<td></td>
</tr>
<tr>
<td>Echinocloa walteri</td>
<td></td>
</tr>
<tr>
<td>Echinocystis lobata</td>
<td></td>
</tr>
<tr>
<td>Eleocharis acicularis</td>
<td></td>
</tr>
<tr>
<td>Eleocharis compressa</td>
<td></td>
</tr>
<tr>
<td>Eleocharis elliptica</td>
<td></td>
</tr>
<tr>
<td>Eleocharis engelmannii</td>
<td></td>
</tr>
<tr>
<td>Eleocharis erythropoda</td>
<td></td>
</tr>
<tr>
<td>Eleocharis intermedia</td>
<td></td>
</tr>
<tr>
<td>Eleocharis obtusa</td>
<td></td>
</tr>
<tr>
<td>Eleocharis olivacea</td>
<td></td>
</tr>
<tr>
<td>Eleocharis palustris</td>
<td></td>
</tr>
<tr>
<td>Eleocharis quinqueflora</td>
<td></td>
</tr>
<tr>
<td>Eleocharis rostellata</td>
<td></td>
</tr>
<tr>
<td>Eleocharis verrucosa</td>
<td></td>
</tr>
<tr>
<td>Ellisia nyctelea</td>
<td></td>
</tr>
<tr>
<td>Elodea canadensis</td>
<td></td>
</tr>
<tr>
<td>Elodea nuttallii</td>
<td></td>
</tr>
<tr>
<td>Elymus canadensis</td>
<td></td>
</tr>
<tr>
<td>Elymus hystrix</td>
<td></td>
</tr>
<tr>
<td>Elymus riparius</td>
<td></td>
</tr>
<tr>
<td>Elymus trachycaulus</td>
<td></td>
</tr>
<tr>
<td>Elymus villosus</td>
<td></td>
</tr>
<tr>
<td>Elymus virginicus</td>
<td></td>
</tr>
<tr>
<td>Enemonium bibernatum</td>
<td></td>
</tr>
<tr>
<td>Epilobium ciliatum</td>
<td></td>
</tr>
<tr>
<td>Epilobium coloratum</td>
<td></td>
</tr>
<tr>
<td>Epilobium leptophyllum</td>
<td></td>
</tr>
<tr>
<td>Equisetum arvense</td>
<td></td>
</tr>
<tr>
<td>Equisetum fluviatile</td>
<td></td>
</tr>
<tr>
<td>Equisetum hyemale</td>
<td></td>
</tr>
<tr>
<td>Equisetum laevigatum</td>
<td></td>
</tr>
<tr>
<td>Eragrostis capillaris</td>
<td></td>
</tr>
<tr>
<td>Eragrostis frankii</td>
<td></td>
</tr>
<tr>
<td>Eragrostis hypnooides</td>
<td></td>
</tr>
<tr>
<td>Eragrostis spectabilis</td>
<td></td>
</tr>
<tr>
<td>Erigenia bulbosa</td>
<td></td>
</tr>
<tr>
<td>Erigeron philadelphicus</td>
<td></td>
</tr>
<tr>
<td>Erigeron pulchellus</td>
<td></td>
</tr>
<tr>
<td>Erigeron strigosus</td>
<td></td>
</tr>
<tr>
<td>Eriophorum angustifolium</td>
<td></td>
</tr>
<tr>
<td>Eryngium yuccifolium</td>
<td></td>
</tr>
<tr>
<td>Erythronium albidum</td>
<td></td>
</tr>
<tr>
<td>Erythronium americanum</td>
<td></td>
</tr>
<tr>
<td>Euonymus atropurpureus</td>
<td></td>
</tr>
<tr>
<td>Euonymus obovatus</td>
<td></td>
</tr>
<tr>
<td>Eupatorium perfoliatum</td>
<td></td>
</tr>
<tr>
<td>Eupatorium sessilifolium</td>
<td></td>
</tr>
<tr>
<td>Euphorbia corollata</td>
<td></td>
</tr>
<tr>
<td>Eurybia macrophylla</td>
<td></td>
</tr>
<tr>
<td>Euthamia graminifolia</td>
<td></td>
</tr>
<tr>
<td>Euthamia gymnospermoides</td>
<td></td>
</tr>
<tr>
<td>Eutrochium maculatum</td>
<td></td>
</tr>
<tr>
<td>Eutrochium purpureum</td>
<td></td>
</tr>
<tr>
<td>Festuca subverticillata</td>
<td></td>
</tr>
<tr>
<td>Filipendula rubra</td>
<td></td>
</tr>
<tr>
<td>Fimbrystylis autumnalis</td>
<td></td>
</tr>
<tr>
<td>Fimbrystylis pubera var. pubera</td>
<td></td>
</tr>
<tr>
<td>Floerkea proserpinacoides</td>
<td></td>
</tr>
<tr>
<td>Fragaria vesca ssp. americana</td>
<td></td>
</tr>
<tr>
<td>Fragaria virginiana</td>
<td></td>
</tr>
<tr>
<td>Frasera caroliniensis</td>
<td></td>
</tr>
<tr>
<td>Fraxinus americana</td>
<td></td>
</tr>
<tr>
<td>Fraxinus nigra</td>
<td></td>
</tr>
<tr>
<td>Fraxinus pennsylvanica</td>
<td></td>
</tr>
<tr>
<td>Fraxinus quadrangulata</td>
<td></td>
</tr>
<tr>
<td>Galearhis spectabilis</td>
<td></td>
</tr>
<tr>
<td>Galium aparine</td>
<td></td>
</tr>
<tr>
<td>Galium asprellum</td>
<td></td>
</tr>
<tr>
<td>Galium borale</td>
<td></td>
</tr>
<tr>
<td>Galium circaezans</td>
<td></td>
</tr>
<tr>
<td>Galium concinnnum</td>
<td></td>
</tr>
<tr>
<td>Galium obtusum</td>
<td></td>
</tr>
<tr>
<td>Galium pilosum</td>
<td></td>
</tr>
<tr>
<td>Galium tinctorum</td>
<td></td>
</tr>
<tr>
<td>Galium trifidum</td>
<td></td>
</tr>
<tr>
<td>Galium triflorum</td>
<td></td>
</tr>
<tr>
<td>Gautheria procumbens</td>
<td></td>
</tr>
<tr>
<td>Gaura longiflora</td>
<td></td>
</tr>
<tr>
<td>Gaylussacia baccata</td>
<td></td>
</tr>
<tr>
<td>Gentiana alba</td>
<td></td>
</tr>
<tr>
<td>Gentiana andrewsii</td>
<td></td>
</tr>
<tr>
<td>Gentiana puberulenta</td>
<td></td>
</tr>
<tr>
<td>Gentiana saponaria</td>
<td></td>
</tr>
<tr>
<td>Gentianella quinquefolia ssp. occidentalis</td>
<td></td>
</tr>
<tr>
<td>Gentianopsis crinita</td>
<td></td>
</tr>
<tr>
<td>Gentianopsis virgata</td>
<td></td>
</tr>
<tr>
<td>Geranium bicknelli</td>
<td></td>
</tr>
<tr>
<td>Geranium carolinianum</td>
<td></td>
</tr>
<tr>
<td>Geranium maculatum</td>
<td></td>
</tr>
<tr>
<td>Geum aleppicum</td>
<td></td>
</tr>
<tr>
<td>Geum canadense</td>
<td></td>
</tr>
<tr>
<td>Geum laciniatum</td>
<td></td>
</tr>
<tr>
<td>Geum triflorum</td>
<td></td>
</tr>
<tr>
<td>Geum vernum</td>
<td></td>
</tr>
<tr>
<td>Glyceria borealis</td>
<td></td>
</tr>
<tr>
<td>Glyceria septentrionalis</td>
<td></td>
</tr>
<tr>
<td>Glyceria striata</td>
<td></td>
</tr>
<tr>
<td>Gnaphalium obtusifolium</td>
<td></td>
</tr>
<tr>
<td>Goodyera pubescens</td>
<td></td>
</tr>
<tr>
<td>Gratiola aurea</td>
<td></td>
</tr>
<tr>
<td>Gratiola neglecta</td>
<td></td>
</tr>
<tr>
<td>Gratiola virginiana</td>
<td></td>
</tr>
<tr>
<td>Hamamelis virginiana</td>
<td></td>
</tr>
<tr>
<td>Hedeoma hispida</td>
<td></td>
</tr>
<tr>
<td>Hedeoma pulegioides</td>
<td></td>
</tr>
<tr>
<td>Helenium autumnale</td>
<td></td>
</tr>
<tr>
<td>Helianthemum bicknelli</td>
<td></td>
</tr>
<tr>
<td>Helianthemum canadense</td>
<td></td>
</tr>
</tbody>
</table>
Helianthus decapetalus
Helianthus divaricatus
Helianthus giganteus
Helianthus grosseserratus
Helianthus hirsutus
Helianthus mollis
Helianthus occidentalis
Helianthus pauciflorus
Helianthus strumosus
Helianthus tuberosus
Helianthus × luxurians
Heliopsis helianthoides
Hepatica nobilis var. acuta
Hepatica nobilis var. obtusa
Heracleum maximum
Hesperostipa spartea
Helenium richardsonii
Hibiscus laevis
Hibiscus moschatus ssp. lasiocarpus
Hibiscus moschatus ssp. moschatus
Hieracium canadense
Hieracium gronovii
Hieracium longipilum
Hieracium scabrum
Houstonia caerulea
Huperzia lucidula
Hydrastis canadensis
Hydrophyllum appendiculatum
Hydrophyllum virginianum
Hylodesmus glutinosus
Hypericum canadense
Hypericum gentianoides
Hypericum gymnanthum
Hypericum majus
Hypericum mutilum
Hypericum prolificum
Hypericum punctatum
Hypericum pyramidatum
Hypericum sphaerocarpum
Hypopitys monotropa
Hyposis hirsuta
Ixer verticillata
Impatiens capensis
Impatiens pallida
Iodonanthus pinatifidus
Ipomoea pandurata
Iris virginica
Jeffersonia diphylla
Juglans cinerea
Juglans nigra
Juncus acuminatus
Juncus biformus
Juncus brachycarpus
Juncus brachycephalus
Juncus bufo
Juncus canadensis
Juncus dudleyi
Juncus effusus
Juncus greenii
Juncus marginatus
Juncus nodosus
Juncus tenuis
Juncus torreyi
Juniperus communis
Justice americana
Koeleria macrantha
Krigia biflora
Krigia virginica
Lactuca biennis
Lactuca canadensis
Lactuca floridana
Laportea canadensis
Lathyrus ochroleucus
Lathyrus palustris
Lathyrus venosus
Lechea mucronata
Lechea pulchella
Leersia ozyroides
Leersia virginica
Lemna aequinoctialis
Lemna minor
Lemna perpusilla
Lemna trisulca
Lespedeza capitata
Lespedeza frutescens
Lespedeza hirta
Lespedeza leptostachya
Lespedeza virginica
Leucospora multifida
Liatris aspera
Liatris clytaea
Liatris pycnostachya
Liatris scariosa var. nieuwlandii
Liatris spicata
Lilium michiganense
Lilium philadelphicum
Lindera benzoin
Lindernia dubia
Linum sulcatum
Liparis lilifolia
Liparis loeselii
Lipocarphe drummondii
Lipocarphe micrantha
Lithospermum canescens
Lithospermum carolinense
Lithospermum incisum
Lithospermum latifolium
Lobelia cardinalis
Lobelia inflata
Lobelia kalmii
Lobelia siphilitica
Lobelia spicata
Lonicera dioica
Lonicera reticulata
Ludwigia alternifolia
Ludwigia palustris
Ludwigia peploides ssp. glabrescens
Ludwigia polycarpa
Lupinus perennis
Luzula multiflora
Lycopus americanus
Lycopus rubellus
Lycopus uniflorus
Lycopus virginicus
Lysimachia ciliata
Lysimachia lanceolata
Lysimachia quadriflora
Lysimachia quadrifolia
Lysimachia terrestris
Lysimachia thysiflora
Lythrum alatum
Maianthemum canadense
Maianthemum racemosum
Maianthemum stellata
Malus coronaria
Malus ioensis
Medeola virginiana
Melampyrum lineare var. latifolium
Melica nitens
Menispernum canadense
Mertensia virginica
Miconanthus pensylvanicus
Mimulus ringsens
Minuartia patula
Minuartia stricta
Mitchellia repens
Mitella diphylla
Moehringia lateriflora
Monarda fistulosa
Monarda punctata
Monotropa uniflora
Morus rubra
Muhlenbergia frondosa
Muhlenbergia glomerata
Muhlenbergia mexicana
Muhlenbergia schreberi
Muhlenbergia sylvatica
Muhlenbergia tenuiflora
Myriophyllum sibiricum
Najas flexilis
Najas guadalupensis
Nuphar advena
Nuphar variegata
Nuttallanthus canadensis
Nymphæa odorata
Nymphæa odorata ssp. tuberosa
Nyssa sylvatica
Oenothera biennis
Oenothera clandii
Oenothera laciniata
Oenothera perennis
Oenothera pilosella
Onoclea sensibilis
Ophioglossum pusillum
Opuntia humifusa
Orobanche uniflora
Osmorhiza claytonii
Osmorhiza longistyliis
Osmunda claytoniana
Osmunda spectabilis
Osmundastrum cinnamomea
Ostrya virginiana
Oxalis dillenii
Oxalis stricta
Oxalis violacea
Oxypolis rigidior
Panax quinquefolius
Panicum capillare
Panicum dichotomiflorum
Panicum flexile
Panicum rigidulum
Panicum virgatum
Parietaria pensylvanica
Parnassia glauca
Paronychia canadensis
Paronychia fastigiata
Parthenium integrifolium
Parthenocissus quinquefolia
Pedicularis canadensis
Pedicularis lanceolata
Pellaea glabella
Peltandra virginica
Penstemon calycosus
Penstemon digitalis
Penstemon hirsutus
Penthorum sedoides
Perideridia americana
Persicaria amphibia
Persicaria careyi
Persicaria hydropiperoides
Persicaria pensylvanica
Persicaria punctata
Persicaria virginianum
Phegopteris hexagonoptera
Phlox bifida
Phlox divaricata
Phlox glaberrima ssp. interior
Phlox pilosa
Phryma leptostachya
Phyla lanceolata
Physalis heterophylla
Physalis virginiana
Physocarpus opulifolius
Physostegia virginiana
Phytolacca americana
Pilea fontana
Pilea pumila
Pinus strobus
Piptatherum racemosum
Plantago rugelii
Platanthera aquilonis
Platanthera ciliaris
Platanthera clavellata
Platanthera flavo var. herbiola
Platanthera hookeri
Platanthera lacera
Platanthera leucophaea
Platanthera orbiculata
Platanthera psyclodes
Platanus occidentalis
Poa palustris
Poa sylvestris
Podophyllum peltatum
Pogonia ophioglossoides
Polenonium reptans
Polygala polygama
Polygala sanguinea
Polygala senega
Polygala verticillata
Polygonatum biflorum
Polygonatum pubescens
Polygonum tenue
Polymnia canadensis
Polypodium virginianum
Polystichum acrostichoides
Polytaenia nuttallii
Pontederia cordata
Populus deltoides
Populus grandidentata
Populus tremuloides
Potamogeton amplifolius
Potamogeton foliosus
Potamogeton gramineus
Potamogeton illinoensis
Potamogeton nodosus
Potamogeton pusillus
Potamogeton robbinsii
Potamogeton strictifolius
Potamogeton zosteriformis
Potentilla anserina
Potentilla norvegica
Potentilla simplex
Prenanthes alba
Prenanthes aspera
Prenanthes crepidinea
Prenanthes racemosa
Prunella vulgaris
Prunus americana
Prunus nigra
Prunus pensylvanica
Prunus serotina
Prunus virginiana
Psoralidium tenuiflorum
Ptelea trifoliata
Pteridium aquilinum var. latisulcum
Pycnanthemum pilosum
Pycnanthemum tenuifolium
Pycnanthemum virginianum
Pyrola elliptica
Quercus alba
Quercus bicolor
Quercus coccinea
Quercus ellipsoidalis
Quercus imbricaria
Quercus macrocarpa
Quercus muhlenbergii
Quercus palustris
Quercus rubra
Quercus velutina
Ranunculus abortivus
Ranunculus cymbalaria
Ranunculus fascicularis
Ranunculus flabellaris
Ranunculus longirostris
Ranunculus pensylvanicus
Ranunculus recurvatus
Ranunculus sceleratus
Ranunculus septentrionalis
Ratibida pinnata
Rhamnus lanceolata

APPENDIX 3 [Contd.]
APPENDIX 3 [Contd.]

Rhexia virginica
Rhus copallinum
Rhus glabra
Rhus typhina
Rhyzchospora capillacea
Rhyzchospora capitellata
Ribes americanum
Ribes cynosbati
Ribes hirtellum
Ribes missouriense
Rorippa palustris
Rorippa palustris ssp. hispida
Rorippa palustris ssp. palustris
Rorippa sessiliflora
Rosa blanda
Rosa carolina
Rosa setigera
Rotala ramosior
Rubus allegheniensis
Rubus flagellaris
Rubus hispidus
Rubus occidentalis
Rubus pubescens
Rudbeckia hirta
Rudbeckia laciniata
Rudbeckia subtomentosa
Rudbeckia triloba
Rumex altilissimus
Rumex mexicanus
Rumex verticillatus
Sagittaria brevirostra
Sagittaria cuneata
Sagittaria graminea
Sagittaria latifolia
Salix amygdaloides
Salix bebbiana
Salix discolor
Salix eriocephala
Salix humilis
Salix interior
Salix myricoides
Salix nigra
Salix petiolata
Sambucus canadensis
Samolus parviflorus
Sanguinaria canadensis
Sanicula canadensis
Sanicula marilandica
Sanicula odorata
Sassafras albidum
Saururus cernus
Schizachyrium scoparium
Schoenoplectus acutus
Schoenoplectus pungens
Schoenoplectus tabernaemontani
Scirpus atrovirens
Scirpus cyperinus
Scirpus georgianus
Scirpus hattorianus
Scirpus pedicellatus
Scirpus pendulus
Scleria trigomerata
Scleria verticillata
Scrophularia lanceolata
Scrophularia marilandica
Scutellaria galericulata
Scutellaria lateriflora
Scutellaria leonardii
Scutellaria parvula
Selaginella eclipus
Senecio aureus
Senecio paucerculat
Senecio plattensis
Senna hebecarpa
Senna obtusifolia
Silene antirrhina
Silene stellata
Silene virginica
Silphium laciniatum
Silphium perfoliatum
Silphium terebinthinaeum
Silyrinchium albidum
Silyrinchium angustifolium
Silyrinchium campestre
Silyrinchium montanum
Sium suave
Smilax eirrata
Smilax hispida
Smilax ilinonensis
Smilax lasioneura
Solidago caesia
Solidago canadensis
Solidago flexicaulis
Solidago gigantea
Solidago juncea
Solidago missouriensis
Solidago nemoralis
Solidago ohioensis
Solidago patula
Solidago ptarmicoides
Solidago riddellii
Solidago rigid
Solidago speciosa
Solidago uliginosa
Solidago ulmifolia
Sorghastrum nutans
Sparganium emersum
Sparganium eurycarpum
Spaetina pectinata
Sphenopholis intermedia
Sphenopholis obtusa
Spiraea alba
Spiraea tomentosa
Spiranthes cernua
Spiranthes lacera
Spiranthes lucida
Spiranthes magnificamporum
Spirodea polyrrhiza
Sporobolus cryptandrus
Sporobolus heterolepis
Sporobolus neglectus
Sporobolus vaginiflorus var. vaginiflorus
Stachys hispida
Stachys pilosa
Staphylea trifolia
Stellaria longifolia
Strophostyles helvola
Strophostyles leiostepoma
Stuckenia pectinata
Symphoricarpos occidentalis
Symphoricarpos foetidus
Taenidia integerrima
Taphrosia virginiana
Teucrium canadense var. canadense
Teucrium canadense var. occidentale
Thalictrum dasy carpum
Thalictrum dioicum
Thalictrum revolutum
Thalictrum thalictroides
Thaspium trifoliatum
Thelepterus palustris var. pubescens
Tilia americana
Toxicodendron radicans
Tradescantia ohiensis
Triadenum fraseri
Trianta glutinosa
Trichostema brachiatum
Trientalis borealis
Trifolium repuls
Triglochin maritima
Triglochin palustris
Trillium cernuum
Trillium flexipes
Trillium grandiflorum
<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Plant Species</th>
<th>Plant Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trillium nivale</td>
<td>Verbena hastata</td>
<td>Viola missouriensis</td>
</tr>
<tr>
<td>Trillium recurvatum</td>
<td>Verbena simplex</td>
<td>Viola pallens</td>
</tr>
<tr>
<td>Trillium sessile</td>
<td>Verbena stricta</td>
<td>Viola pedata</td>
</tr>
<tr>
<td>Triodanis perfoliata</td>
<td>Verbena urticifolia</td>
<td>Viola pedatifida</td>
</tr>
<tr>
<td>Triosteum aurantiacum</td>
<td>Verbesina alternifolia</td>
<td>Viola pubescens</td>
</tr>
<tr>
<td>Triosteum aurantiacum var. illinoiense</td>
<td>Vernonia fasciculata</td>
<td>Viola sagittata</td>
</tr>
<tr>
<td>Triosteum perfoliatum</td>
<td>Vernonia gigantea</td>
<td>Viola sororia</td>
</tr>
<tr>
<td>Triphora trianthophoros</td>
<td>Vernonia missurica</td>
<td>Viola striata</td>
</tr>
<tr>
<td>Triplasis purpurea</td>
<td>Veronica catenata</td>
<td>Viola subsinuata</td>
</tr>
<tr>
<td>Typha latifolia</td>
<td>Veronica peregrina</td>
<td>Vitis aestivalis</td>
</tr>
<tr>
<td>Ulmus americana</td>
<td>Veronicastrum virginicum</td>
<td>Vitis riparia</td>
</tr>
<tr>
<td>Ulmus rubra</td>
<td>Viburnum acerifolium</td>
<td>Vulpia octoflora</td>
</tr>
<tr>
<td>Utricularia gibba</td>
<td>Viburnum dentatum</td>
<td>Wolffia brasiliensis</td>
</tr>
<tr>
<td>Utricularia intermedia</td>
<td>Viburnum prunifolium</td>
<td>Wolffia columbiana</td>
</tr>
<tr>
<td>Utricularia vulgaris</td>
<td>Viburnum rafinesquianum</td>
<td>Xyris torta</td>
</tr>
<tr>
<td>Uvularia grandflora</td>
<td>Viola affinis</td>
<td>Zizania aquatica</td>
</tr>
<tr>
<td>Vaccinium angustifolium</td>
<td>Vicia americana</td>
<td>Zizania palustris</td>
</tr>
<tr>
<td>Vaccinium macrocarpon</td>
<td>Vicia caroliniana</td>
<td>Zizia aptera</td>
</tr>
<tr>
<td>Vaccinium pallidum</td>
<td>Viola canadensis</td>
<td>Zizia aurea</td>
</tr>
<tr>
<td>Valeriana edulis var. ciliata</td>
<td>Viola cucullata</td>
<td>Zosterella dubia</td>
</tr>
<tr>
<td>Vallisneria americana</td>
<td>Viola labradorica</td>
<td></td>
</tr>
<tr>
<td>Verbena bracteata</td>
<td>Viola lanceolata</td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>SALES QUOTE COLUMN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>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.</td>
</tr>
<tr>
<td>Tier</td>
<td>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.</td>
</tr>
<tr>
<td>Notes</td>
<td>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.</td>
</tr>
<tr>
<td>Quantity Desired</td>
<td>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.</td>
</tr>
<tr>
<td>Quantity Available</td>
<td>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.</td>
</tr>
<tr>
<td>Price per Unit</td>
<td>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.</td>
</tr>
<tr>
<td>Extension Price</td>
<td>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).</td>
</tr>
</tbody>
</table>
### APPENDIX 6  [Contd.] Sales quote form.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>TIER (1, 2, &amp; 3)</th>
<th>NOTES FOR TIER INCLUDING STATE, COUNTY, &amp; MILES FROM COOK COUNTY</th>
<th>QTY (PLS POUNDS)</th>
<th>QTY AVAILABLE</th>
<th>UNIT PRICE</th>
<th>EXTENSION PRICE</th>
</tr>
</thead>
</table>
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) x (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 Pick Ticket.

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 PM. 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, SaukTrail, 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.