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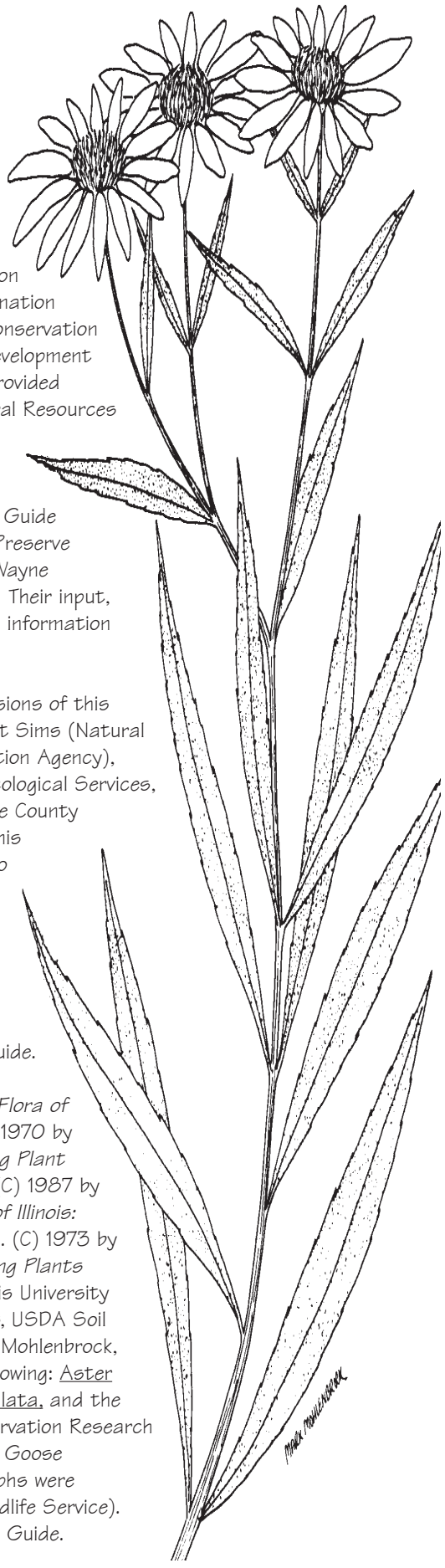


Effective Protection With Visual Appeal

Wet bottom detention basins incorporating emergent shoreline plantings discussed in this Guide can prevent shoreline erosion and add an aesthetically appealing appearance as depicted in the photograph above. As shown below, wetland detention basins that incorporate emergent plants across the basin bottom provide greater wildlife habitat and water quality benefits.

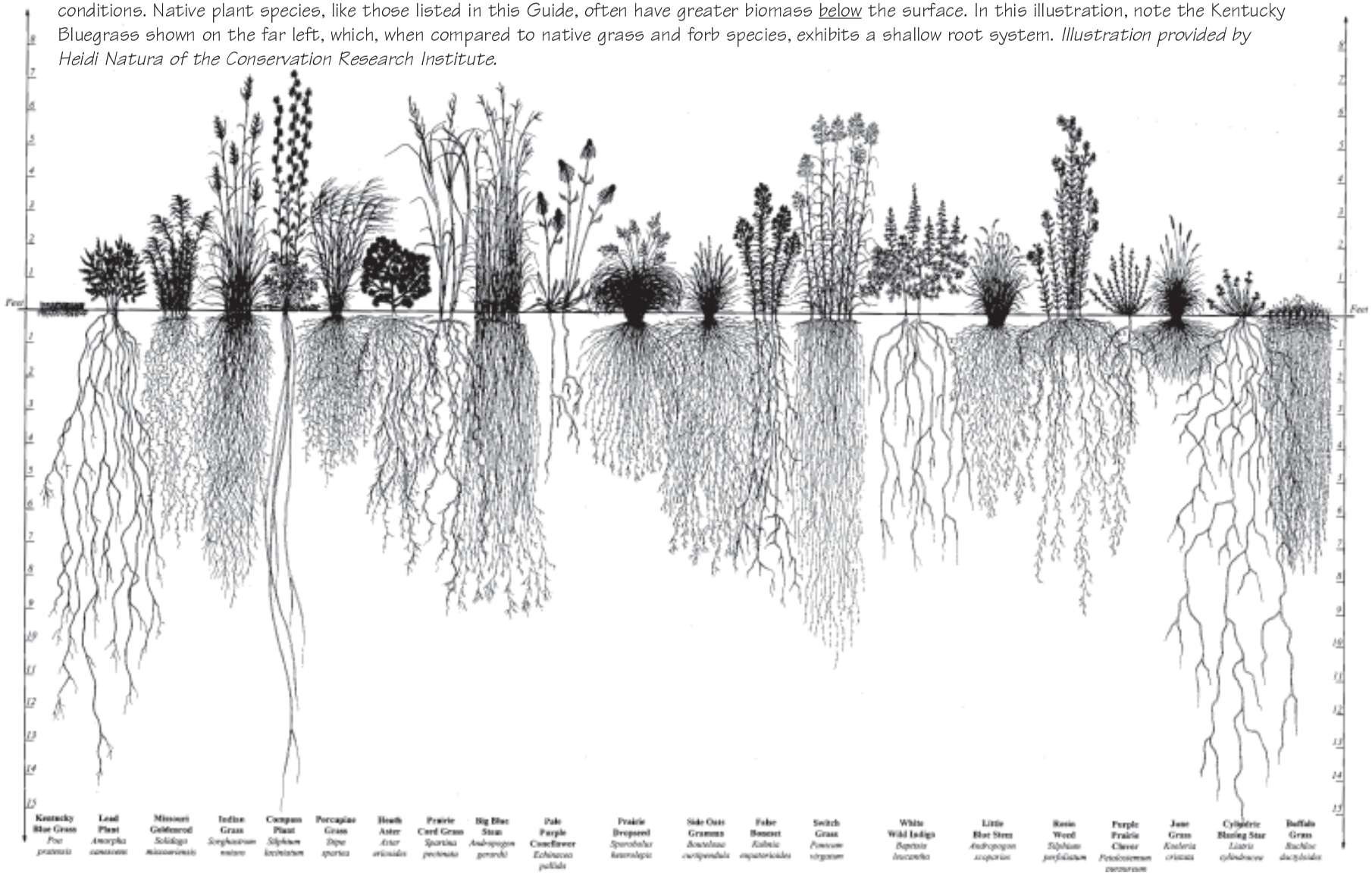
The photograph above illustrates the more traditional approach to stormwater basins with mowed turf grass shorelines, which can erode and cause water quality problems. The photograph below shows a stormwater basin with native plantings for shoreline stabilization and upland slope buffer. The shoreline and buffer plantings reduce erosion, improve water quality and wildlife habitat, and reduce maintenance costs.

The following illustrations on the Root Systems of Prairie Plants and the Plant Zone Schematic are available in a large 11x17 size as a PDF file. You may download the large size illustrations at:

ftp://ftp-fc.sc.egov.usda.gov/IL/techres/npg/NPGpp5-6-11x17.pdf

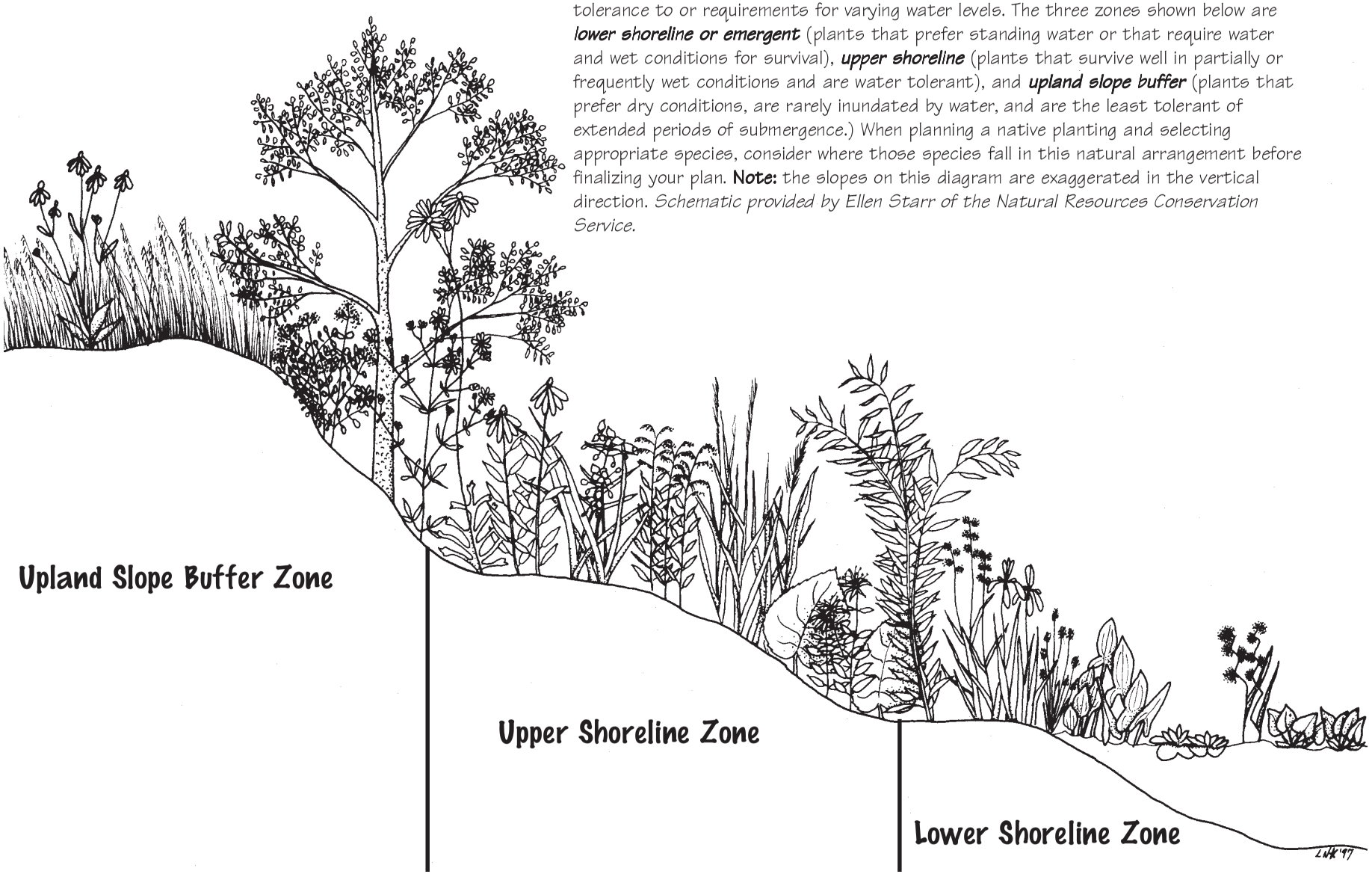
Root Systems of Prairie Plants

The fundamental basis for encouraging use of native plant species for improved soil erosion control in streams and stormwater facilities lies in the fact that native plants have extensive root systems which improve the ability of the soil to infiltrate water and withstand wet or erosive conditions. Native plant species, like those listed in this Guide, often have greater biomass below the surface. In this illustration, note the Kentucky Bluegrass shown on the far left, which, when compared to native grass and forb species, exhibits a shallow root system. *Illustration provided by Heidi Natura of the Conservation Research Institute.*

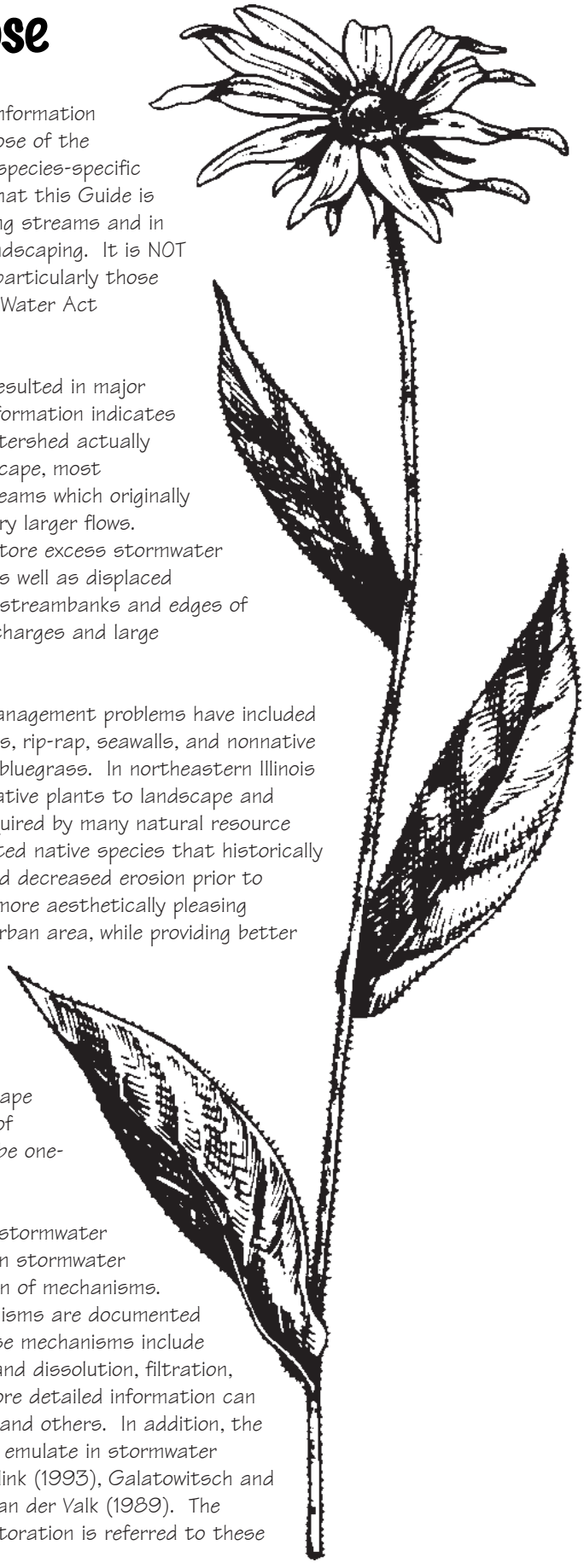


Plant Zone Schematic

The drawing below shows the natural arrangement of plant species as dictated by their tolerance to or requirements for varying water levels. The three zones shown below are ***lower shoreline or emergent*** (plants that prefer standing water or that require water and wet conditions for survival), ***upper shoreline*** (plants that survive well in partially or frequently wet conditions and are water tolerant), and ***upland slope buffer*** (plants that prefer dry conditions, are rarely inundated by water, and are the least tolerant of extended periods of submergence.) When planning a native planting and selecting appropriate species, consider where those species fall in this natural arrangement before finalizing your plan. **Note:** the slopes on this diagram are exaggerated in the vertical direction. *Schematic provided by Ellen Starr of the Natural Resources Conservation Service.*



Introduction and Purpose



In order to gain the most benefit from the concepts and information presented in this Guide, users must understand the purpose of the Guide and its limitations and must consider the detailed species-specific information. It is important to emphasize at the outset that this Guide is intended to encourage the use of native plant species along streams and in and around stormwater facilities instead of traditional landscaping. It is NOT intended for wetland or prairie restorations or creations, particularly those restorations or creations implemented as part of a Clean Water Act permitted mitigation plan.

Increased urban development in northeastern Illinois has resulted in major changes in the area's hydrologic regime. Presettlement information indicates that only a small percentage of precipitation in a given watershed actually resulted in measurable runoff. In the presettlement landscape, most precipitation was able to infiltrate into the soil. Today, streams which originally meandered have been straightened and channelized to carry larger flows. Stormwater detention basins are utilized to temporarily store excess stormwater generated by impervious surfaces and compacted lawns, as well as displaced floodplains and wetlands. Erosion commonly occurs along streambanks and edges of detention basins as a result of increased stormwater discharges and large fluctuations in water levels.

Traditional methods to control erosion and stormwater management problems have included structural measures such as rock and concrete structures, rip-rap, seawalls, and nonnative plant materials, such as reed canary grass and Kentucky bluegrass. In northeastern Illinois and elsewhere, there is a growing interest in the use of native plants to landscape and stabilize these areas. This approach, recommended or required by many natural resource and regulatory agencies, takes advantage of the deep-rooted native species that historically stabilized the soil, slowed runoff, facilitated infiltration, and decreased erosion prior to development of the area. These species may also offer a more aesthetically pleasing solution to the stormwater and erosion challenges of an urban area, while providing better wildlife habitat.

Native plantings can also provide economic benefits. The "bottom line" can be a strong motivation for installing and maintaining natural landscaping instead of conventional turfgrass. The major savings is in the lower cost of landscape maintenance. Over a ten year period, the combined costs of installation and maintenance for natural landscapes may be one-fifth of the costs for conventional landscape maintenance.

Using native vegetation along streams and in and around stormwater facilities also provides water quality benefits. Pollutants in stormwater can be removed by native vegetation through a combination of mechanisms. Physical, biological, and chemical pollutant removal mechanisms are documented to occur in wetlands and other natural communities. These mechanisms include nutrient uptake, sedimentation, adsorption, precipitation and dissolution, filtration, biochemical interactions, volatilization, and infiltration. More detailed information can be found in Strecker, *et al.* (1992), Adamus, *et al.* (1987), and others. In addition, the processes that occur in natural wetlands, which we try to emulate in stormwater management facilities, are described in Mitsch and Gosselink (1993), Galatowitsch and van der Valk (1994), Marble (1992), Hammer (1992), and van der Valk (1989). The reader who wishes to pursue a more complete wetland restoration is referred to these

five referenced publications for more detailed and comprehensive information. For prairie restorations, Packard and Mutel (1997) is recommended reading.

There are 1,638 native taxa (species or subspecies) of plants found in the Chicago region (Swink and Wilhelm 1994). Native plants are those that are believed to have grown naturally in this region prior to settlement by Europeans. An additional 892 taxa grow naturally but are believed to have been introduced by settlers from other parts of the world. Current ecological understandings indicate that many of these introduced species displace native species and reduce diversity. Of the 2,530 types of plants known in the Chicago region, more than one-third were not here prior to European settlement. Yet out of the nearly 900 nonnative species, only about 150 species are generally successful and persistent. **These 150 nonnative species dominate more than 95 percent of the vegetated landscape.** Most human disturbed or managed landscapes are nearly monocultures, vegetated by only one or a few species. A natural prairie remnant, in contrast, can contain more than 100 species within just two or three acres. This mix of more than 100 species is what is meant by diversity, and is one example of biodiversity. Thus, using native species in stormwater management facilities and for streambank and shoreline stabilization can help increase biodiversity while providing a more aesthetically pleasing landscape. The more diverse native landscapes will be able to withstand more adverse conditions, such as droughts.

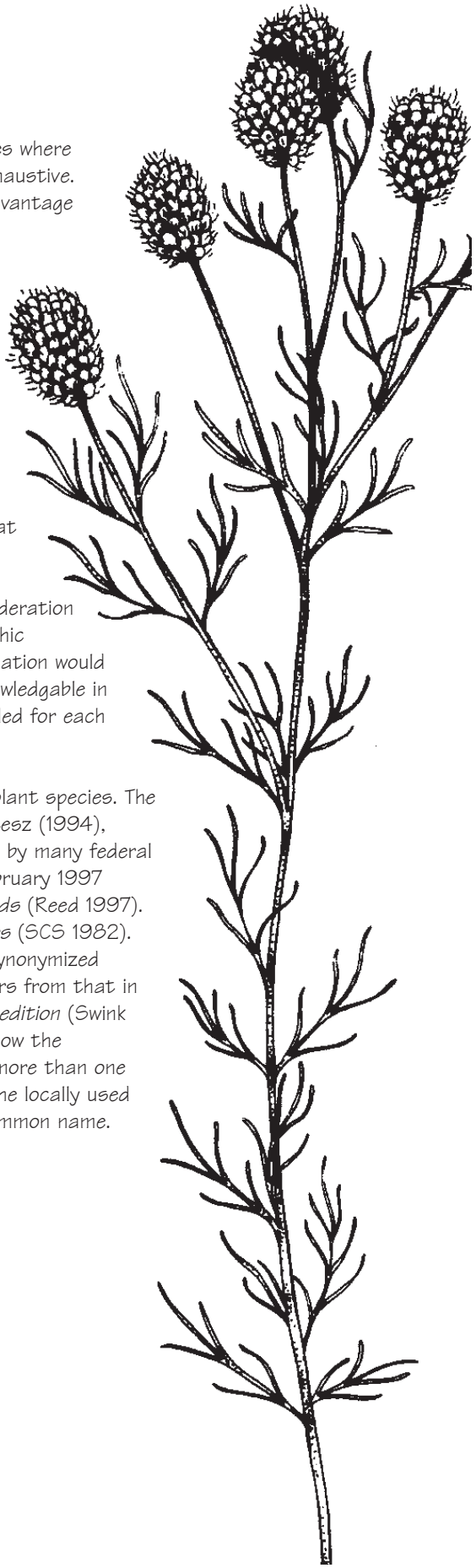
Currently, there are no other comprehensive guides that provide information on native species for streams and stormwater facilities in northeastern Illinois. This Guide will provide a valuable new tool for federal, state, and local governments, park districts, developers, landscape architects, engineers, homeowners' associations, and others. While the science of using native plants in urban landscapes is expanding rapidly, much remains to be learned about most aspects of native landscaping in stormwater management facilities and streambank stabilization projects. With each project and with each native landscape restoration in the northeastern Illinois region, information about plant "preferences" and tolerances is obtained. Surprisingly little of this new knowledge is published and that which is, remains difficult for nonscientists to access and apply.

This Guide is an effort to consolidate the information available from as many different sources as possible. It also relies heavily on the knowledge and experience of local restoration ecologists and practitioners. This knowledge and experience encompasses a large amount of information that is not published and is generally not available to those from other disciplines or vocations. *The information in this Guide is intended primarily for use in stormwater management facilities and streambank stabilization projects. Wetland or prairie restorations or mitigation required under Section 404 of the Clean Water Act will likely need to go beyond the species and information in this Guide. True prairie and wetland restorations will not be constrained by detention or other goals and purposes and should include more diverse species communities.* The species selected for inclusion in this Guide are thought to be more tolerant of the harsh urban environment, relative to other more sensitive native species. Species in this Guide are also more easily established and widely available.

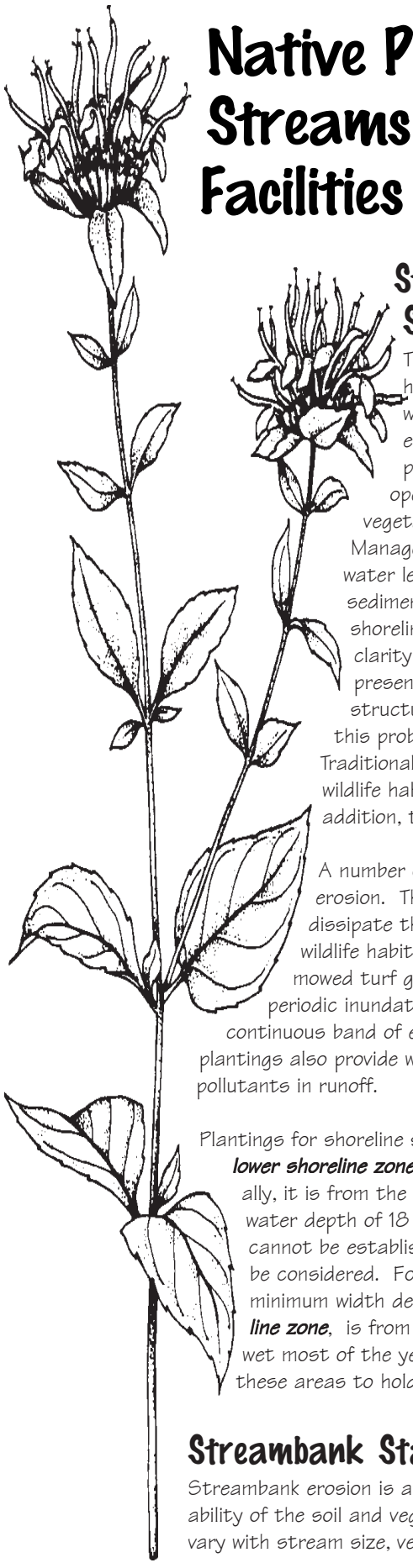
This Guide provides practical information in a user-friendly format and will guide the selection and placement of native species in those areas where they can best compete and survive. Individual species are presented on facing pages with several categories of information given for each. Some species were included even if all the information required in a given category was not available. Suggested mixes or lists of species for different applications are also suggested. If users of this Guide have experience or literature references that would add to the information contained herein, this information with references should be sent to: USDA Natural Resources Conservation Service's Plainfield Special Project Office, 313 Naperville Road, Suite J, Plainfield, Illinois 60544 or U.S. Fish and Wildlife Service, Chicago Field Office, 1250 South Grove Avenue, Suite 103, Barrington, Illinois 60010 for possible inclusion in future editions.

Information Sources

Information was obtained from published scientific literature sources where available, though the literature search should not be considered exhaustive. Locally-based restoration practitioners were interviewed to take advantage of the most current but as yet unpublished information on restoration and establishment techniques. In some instances this local experience conflicted with literature information. In many cases this was due to the geographic location of the research reported in the literature. As an illustration, Marburger (1993) provides an example of a species known to have different germination requirements in different parts of the United States. Differing climate, soil chemistry, geology, and genotype may influence the germination and establishment requirements of species in different locations. Therefore, local knowledge was included here preferentially over literature references that may be from other parts of the country. Thus, it should be emphasized that this Guide contains information on growing these species in the northeastern Illinois region, and this information should not be extrapolated to other geographic locations without adequate consideration of these factors. Of course, some species have widespread geographic distribution. In these cases, the application and propagation information would be applicable in a larger geographic area. Individuals or agencies knowledgable in this field should be consulted to determine if the information provided for each species is applicable in areas outside of northeastern Illinois.



Both the scientific name and common name are included for each plant species. The primary nomenclature (plant names) used in this guide follows Kartesz (1994), which has been largely adopted as a national standard and is used by many federal agencies. This is consistent with the nomenclature used in the February 1997 *Revision of the National List of Plant Species that Occur in Wetlands* (Reed 1997). Kartesz (1994) replaces the *National List of Scientific Plant Names* (SCS 1982). The Natural Resources Conservation Service maintains the 1994 Synonymized Checklist as the PLANTS database. Where this nomenclature differs from that in the most widely used local flora, *Plants of the Chicago Region, 4th edition* (Swink and Wilhelm 1994), the name used in Swink and Wilhelm is listed below the scientific name in parentheses. Please understand, however, that more than one species of plant can be referred to with the same common name. The locally used common name is included in smaller type below the predominant common name.



Native Plant Applications for Streams and Stormwater Facilities

Stormwater Detention Basins--Shoreline Stabilization

This application includes wet-bottom detention basins and ponds that have a permanent pool of open water as well as wetland detention basins, which only detain water for a limited period during and after rainfall events. Wet-bottom detention basins are those that have a permanent pool of open water, while wetland detention basins do not have permanent open water but maintain saturated conditions such that wetland vegetation can grow on the bottom. Dry detention is not a recommended Best Management Practice (BMP). Shoreline erosion is caused by wave action and water level fluctuations that can erode the shoreline and contribute to sedimentation of the pond. This in-filling of sediment from erosion of the shoreline can decrease the storage capacity of ponds, reduce water quality and clarity, and cause the shoreline to recede. The receding shoreline frequently presents additional problems with the integrity of adjacent facilities and structures, such as buildings and trails. In many cases traditional solutions to this problem, such as rip-rap, do not provide adequate long-term stabilization. Traditional engineered solutions have the added problem of providing little or no wildlife habitat, or in the case of seawalls can have a negative affect on wildlife. In addition, these traditional engineering approaches are often visually unappealing.

A number of native wetland plants can be used to effectively correct shoreline erosion. The deep roots of the plants will stabilize the soil. Stems and foliage dissipate the wave energy before it hits the shoreline. An added benefit is the wildlife habitat provided by such vegetation far exceeds that offered by rip-rap, mowed turf grass, or steel seawalls. Many native species are more tolerant of periodic inundation from wave action or fluctuating water levels than turf grasses. A continuous band of emergent plants will reduce nuisance geese problems. These shoreline plantings also provide water quality benefits through removal, uptake, and transformation of pollutants in runoff.

Plantings for shoreline stabilization in ponds can consist of two components. The first is the ***lower shoreline zone***, which occupies the shallow water around the basin's perimeter. Generally, it is from the water's edge to a water depth of 6 inches, with a seasonal maximum water depth of 18 inches. If such a shallow shelf is not present around the pond, this zone cannot be established and limited regrading to flatten slopes and establish a shelf should be considered. For shoreline stabilization, a wider shelf provides more benefit, but a minimum width depends on storage and safety needs. The second zone, the ***upper shoreline zone***, is from the water's edge to the point where the soil is no longer saturated or wet most of the year. Plant deep-rooted plants naturally adapted to shoreline settings in these areas to hold the soil together and reduce shoreline erosion.

Streambank Stabilization

Streambank erosion is a natural process that occurs when the forces of flowing water exceed the ability of the soil and vegetation to hold the banks in place. Natural rates of streambank erosion vary with stream size, velocity, amount of vegetative cover, and the type of soil. Under well-

vegetated conditions, lower order (smaller) streams show little erosion over decades. Larger streams often show erosion on the outside bank of bends, but under natural vegetated conditions, this becomes a part of the naturally meandering stream morphology. Under natural conditions, stream channels are continuously changing as the outside banks of the meanders are carved out while deposition continues on the point bars. With the urbanization of the region, society has sought to keep streams in one place so as to not disrupt the man-made environment. Furthermore, many streams have been straightened to increase conveyance and provide surface and subsurface drainage to urban and agricultural landscapes. This has caused increased velocities and in turn increased erosion. To exacerbate this further, increasing amounts of impervious surface increase the flow rates and volumes in urban streams after each storm event. In many places, these high velocity, straightened channels are lined by shallow-rooted turf grass areas and other features of the urban landscape. In this type of setting nearly all of the factors that once held streambanks in place have been removed. By reestablishing deep-rooted native vegetation along streams, streambanks can be stabilized in a more natural and longer lasting way.

Bioengineering or bio-erosion control in some cases involves the use of structural elements such as coconut fiber rolls, concrete A-jacks, lunkers, and others. In most cases it also involves the establishment of native vegetation. This native vegetation can be herbaceous or woody, depending on the situation. In most cases the banks have become nearly vertical, due to the continued severe erosion in both urban and agricultural environments. In order for the native herbaceous vegetation to be successful, these slopes must be reduced to approximate those that existed prior to the accelerated erosion caused by human activities. Gradual slopes (no steeper than 5:1 horizontal: vertical) are recommended. Flatter slopes should be considered whenever possible. Woody vegetation can also be used, especially in more severe erosion situations. Trees and shrubs provide root reinforcement of the soil. Roots mechanically reinforce soil by transfer of the shear stresses in the soil to tensile resistance in the roots. Woody vegetation also provides soil reinforcement by the buttressing and arching support provided by embedded roots and stems. Native woody vegetation can also provide similar benefits to those described for the herbaceous vegetation for upland slope buffers.

Stormwater Detention Basins & Streambanks-Upland Slope Buffer

Stormwater runoff on slopes can cause significant soil erosion problems and non-point source pollution if the runoff is not slowed and the soil is not protected. Native herbaceous vegetation can provide a solution to these problems through a number of mechanisms. The above-ground portions of the plant, the leaves and stems, absorb rainfall energy and thus reduce the impact on the soil surface. Root systems physically bind the soil together so that it remains stabilized during runoff events. Root channels also help facilitate infiltration of the rain. Through these mechanisms the erosion potential on the slopes is greatly reduced. In addition, once runoff reaches the slope, the vegetation serves to slow it down and filter out sediment. Deep-rooted native species have a much greater capacity for overall erosion prevention than shallow-rooted, mowed turf grass. As with shoreline vegetation, a native plant buffer on slopes around basins and along streams offers considerably more habitat value for wildlife than mowed turf grass or other more traditional urban treatments, yet is unattractive to nuisance Canada geese. Buffers should be as wide as possible for maximum benefit. Their size is dependent on drainage area and slope, but as a rule of thumb, a 25-100 foot minimum is recommended.

Vegetated Swales

Erosion can be a problem in drainageways where the gradient is steep or water flow velocities are high. Deep-rooted native species can help to bind and stabilize the soil. Dense native vegetation can also slow runoff, thereby reducing erosive forces while filtering out some sediments and contaminants. Most native species however, are not tolerant of high salt concentrations or other contaminants which often accumulate along roads and in ditches. Caution should be exercised by using the tolerance information provided with each species in this Guide. Ditches should be configured as swales with gentle side-slopes rather than traditional square or V-shaped ditches in order to maximize water quality benefits and infiltration. See also the *Illinois Urban Manual* for design information. Drainage swales are often recommended as an alternative to pipes or ditches for water quality benefits in stormwater management systems. Swales have gentle side slopes and should be low gradient. If vegetated with deep-rooted native species, swales can provide wildlife habitat, reduce erosive forces, slow runoff rates, promote infiltration, and filter out sediments and nutrients. The species used for drainage swales should be selected based on how wet the swale will be between rain events, the water quality expected, and anticipated flow conditions. The selection of any particular species or mix of species must also include its effect on the capacity or size of a vegetated swale.

General Design, Application, & Management Considerations

Sources of Design Information

The overall design of any stormwater management facility or streambank stabilization project is very important. If designed inappropriately, it will be very difficult, if not impossible, to establish native species. It will also be difficult to realize any of the water quality or habitat benefits. A brochure entitled *Stormwater Detention Basin Retrofitting* available from the Northeastern Illinois Planning Commission (NIPC) provides guidelines for incorporating best management practices (BMP) and native plantings into existing facilities. NIPC also has a course curriculum notebook for *Urban Stormwater Best Management Practices for Northeastern Illinois* and a *Source Book: Natural Landscaping for Public Officials*, which provide design guidelines and encourage the use of native plantings.

For streambank and shoreline stabilization methods and design information, Appendix A in the *Streambank Stabilization Program* report (RUST 1995) available from DuPage County Department of Environmental Concerns is a recommended reference. The latest edition of the *Illinois Urban Manual* (NRCS/IEPA) is also a good reference for design information and specifications. Bioengineering techniques are becoming increasingly popular nationwide and new information is continually appearing in the literature. The Illinois State Water Survey has done extensive work on streambank stabilization and can be contacted for further information or refer to *"Field Manual of Urban Stream Restoration,"* (Gaboury, *et al.*, 1996) for more comprehensive stream restoration information. Other references may be available from your county Soil and Water Conservation District or from the local offices of the agencies that produced this Guide (See Appendix C).

Slopes

In most stormwater management facilities and streambank projects attempting to use native vegetation, the most gentle slopes possible should be used. Steeper slopes magnify the erosive forces and make it more difficult to establish the plant material before a major erosion event damages or destroys the plantings. Gradual slopes (no steeper than 5:1 horizontal: vertical) are particularly important along the shorelines of ponds and detention basins. Most native plants are adapted to the gentle slopes that surrounded natural ponds and wetlands or were present along streams in the presettlement condition. Appropriate BMP's for soil erosion and sediment control (see *Illinois Urban Manual*) should be used during construction at sites where native vegetation will be installed.

Soils

The condition and type of soil at the site where native plants are to be established are also important factors. Many native species are widely distributed in the United States and naturally grow in many soil textures and soil types. For most users of this Guide, however, the soil present will not be a natural soil profile, but rather a regraded situation with topsoil placed on the site as a growth medium. Soil compaction is a common cause of failure in wetland restorations and other native plantings. Care must be taken to ensure that soil compaction is minimized so that the plant roots can obtain water and oxygen. A minimum of one foot of topsoil applied with the least compaction possible is recommended. A soil with a coarser texture (higher sand and silt content than clay) is recommended because it reduces the potential for compaction. A mineral soil with a high organic content is also recommended. Organic matter in the soil increases water holding capacity, reduces compaction potential, and provides plant nutrients. Care should also be taken to ensure that the soil used does not contain a large number of weed seeds that would compete with the native plantings. Organic soils, such as peat or muck, present special problems if their hydrology is modified and should be avoided above the water line if possible.

Installation & Establishment

Detailed information is provided for each species on germination requirements and recommended establishment practices. Particular attention should be given to recommendations on seeding versus live plants or rootstock. There is no single best time to plant or seed. Generally, live plants and rootstock should be planted in the spring, approximately from last frost until mid-June. For seeding, fall or spring sowing are options. Spring seeding can be performed from March 1st through May. Fall seeding or dormant seeding can be performed after November 15. Some species are inhibited by fall planting while others are favored by fall planting. Summer seeding and planting in July, July, or August can be used if necessary, but only with adequate irrigation. Where specific information is available, this information is given within the establishment category for each species. The information provided assumes adequate seedbed preparation that includes a relatively smooth topsoil surface, free of stones, clods, sticks and other debris. Also please consult the section on soils. Recommendations are given with each species for seeding or planting method.

Water Levels

Information is provided concerning water depth preferences and inundation tolerances for all species. This information should be used with the overall guiding principle that native plants are adapted to seasonal flooding and flooding of short duration. Prior to the intensified flooding problems brought on by urbanization, natural flooding occurred occasionally, but mostly in the spring with spring rainfall and snow melt. It did not occur with each major storm event throughout the summer, as occurs in many detention basins. Many native plants cannot tolerate the widely fluctuating water levels often associated with stormwater facilities. An effort should be made to reduce or dampen the water level fluctuations and flood plantings only for short durations during the growing season. It is also important to keep in mind that many mature wetland plants can survive flooding or inundation, but the seedlings cannot. Natural marshes go through an annual draw-down cycle as well as during droughts to allow germination of new plants, which allows these seedlings to become established. Provision should be made to lower the water levels during the critical establishment period.

Irrigation

While established deep-rooted native plants are generally drought resistant, some irrigation of new plantings may be needed. If initial seeding or planting is followed by a dry period, irrigation may be required until the plants are fully established and can withstand a drought. Irrigation should be performed in a manner that does not erode the soil or wash away the seed.

Seeding Rates

Seeding rates for any species depends on the mix of species, setting, and desired result. In order to establish a dense, single-species stand, seeding rates would be heavier than that needed for a mixed species planting. Many plant vendors and installation contractors do not provide seeding rates in their catalogs as they want to adapt rates to each site or they consider rates "trade secrets." Seeding rates provided in this Guide are ranges taken from three local sources that have experience in the establishment of native plantings in northeastern Illinois. Consideration of the setting, goals and objectives, and best professional judgement should be used in determining final seeding rates for any given project. This information applies only to those species where seeding is appropriate and does not apply to rootstock, transplant, or other planting methods. In these cases, seeding rates are shown as "Not Applicable." Seeding rates listed as "Not Available" are listed as such because the source references used did not contain seeding rate information for all species. All rates are pure live seed (PLS).

Cover Crops/Mulch/Erosion Blanket

Most native vegetation installation contractors will recommend that a cover crop or mulch be used. A cover crop is a crop of quick germinating species that will serve to hold and stabilize the soil until the desired permanent vegetation is established. Mulch is a natural or artificial layer of suitable materials that aid in soil stabilization and soil moisture conservation which provides microclimatic conditions suitable for germination and growth. Both techniques are recommended for temporary soil erosion control measures. They also can provide a temporary fuel matrix to allow prescribed burning before the native vegetation is fully established. Typically, cover crops consist of nonnative species. Any cover crop used should be composed of nonpersistent species so that it is in fact only a temporary cover crop

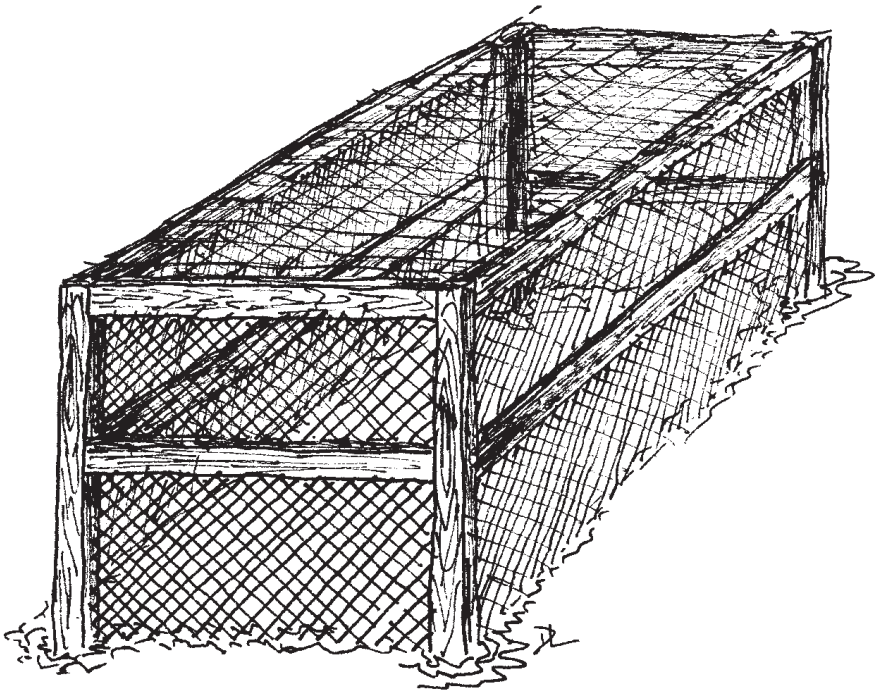
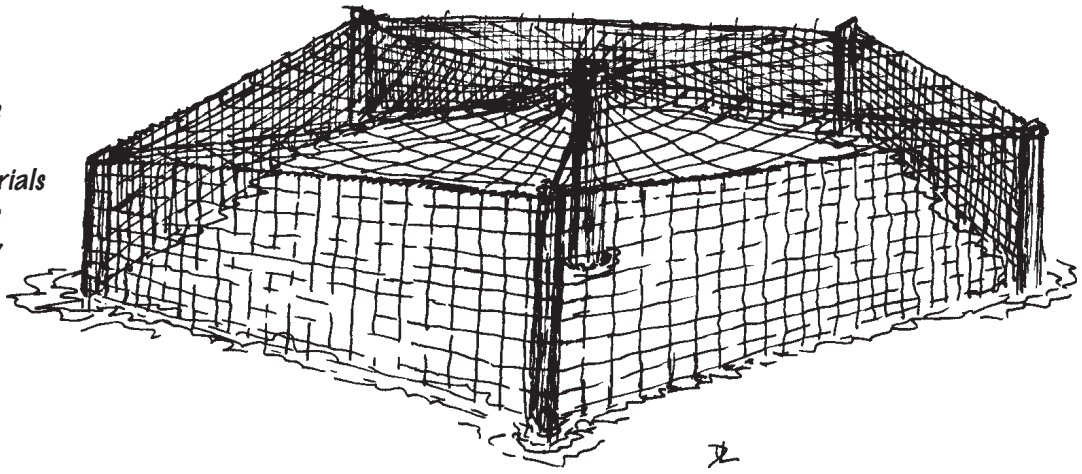


Figure 1.
Framed goose-protection structure. Made of wood and chicken wire (hardware cloth), this sturdy cage protects newly planted material while allowing them to establish in a natural setting. The structure is put in place for a period of several months, and then removed once plants are well established.

Figure 2.
Netted goose-protection structure. This is a more cost-effective version than the framed structure depicted above. While still providing reasonable protection from predators, the materials for constructing this device are relatively less expensive.



and is eventually replaced by the desired native vegetation. Many contractors have strong preferences on cover crop composition. Recommended species frequently included are: annual ryegrass (*Lolium multiflorum*), red top (*Agrostis alba*), timothy (*Phleum pratense*), wild ryes (*Elymus spp) (native*), oats (*Avena sativa*), barley (*Hordeum vulgare*), rye (*Secale cereale*) and others. Some native species such as smartweeds (*Polygonum* spp), rice cut grass (*Leersia oryzoides*), and barnyard grass (*Echinochloa crusgalli*) can also serve this purpose. Species that will persist and compete with the desired native vegetation such as Hungarian or smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and fescue (*Festuca* spp) should be avoided. Properly applied nonallelopathic mulch or erosion control blanket should be used on steeper slopes. Erosion control blankets are recommended on detention basin side slopes and in vegetated swales where flowing water is present. Some native species require light for germination. This should be considered when selecting either a cover crop, mulch, or erosion blanket.

Growth Rates

It may appear that many of these native plants are very slow growing, as reported in some landscape literature sources. It should be noted, however, that for most native plants the strategy is to grow a deep root system before putting energy into above-ground growth. While it may appear that they are slow growing initially, they are simply growing beneath the ground where the growth cannot be seen, but where it will provide the important soil stabilizing benefits.

Fertilizer

As mentioned under the nutrient loading tolerance section, most native species do not require any traditional fertilization to become established. Fertilizer application promotes the growth of many undesirable weeds and should not be used. Traditional landscaping specifications should be modified to discourage fertilization of native plantings.

Depredation

Depredation refers to the problem of wildlife eating the plant material, including root stock, plant shoots, and seeds. Many of the native plant species described in this Guide are an excellent wildlife food source. When a large amount of seeds and root stock are put into an unvegetated area, it is an attractive smorgasbord of food for urban wildlife, especially resident giant Canada geese. Protective measures are required to prevent the loss of native plantings. Installation contractors have a variety of protection methods. Currently, the most successful technique involves cells or compartments of plastic or nylon mesh. The mesh must cover the sides and top of each cell or compartment and be able to prevent animals from getting under the fence. It is very important that these protective measures be monitored and maintained until the plants become fully established (See figures 1 and 2).

Naturally Invading Plant Species

There are many species of plants that may volunteer in an area of native vegetation planting. Some of these will present problems, some will not. There may be some species which are desirable natives that have appeared from a soil seed bank or that were blown or carried in from nearby sites. There will be some annual or biennial weeds that colonize recently disturbed soil, but do not persist when the planted material competes with it. Thus these species will drop out and not present any problems. A third group of species that may appear, however, are very aggressive and will overtake planted material without management and intervention. These include such species as reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*), buckthorn (*Rhamnus cathartica, R. frangula*), and purple loosestrife (*Lythrum salicaria*). These species tend to form monocultures (single species) and do not provide the soil-holding capacity that desired natives provide. These species can be controlled in time with various management tools. Initially, these species may need to be controlled with selective herbicide application. This should be applied in a manner that does not impact other nearby plants and is consistent with the label indications and best management practices. A licensed applicator must be used. Prescribed burning over time will promote the desired native species and reduce many of these non-fire adapted invaders. Mowing can also be used to control some of these species. Techniques used in a given area depend on which problem species are present, setting and context of the area, and preferences and recommendations of the installation contractor.

Mowing and Prescribed Fire

Most native plant species are adapted to a natural regime of fire and limited grazing. In a modern urban context, prescribed fire is used as a primary management tool to sustain native plant communities. Prescribed burning requires an Open Burning Permit from the Illinois Environmental Protection Agency (IEPA), permission from the local Fire Department, and a qualified, experienced contractor or crew. Prescribed burning can be done in urban settings in most instances, with proper planning, smoke management, and contingencies. Where burning is not possible, or in the early stages of establishment, mowing can be used as a management tool for native plantings. To reduce weed competition in early stages, native vegetation establishment areas should be mowed once or twice per year with a mower height of 6-12 inches. Normal turf management type mowing is inappropriate and will result in the loss of native plantings. See Appendix B for a list of prescribed burn contractors in northeastern Illinois.

Other Considerations

There are many factors that contribute to the success or failure of any given native vegetation planting, just as there are with engineered structures and traditional landscape plantings. This Guide attempts to provide the best available information at the time of publication, but is not an exhaustive reference nor a definitive design manual. Conditions necessary for successful native plant establishment and maintenance vary too greatly from site to site and from year to year to allow absolute guarantees of success. The use of this Guide should, however, substantially increase the likelihood of success and will provide a base of understanding for interpreting results at the project site. Best professional judgement and experience must enter into the design and implementation of any project. Finally, it is important that designs include a maintenance and monitoring plan. In the short-term (3 to 5 years), it should identify performance criteria for the landscape contractor. For example, it should also identify a responsible party for long-term maintenance once the contractor's job is complete. The long-term maintenance will generally be less costly than traditional landscape maintenance.

Suggested Plant Species Mixes

for Stormwater Applications

The suggested plant species mix lists which follow are intended to provide users with an idea of species that could be used together. **These lists should NOT be used without consideration of the specific information provided within this Guide for each species.** Each site will provide a different set of environmental conditions and an effort should be made to match the most suitable species to those conditions. In some cases, it may be best to overlap planting of different species mixes to hedge on the establishment of a hydrology regime in a given zone. Depending on the application, **it may be appropriate to select a few species from a given mix, or for maximum diversity the entire mix could be used in a given zone.** For prairie or wetland restorations, or for Section 404 (of the Clean Water Act) compensatory mitigation, planting mixes should go beyond the species listed here.

Stormwater Detention Basins, Upper Shoreline Zone (Saturated)

Scientific Name	Common Name
Alisma subcordatum	COMMON WATER PLANTAIN
Aster lanceolatus	PANICLED ASTER
Aster novae-angliae	NEW ENGLAND ASTER
Bidens cernua	NODDING BEGGARSTICKS
Bidens frondosa	COMMON BEGGARSTICKS
Calamagrostis canadensis	BLUE JOINT GRASS
Carex comosa	BRISTLY SEDGE
Carex cristatella	CRESTED OVAL SEDGE
Carex granularis	PALE SEDGE
Carex lanuginosa	WOOLY SEDGE
Carex stipata	AWL-FRUITED SEDGE
Carex vulpinoidea	FOX SEDGE
Celtis occidentalis	HACKBERRY
Cephalanthus occidentalis	COMMON BUTTONBUSH
Cornus racemosa	GRAY DOGWOOD
Cornus sericea	RED OSIER DOGWOOD
Cyperus esculentus	FIELD NUT SEDGE
Eleocharis obtusa	BLUNT SPIKE RUSH
Eleocharis smallii	CREEPING SPIKE RUSH
Elymus canadensis	NODDING WILD RYE
Elymus virginicus	VIRGINIA WILD RYE
Eupatorium maculatum	SPOTTED JOE PYE WEED
Eupatorium perfoliatum	COMMON BONESET
Glyceria striata	FOWL MANNA GRASS
Helenium autumnale	COMMON SNEEZEWEED
Helianthus grosseserratus	SAWTOOTH SUNFLOWER
Juncus effusus	COMMON RUSH
Juncus torreyi	TORREY'S RUSH
Leersia oryzoides	RICE CUT GRASS
Pycnanthemum virginianum	COMMON MOUNTAIN MINT
Quercus bicolor	SWAMP WHITE OAK
Salix amygdaloides	PEACHLEAF WILLOW
Salix nigra	BLACK WILLOW
Solidago gigantea	LATE GOLDENROD
Spartina pectinata	PRAIRIE CORDGRASS
Verbena hastata	BLUE VERVAIN
Vernonia fasciculata	COMMON IRON WEED
Viburnum lentago	NANNYBERRY

Stormwater Detention Basins, Lower Shoreline Zone (Emergent)

Scientific Name	Common Name
Acorus calamus	SWEET FLAG
Alisma subcordatum	COMMON WATER PLANTAIN
Cephalanthus occidentalis	COMMON BUTTONBUSH
Cyperus esculentus	FIELD NUT SEDGE
Iris virginica	BLUE FLAG IRIS
Juncus effusus	COMMON RUSH
Polygonum amphibium	WATER SMARTWEED
Sagittaria latifolia	BROADLEAF ARROWHEAD
Scirpus acutus	HARDSTEM BULRUSH
Scirpus americanus	CHAIRMAKER'S RUSH
Scirpus fluviatilis	RIVER BULRUSH
Scirpus tabernaemontani	SOFT-STEM BULRUSH
Sparganium eurycarpum	COMMON BURREED

Streambank Stabilization

Scientific Name	Common Name
Alisma subcordatum	COMMON WATER PLANTAIN
Carex vulpinoidea	FOX SEDGE
Celtis occidentalis	HACKBERRY
Cephalanthus occidentalis	COMMON BUTTONBUSH
Cornus racemosa	GRAY DOGWOOD
Cornus sericea	RED OSIER DOGWOOD
Eleocharis obtusa	BLUNT SPIKE RUSH
Eleocharis smallii	CREEPING SPIKE RUSH
Elymus canadensis	NODDING WILD RYE
Elymus virginicus	VIRGINIA WILD RYE
Fraxinus pennsylvanica	GREEN ASH
Glyceria striata	FOWL MANNA GRASS
Helenium autumnale	COMMON SNEEZEWEED
Leersia oryzoides	RICE CUT GRASS
Panicum virgatum	SWITCH GRASS
Salix amygdaloides	PEACHLEAF WILLOW
Salix nigra	BLACK WILLOW
Scirpus americanus	CHAIRMAKER'S RUSH
Solidago gigantea	LATE GOLDENROD
Spartina pectinata	PRAIRIE CORDGRASS
Verbena hastata	BLUE VERVAIN
Viburnum lentago	NANNYBERRY

NOTE: In severe erosion situations where the dormant willow post method is appropriate, sandbar willow (Salix interior) may be recommended due to its aggressive nature.

Upland Slope Buffers- Stormwater Ponds & Streambanks

Scientific Name	Common Name
Andropogon gerardii	BIG BLUESTEM
Aster laevis	SMOOTH BLUE ASTER
Aster lanceolatus	PANICLED ASTER
Aster novae-angliae	NEW ENGLAND ASTER
Bidens frondosa	COMMON BEGGARSTICKS
Bouteloua curtipendula	SIDE-OATS GRAMA
Celtis occidentalis	HACKBERRY
Coreopsis tripteris	TALL COREOPSIS
Cornus racemosa	GRAY DOGWOOD
Cornus sericea	RED OSIER DOGWOOD
Elymus canadensis	NODDING WILD RYE
Elymus virginicus	VIRGINIA WILD RYE
Fraxinus pennsylvanica	GREEN ASH
Monarda fistulosa	WILD BERGAMOT
Panicum virgatum	SWITCH GRASS
Petalostemum purpureum	PURPLE PRAIRIE CLOVER
Pycnanthemum virginianum	COMMON MOUNTAIN MINT
Quercus bicolor	SWAMP WHITE OAK
Quercus macrocarpa	BUR OAK
Quercus palustris	PIN OAK
Ratibida pinnata	YELLOW CONE FLOWER
Rudbeckia hirta	BLACK-EYED SUSAN
Schizachyrium scoparium	LITTLE BLUESTEM
Silphium laciniatum	COMPASS PLANT
Silphium terebinthinaceum	PRAIRIE DOCK
Solidago rigida	STIFF GOLDENROD
Sorghastrum nutans	INDIAN GRASS
Spartina pectinata	PRAIRIE CORDGRASS
Tradescantia ohiensis	SPIDERWORT
Vernonia fasciculata	COMMON IRON WEED
Viburnum dentatum lucidum	ARROW WOOD VIBURNUM
Viburnum lentago	NANNYBERRY

Vegetated Swales

Scientific Name	Common Name
Acorus calamus	SWEET FLAG
Alisma subcordatum	COMMON WATER PLANTAIN
Aster lanceolatus	PANICLED ASTER
Bidens cernua	NODDING BEGGARSTICKS
Bidens frondosa	COMMON BEGGARSTICKS
Calamagrostis canadensis	BLUE JOINT GRASS
Carex cristatella	CRESTED OVAL SEDGE
Carex lanuginosa	WOOLY SEDGE
Carex stipata	AWL-FRUITED SEDGE
Carex vulpinoidea	FOX SEDGE
Eleocharis obtusa	BLUNT SPIKE RUSH
Elymus canadensis	NODDING WILD RYE
Elymus virginicus	VIRGINIA WILD RYE
Eupatorium maculatum	SPOTTED JOE PYE WEED
Eupatorium perfoliatum	COMMON BONESET
Glyceria striata	FOWL MANNA GRASS
Helenium autumnale	COMMON SNEEZEWEED
Helianthus grosseserratus	SAWTOOTH SUNFLOWER
Iris virginica	BLUE FLAG IRIS
Juncus effusus	COMMON RUSH
Juncus torreyi	TORREY'S RUSH
Leersia oryzoides	RICE CUT GRASS
Panicum virgatum	SWITCHGRASS
Pycnanthemum virginianum	COMMON MOUNTAIN MINT
Scirpus acutus	HARD STEM BULRUSH
Scirpus americanus	CHAIRMAKER'S RUSH
Scirpus fluviatilis	RIVER BULRUSH
Scirpus tabernaemontani	SOFT-STEM BULRUSH
Solidago gigantea	LATE GOLDENROD
Spartina pectinata	PRAIRIE CORDGRASS
Verbena hastata	BLUE VERVAIN

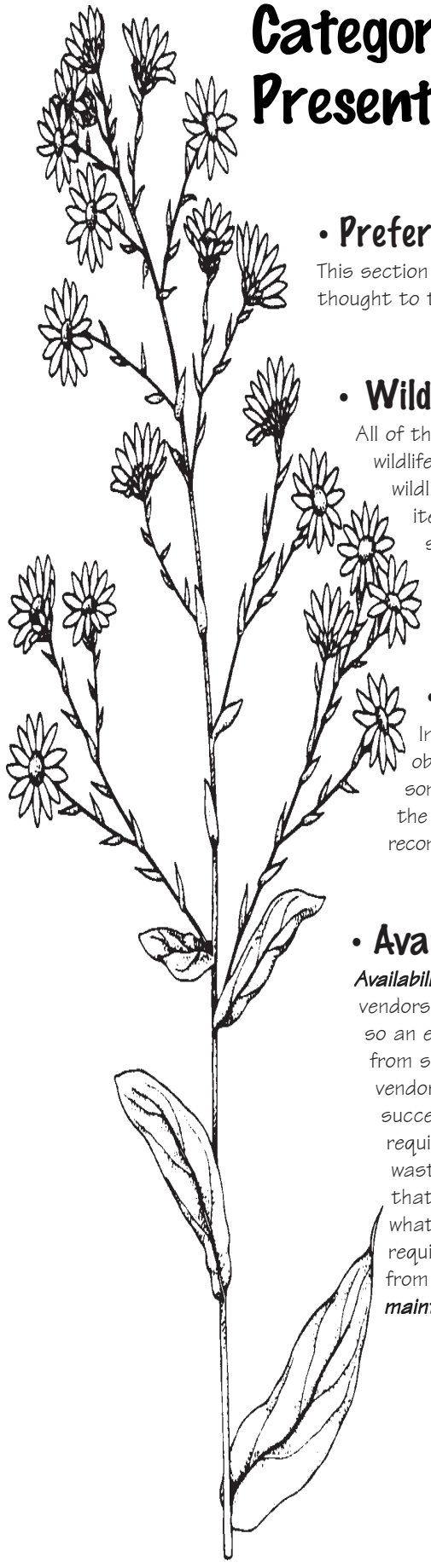
Species Information Summary Table

The information provided in this table is a condensed format designed to be used as a quick reference for users of this Guide. The data provided in the tables is not a complete profile for each species. Users are advised to consult the specific species descriptions for a comprehensive description and evaluation for a particular application.

These charts (pages 20-24) are located in a PowerPoint document located under the Native Plant Guide folder.

Native Plant Species List--Scientific/Common

Native Plant Species List--Common/Scientific



Categories of Information Presented for Each Species

• Preferred Water Depth and Inundation Tolerance

This section provides information on the depth of water that each species is thought to tolerate, as well as the ideal or "preferred" depth where known.

• Wildlife Value

All of the plant species in this Guide provide some habitat and are valuable for wildlife. Native vegetation provides much better habitat for all types of wildlife than mowed turf grass, rip-rap, or seawall. Information under this item identifies wildlife that is associated with that plant species. In some cases, a particular plant species is required to complete a portion of the life cycle, in others it simply provides the "preferred" habitat.

• Application/Zone

Information provided indicates the role or uses individual species have been observed to provide in reducing soil erosion. All species in this Guide provide some erosion control benefits, but this entry provides specific information on the application or zone where the species is best suited. Note that recommended species mixes for different settings are also provided.

• Availability, Establishment, & Maintenance

Availability refers to the ease of obtaining seeds, or rootstock from commercial vendors. Many native species are not widely available in the landscaping trade, so an effort has been made to select species that are known to be available from some native plant vendors. See Appendix A for a listing of known vendors. ***Establishment*** refers to requirements for plant species to be successfully established in an area. This includes various germination requirements for a species. This information is important in order to avoid wasting plant material due to a lack of information on various treatments that may be required. Information is also included about survival rates and what type of propagation works best for a given species. Some species require cuttings, plugs, or root stock, while others are readily established from untreated seed. Finally, information is provided on any long-term ***maintenance or management concerns or requirements*** for each species.

• Mature Height

This category provides a range which indicates the height above ground that a plant species may achieve when mature. Note that many deep-rooted native species can take several years to achieve full stature above ground, due to their growth strategy of putting down a deep root system first. This is the primary reason native plants can be very effective at reducing soil erosion.

• Plant Type

Information is provided on whether a species is annual, perennial, biennial and whether it is a shrub, tree, grass, sedge, or forb. See the glossary for definition of terms used for this information.

• Indicator Status

This refers to the wetland indicator categories published for all wetland plant species in the U. S. Fish and Wildlife Service's *National List of Plant Species that Occur in Wetlands: North Central (Region 3).* The categories are based upon the probabilities that each species would occur in a wetland habitat. For example, those designated OBL are thought to occur in wetland habitats more than 99% of the time. See Reed (1997) and the glossary for further information. Two species (*Aster laevis, Cornus racemosa*) were not given an indicator in Reed (1997), so the indicator categories for these two species from the previous version of the list (Reed 1988) are given in brackets.

• pH

PH is a measure of the soil acidity/alkalinity. Information is provided on the pH range a given species will tolerate. For many species, specific pH values were found in the literature, however, in some cases local experience suggests that these values may be too narrow. A widely distributed plant species may have different pH ranges or tolerances in different parts of the country, depending on other soil chemistry and climatological factors.

• Nutrient Load Tolerance

Native plants typically do not require fertilization to become established in a restoration. Experience in prairie restorations in northeastern Illinois suggests that fertilizing native plantings adds to weed problems and promotes undesirable species. For this reason, fertilizing, as in traditional landscaping, is not recommended for native plantings. Information provided under this heading refers instead to the species tolerance of excess nutrient input. High nutrient input from lawn fertilizer runoff, septic fields, or livestock yards can be detrimental to many native species. In this Guide, plant species are rated as having low, moderate, or high tolerance of excess nutrient input. The species included are those natives that are at least somewhat tolerant of disturbed, man-made environments. Those conservative species that survive only under pristine, natural conditions were not included. Thus, of the species listed, those rated as having a **low tolerance** for nutrient loading would be the least tolerant to high nutrient inputs. Those rated with **high tolerance** are those most likely to withstand relatively high nutrient levels from a direct source. A **moderate** rating indicates an intermediate level of tolerance. High, moderate, and low are relative terms that do not consider quantitative values and relate only to the species within this Guide.

• Salt Tolerance

This category provides general information on the salt (NaCl) tolerance of the species. In a few cases, quantitative values were reported in the literature, but in most cases general salt tolerance is provided based upon local observations. A scale of not tolerant, low, moderate, or high was used, based on local observations in road ditches. Again, low, moderate, and high are relative terms that do not correspond to any quantitative values. Please see discussion of these terms under the Nutrient Load Tolerance section on the opposite page. In northeastern Illinois, chloride concentrations from de-icing salt can range from as low as 20 ppm in an isolated natural wetland to as high as 3,000 ppm in a constructed wetland along a multi-lane expressway.

• Siltation Tolerance

The section provides general information on the siltation tolerance of a species. This is based largely upon local observations of species that survive in disturbed habitats where siltation is present. It should be noted that this applies to mature plants, and that young plants can be easily killed if subjected to siltation at an early stage. This problem can be very pronounced for establishment from seed. Jurik *et al* (1994) found that for many native wetland species, seedling emergence was significantly reduced with as little as 0.25cm of silt. This study was conducted using seeds in a native soil seed bank, but clearly has ramifications for seeds of native species sown in an area subject to siltation. This fact stresses the importance of providing adequate soil erosion and sediment control on project sites. High, moderate, and low tolerance ratings are given as relative terms. See discussion of these terms under the section on Nutrient Load Tolerance.

• Flowering Color and Time

Information is provided on flower color and the time of year one can expect the mature plants to flower. For some users this information may assist in plant selection, arrangement, or planning.

• Light Preference

Information is given as to the shade or sun preference or tolerance of each species.

• Seeding Rate

A range of recommended seeding rates in lbs/acre is provided for each species. Seeding rates for any species depends on the mix of species, setting, and desired result. In order to establish a dense, single-species stand, seeding rates would be heavier than that needed for a mixed species planting. Many plant vendors and installation contractors do not provide seeding rates in their catalogs as they want to adapt rates to each site or they consider rates "trade secrets." Seeding rates provided in this Guide are ranges taken from three local sources that have experience in the establishment of native plantings in northeastern Illinois. Consideration of the setting, goals and objectives, and best professional judgement should be used in determining final seeding rates for any given project. This information applies only to those species where seeding is appropriate and does not apply to rootstock, transplant, or other planting methods. All rates are pure live seed (PLS).