

APPENDIX A

DESIRED RESTORED NATIVE VEGETATION AND GRASSLAND HABITATS

The following narrative describes types of native vegetation present on Midewin, both as likely original condition (pre-1830) and as desired future condition. The descriptions are not meant to be exhaustive, but are meant to serve as a guide for restoration. Of course, the two grassland habitats (short-stature and medium-stature) are not native vegetation types, but do serve as guidelines to restoration of these habitats that are necessary for continued persistence of certain grassland birds at Midewin.

Vegetation descriptions are based on community descriptions by Glass (1994), Ecological Services (1995), Eggers and Reed (1997), NatureServe (2000), Sluis and Tanderich (2000), Swink and Wilhelm (1994), The Wetlands Initiative (1999), and White and Madany (1978), plus field notes and observations by William D. Glass (Illinois Department of Natural Resources) and Eric Ulaszek (Forest Service) at Midewin National Tallgrass Prairie, Des Plaines State Fish and Wildlife Area, and other sites with similar physiognomy in Will, Grundy, and Kankakee counties, Illinois.

DOLOMITE PRAIRIE

Synonyms: Includes dry dolomite prairie, dry-mesic dolomite prairie, mesic dolomite prairie, wet-mesic dolomite prairie, and wet dolomite prairie moisture classes of White and Madany (1978) and Ecological Services (1995). We have combined these natural communities under one heading (dolomite prairie), because of the locally complex nature of the physical conditions (soil depth and drainage) that control development of the specific moisture classes. Dolomite prairies share some similarities with alvars, a unique habitat found north and west of Illinois, but around the Great Lakes (Sluis and Tanderich 2000). Alvars occur on exposures of dolomite bedrock and their surrounding shallow soils, but exist within forests, not prairie vegetation. Alvars do share many characteristic species with dolomite prairie.

Physical Environment: This habitat occurs on shallow soils (<50 cm to bedrock) over dolomite bedrock. The relatively shallow bedrock restricts plant rooting depth, and certain deep-rooted prairie plants (White Wild Indigo, *Baptisia leucantha*; Pale Purple Coneflower, *Echinacea pallida*; Round-headed Bush Clover, *Lespedeza capitata*; Prairie Dock, *Silphium terebenthinaceu*;; Compass Plant, *S. laciniatum*; and Prairie Gentian, *Gentiana puberulenta*) may be rare in or absent from dolomite prairie. The soils may be silty loam, clays, or sandy loams; they are usually derived from outwash, reworked glacial till, and

decomposed bedrock. Bedrock fragments and glacial erratics are usually present. There may be relatively extensive exposures of bedrock (outcroppings and pavements) with no or little accumulated soil cover. These areas, however, provide suitable substrate for lichens, bryophytes, and algae.

Dolomite is a calcareous, sedimentary bedrock similar to limestone; this rock is also called dolostone and dolomitic limestone. Some (or most) of the calcium carbonate, however, has been replaced by magnesium carbonate. Because of the relatively high magnesium levels derived from the bedrock and dolomite fragments, some common prairie plants may be reduced in abundance or even absent from dolomite prairie. This reduction in competition may allow other species rare species to become predominant (e.g., tufted hair grass, *Deschampsia cespitosa*).

In northeastern Illinois, dolomite prairies may be present on the outwash plains of river valleys, or on bedrock terraces along the valley sides. Most dolomite prairie in Illinois was concentrated in the lower DesPlaines River valley, but smaller amounts were present in the lower Kankakee, upper Illinois, Fox, and Rock River valleys. Because of the shallow soils and relatively level topography, internal drainage is often poor. Conversely, the shallow soils limit rooting depth and moisture storage, and dolomite prairies dehydrate rapidly between summer rains. Native plants unable to tolerate these moisture extremes may be excluded from dolomite prairie, and otherwise uncommon species may predominate (e.g., nodding wild onion, *Allium cernuum*).

Where dolomite prairies occur on extensive outwash plains, as at MNTP, they are a relatively level landscape. However, there is some variation to the bedrock surface, with deeper areas created by the scouring action of the glacial ice and the post-glacial flooding. The depth of the soil also varies, reflecting deposition by post-glacial flooding and more recent surface flow. This interaction between bedrock depth and surface topography creates a mosaic of soil moisture and drainage conditions, often reflected in the vegetation.

Natural disturbances are important factors in dolomite prairie. Fire removes accumulated litter, top kills shrubs, and creates exposed soil, which serves as sites for seedling germination and establishment. Where the bedrock is near the surface, potential fuels are often low or patchy, effectively reducing fire frequency and intensity. Frost heaving is another factor that disturbs the soil surface. Burrowing by small vertebrates and insects may also disturb the soil. Large herbivores may also disturb the soil, and their selection of forage may favor certain less competitive plant species.

Some areas with bedrock >50 cm deep also support dolomite prairie-like vegetation. These areas are on the outwash plain at Midewin (most of the area west of IL 53), and occur near Grant and Prairie creeks. Their similarity to dolomite prairies appears to be a result (in part) of relatively shallow, dense layer

of clay in the soil. Additionally, these outwash plain soils contain dolomite fragments and particles, and the presence of the dissolved magnesium affects the vegetation. Many of the common plants of these areas are also characteristic of dolomite prairie (flattened spikerush, low calamint).

Vegetation: Because factors like soil depth may change drastically within a short distance, dolomite prairie is often a mosaic of plant associations. A few plant species occur under a wide range of soils depths and moisture, including low calamint (*Satureja arkansana*) and flattened spikerush (*Eleocharis compressa*).

Where bedrock is exposed, there are no vascular plants. Instead, there may be covering of lichens (e.g., *Dermatocarpon miniatum*, *Placynthium nigrum*, *Caloplaca* spp.) and mosses (e.g. *Hedwigia ciliata*), or cyanobacterial mats (“blue-green algae”). Some perennial herbs may be present in bedrock cracks, especially side-oats grama (*Bouteloua curtipendula*), prairie satin grass (*Muhlenbergia cuspidata*), and aromatic aster (*Aster oblongifolius*). Where shallow soil has accumulated on the bedrock, there may be different lichens (*Catapyrenium lachneum*) and liverworts (*Asterella* spp. and *Riccia* spp.) or stands of annuals, including wiry panic grass (*Panicum flexile*), awned flatsedge (*Cyperus inflexus*), false mallow (*Malvastrum hispidum*), common ragweed (*Ambrosia artemisiifolia*), Pitcher’s stitchwort (*Minuartia patula*), woolly croton (*Croton capitatus*), spring forget-me-not (*Myosotis verna*), whitlow-cress (*Draba reptans*), nodding spurge (*Chamaesyce maculata*), and rush grass (*Sporobolus vaginiflorus*). The prickly-pear cactus (*Opuntia humifusa*) occurs in this situation. Perennial grasses and forbs occur in deeper soils adjacent to bedrock exposures, and may be rooted in deep bedrock joints. Typical perennial species include nodding wild-onion (*Allium cernuum*), hairy beardtongue (*Penstemon hirsutus*), sheathed rush grass (*Sporobolus clandestinus*), small skullcaps (*Scutellaria parvula*), scurfy-pea (*Psoralea tenuiflora*), stiff vervain (*Verbena simplex*), whorled milkweed (*Asclepias verticillata*), and Ohio horse-mint (*Blephilia ciliata*).

As the soils become deeper (>5 cm), plant species diversity increases. Perennial grasses become more important, especially prairie dropseed (*Sporobolus heterolepis*), but also big bluestem (*Andropogon gerardii*), Canada wild-rye (*Elymus canadensis*), Indian grass (*Sorghastrum nutans*), and little bluestem (*Schizachyrium scoparium*). Frequent forbs include round-fruited St. John’s-wort (*Hypericum sphaerocarpum*), thicket parsley (*Perideridia americana*), wild hyacinth (*Camassia scilloides*), prairie ironweed (*Vernonia fasciculata*), Riddell’s goldenrod (*Solidago riddellii*), Canada onion (*Allium canadense*), marsh phlox (*Phlox divaricata*), mountain-mint (*Pycnanthemum virginianum*), prairie milkweed (*Asclepias sullivantii*), and saw-toothed sunflower (*Helianthus grosseserratus*). Certain sedges (*Carex granularis*, *C. suberecta*) may be locally common.

As soil moisture and depth increases, additional species become common,

including prairie cordgrass (*Spartina pectinata*), red bulrush (*Scirpus pendulus*), tufted hair-grass (*Deschampsia cespitosa*), switchgrass (*Panicum virgatum*), marsh hedge-nettle (*Stachys tenuifolia hispida*), Torrey's rush (*Juncus torreyi*), erect knotweed (*Polygonum ramosissimum*), wild madder (*Galium obtusum*), water horehound (*Lycopus americanus*), sedges (*Carex pellita*), and spikerushes (*Eleocharis erythropoda*). Broad depressions over shallower soils are often dominated by stands of tufted hair grass. Smaller depressions with shallow soil over bedrock are important microhabitat for Butler's quillwort (*Isoetes butleri*), glade onion (*Allium mobilense*), Crawe's sedge (*Carex crawei*), and scarlet loosestrife (*Ammannia coccinea*); some species from drier sites are also present around the margins of these depressions (hairy beardtongue, nodding wild-onion, Pitcher's stitchwort).

Smaller, but often deeper depressions within dolomite prairie provide important micro-habitats for certain wetland species, including white water-crowfoot (*Ranunculus longirostris*), mud-plantain (*Alisma trivale*), water purslane (*Ludwigia polycarpa*), smartweeds (*Polygonum* spp.), and spikerushes (*Eleocharis acicularis*, *E. obtusata*). The moss *Drepanocladus* is sometimes associated with these depressions.

Shrubs and trees are usually not important components of dolomite prairie. Well-drained sites may support occasional shrubs, such as leadplant (*Amorpha canescens*) or New Jersey tea (*Ceanothus americanus*). Pasture rose (*Rosa carolina*), another low shrub, may form colonies in dolomite prairie. Where dolomite prairie occurs along drainages or adjacent to streams, false indigobush (*Amorpha fruticosa*) may be present.

Restoration: Dolomite prairie will be restored on shallow soils (<50 cm) over dolomite bedrock. Given present characteristics of shallow soil areas on Midewin, the full range of moisture classes (dry, dry-mesic, mesic, wet-mesic, and wet dolomite prairies) can be restored. Because of local soil conditions, certain areas with >50 cm to bedrock are likely to resemble dolomite prairie. Some of these areas may be identifiable through soil surveys, but others may not become apparent until the restoration process has been initiated, and supplemental seeding may be necessary. There may also be some disturbed areas (abandoned quarries) that may be suitable for dolomite prairie restoration. Restoration will emphasize a mixture of native grasses and forbs that will vary with soil depth and moisture regime; supplemental seeding and planting will be required to reach these goals.

UPLAND TYPIC PRAIRIE

Synonyms: Includes dry typic prairie, dry-mesic typic prairie, and mesic typic prairie moisture classes of White and Madany (1978) and Ecological Services (1995). We have combined these natural communities under one heading (upland typic prairie) because they are all non-wetland, non-dolomite prairie vegetation. On Midewin, mesic typic prairie would be the predominant moisture

class, with smaller inclusions of the dry and dry-mesic classes on especially well drained sites. We also include shrub prairie (White and Madany 1978) in this category.

Physical Environment: This habitat occurs on relatively deep (>50 cm to bedrock), well-drained to excessively well-drained soils. Soils may be temporarily saturated after a heavy rainfall or immediately after spring thawing. The soils may be derived from glacial till, post-glacial lacustrine deposits, outwash, alluvium, or loess. Glacial erratics (sandstone, granite, quartzite) are occasionally present at the surface, where they provide substrate for lichens and bryophytes not found on soil. On Midewin, these erratics are most abundant on the outwash plain west of IL 53. Bedrock exposures (dolomite) are rare, and occur usually near streams.

East of IL 53, upland typic prairie was present on upland soils derived from glacial till, post-glacial lacustrine deposits, and loess, and on well-drained alluvium in riparian areas. Typical sites include broad ridges and adjacent gentle slopes, but also some steeper sites (>6-7 percent slopes). West of IL 53, upland typic prairie was present on the loamy soils of the outwash plain. Some sites had excessively well-drained soils with a relatively high sand or gravel content; these sites are at the margins of post-glacial terraces. The vegetation on these sites contains some plant species found in sand and gravel prairies (White and Madany 1978) but lacks many of the characteristics of the sand prairies of the Kankakee and Illinois river valleys.

Some areas on the outwash plain support dolomite prairie-like vegetation. These areas are associated with Grant and Prairie creeks. Their similarity to dolomite prairies appears to be a result (in part) of relatively shallow, dense layer of clay in the soil. Additionally, these outwash plain soils contain dolomite fragments and particles, and the presence of the dissolved magnesium affects the vegetation. Many of the common plants of these areas are also characteristic of dolomite prairie.

Natural disturbances are important factors in upland typic prairie. Fire removes accumulated litter, top kills shrubs, and creates exposed soil, which serves as sites for seedling germination and establishment. Burrowing by vertebrates (ground squirrels, voles, badgers, pocket gophers, snakes) and insects also disturbs the soil surface. Large herbivores may also disturb the soil, and their selection of forage may favor certain less competitive plant species.

Vegetation: The vegetation of upland typic prairie is a diverse mixture of grasses and forbs. Plant species richness is highest on mesic (moist but well-drained) sites and declines as soil moisture conditions decrease. Peaks in flowering occur in late spring, early summer, and from late summer into early fall. Under typical conditions, however, three or more common forb species can be found in flower from late April to early October. Most flowering grasses regularly

exceed 1-1.5 meters in height on all but the driest sites.

Dominant grasses include prairie dropseed (*Sporobolus heterolepis*), little bluestem (*Andropogon scoparius*), big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). Bunch grasses such as prairie dropseed and little bluestem are often associated with high forb diversity. The sod-forming grasses (big bluestem, Indian grass, switchgrass) are widespread, but are locally dominant at sites, often following disturbance. Prairie cordgrass (*Spartina pectinata*) is occasional on moist sites, but may be an indicator of disturbance in upland typical prairie. Canada wild-rye (*Elymus canadensis*) is occasional, even on drier sites, but may be more frequent where there has been some disturbance. Less common grasses include porcupine grass (*Stipa spartea*), June grass (*Koeleria macrantha*), prairie panic grass (*Panicum leibergii*), and vanilla grass (*Hierochloë odorata*). Other graminoids, such as Mead's sedge (*Carex meadii*) and prairie sedge (*Carex bicknellii*), are also present in upland prairie.

Common spring-flowering forbs include shooting-star (*Dodecatheon meadia*), hoary puccoon (*Lithospermum canescens*), prairie phlox (*Phlox pilosa*), white blue-eyed grass (*Sisyrinchium albidum*), yellow star-grass (*Hypoxis hirsuta*), prairie violet (*Viola pedatifida*), alumroot (*Heuchera richardsonii*), wild hyacinth (*Camassia scilloides*), common lousewort (*Pedicularis canadensis*), false-toadflax (*Comandra umbellata*), golden alexanders (*Zizia aurea*), and cream wild indigo (*Baptisia leucophaea*). As the season progresses, tall spiderwort (*Tradescantia ohimensis*), prairie thimbleweed (*Anemone cylindrica*), white wild indigo (*Baptisia leucantha*), and foxglove beardtongue (*Penstemon digitalis*) come into flower. By early summer, leadplant (*Amorpha canescens*), prairie cinquefoil (*Potentilla arguta*), prairie milkweed (*Aclepias sullivantii*), and both purple and white prairie-clovers (*Dalea purpurea* and *D. candida*, respectively) are flowering, accompanied by various composites, including prairie coreopsis (*Coreopsis palmata*), pale purple coneflower (*Echinacea pallida*), and wild quinine (*Parthenium integrifolium*). During middle to late summer many characteristic prairie forbs are in flower, including yellow coneflower (*Ratibida pinnata*), prairie blazing-star (*Liatris pycnostachya*), rosinweed (*Silphium integrifolium*), compass-plant (*Silphium laciniatum*), prairie dock (*Silphium terebenthinaceum*), rattlesnake-master (*Eryngium yuccifolium*), Culver's-root (*Veronicastrum virginicum*), flowering spurge (*Euphorbia corollata*), tall coreopsis (*Coreopsis tripteris*), showy tick-trefoil (*Desmodium canadense*), obedient-plant (*Physostegia virginiana arenaria*), nodding wild-onion (*Allium cernuum*), round-headed bush-clover (*Lespedeza capitata*), and wild bergamot (*Monarda fistulosa*). By late summer, composites dominate, with smooth blue aster (*Aster laevis*), sky blue aster (*Aster azureus*), heath aster (*Aster ericoides*), stiff goldenrod (*Solidago rigida*), Missouri goldenrod (*Solidago missouriensis fasciculata*), rough blazing-star (*Liatris aspera*), rough white lettuce (*Prenanthes aspera*), prairie sunflower (*Helianthus rigidus*), and ashy sunflower (*Helianthus mollis*). Great Plains ladies'-tresses (*Spiranthes magnicamporum*) and prairie

gentain (*Gentiana puberulenta*) are among the last non-composite prairie forbs to flower in upland typic prairie.

On sites where the soils are excessively well-drained, a less diverse association is present. Flowering grasses rarely reach over one meter, except during wetter than average years. The most common grasses are side-oats grama, little bluestem, porcupine grass, June grass, and prairie dropseed. Indian grass and big bluestem are present, but rarely dominant. On sandy soils, sand dropseed (*Sporobolus cryptandrus*) may be locally common. Some forbs characteristic of these dry sites include short-green milkweed (*Asclepias viridiflora*), scurfy-pea (*Psoralea tenuiflora*), sand milkweed (*Asclepias amplexicaulis*), fringed puccoon (*Lithospermum incisum*), false boneset (*Brickellia eupatorioides*), showy goldenrod (*Solidago speciosa*), stiff aster (*Aster ptarmicoides*), small skullcaps (*Scutellaria parvula*), Illinois tick-trefoil (*Desmodium illinoiense*), small beardtongue (*Penstemon pallidus*), and western sunflower (*Helianthus occidentalis*). Certain forbs found in more mesic prairies may also be common, such as purple prairie-clover, shooting star, rough blazing-star, leadplant, prairie coreopsis, flowering spurge, pale purple coneflower, prairie cinquefoil, and prairie thimbleweed.

When present on outwash plains, upland typic prairie often contains some elements of savanna, dolomite prairie, and sand prairie. Low calamint (*Satureja arkansana*), flattened spikerush (*Eleocharis compressa*), Illinois bundle-flower (*Desmanthus illinoensis*), spring-beauty (*Claytonia virginica*), tall green milkweed (*Asclepias hirtella*), Sullivan's coneflower (*Rudbeckia fulgida sullivantii*), smooth beardtongue (*Penstemon calycosus*), and marbleseed (*Onosmodium hispidissimum*) are among the additional species present. Marsh blazing-star (*Liatris spicata*) is the common tall *Liatris* on the outwash plain, instead of prairie blazing-star.

Woody plants are present in upland typic prairie, but as only an occasional element. There are no trees. A few low shrubs may be widespread and common in upland prairie, associating with characteristic prairie forbs and grasses. These shrubs include leadplant, New Jersey tea (*Ceanothus americanus*), pasture rose (*Rosa carolina*), and prairie willow (*Salix humilis*). Taller shrubs occasionally form thickets on the prairie, sometimes termed shrub prairie (White and Madany 1978). Shrub prairie consists of <5% of total upland typic prairie. The most frequent shrubs include American hazel (*Corylus americana*), wild plum (*Prunus americana*), hawthorns (*Crataegus* spp.), prairie crabapple (*Malus ioensis*), nannyberry (*Viburnum lentago*), wild blackberries (*Rubus* spp.), Illinois rose (*Rosa setigera*), gray dogwood (*Cornus racemosa*), and smooth sumac (*Rhus glabra*). Prairie forbs and grasses may grow interspersed with or under these shrubs.

Restoration: Upland typic prairie will be restored on non-hydric mollisols in which the depth to bedrock is >50 cm. This includes many areas on the outwash

plain where other soil characteristics (clay layers, dissolved magnesium) may create soil conditions mimicking dolomite prairie. Some upland prairie may be restored on transition soils and alfisols where there is no evidence of recent occupancy by savannas or woodlands. Given conditions on Midewin, it should be possible to restore a full range of moisture classes (dry, dry-mesic, and mesic typic prairie). Some sites may be drier because of landscape position; others because of soil components (sand or gravel). For the moist part, restored upland typic prairie will consist of a diverse mix of native grasses and forbs. Prairie dropseed will be locally dominant, but other grasses will be present and locally common. In the early stages of restoration, species diversity may be relatively low and periodic over-seeding and supplemental planting may be required. Where soils are drier, species diversity and grass height will be lower, but this creates opportunities to establish species unable to compete on moister sites. There will be scattered areas (<5% total coverage) of shrub prairie; shrub prairie restoration will occur where the presence of shrubs will not fragment habitat for area-sensitive grassland birds.

WET TYPIC PRAIRIE

Synonyms: Includes wet typic prairie and wet-mesic typic prairie moisture classes of White and Madany (1978) and Ecological Services (1995). We have combined these natural communities under one heading (wet typic prairie) because both are wetland, non-dolomite prairie vegetation. On Midewin, both moisture classes would be roughly equal in coverage, and may occur among more well-drained vegetation types.

Physical Environment: This habitat occurs on relatively deep (>50 cm to bedrock), somewhat-poorly drained to poorly drained soils. Soils may be temporarily inundated after a heavy rainfall or for brief periods during the spring, but may remain saturated into early summer. The soils may be derived from glacial till, post-glacial lacustrine deposits, outwash, or alluvium. Glacial erratics (sandstone, granite, quartzite) are occasionally present at the surface, where they provide substrate for lichens and bryophytes not found on soil. On Midewin, these erratics are most abundant on the outwash plain west of IL 53.

East of IL 53, wet typic prairie was present on hydric soils derived from glacial till, post-glacial lacustrine deposits, and alluvium in riparian areas; these areas were often in broad, shallow drainages, around potholes, swales, and in channels and behind natural levees in floodplains. Relief is low, often <2-3 percent slopes. West of IL 53, wet typic prairie was present in depressions and swales on the outwash plain. The wet typic prairie vegetation on the outwash plain contains some plant species characteristic of dolomite prairies (White and Madany 1978). Their similarity to dolomite prairies appears to be a result (in part) of relatively shallow, dense layer of clay in the soil. Additionally, these outwash plain soils contain dolomite fragments and particles, and the presence of the dissolved magnesium affects the vegetation. Many of the common plants of these areas are also characteristic of dolomite prairie.

Natural disturbances are important factors in wet typic prairie. Fire removes accumulated litter, top kills shrubs, and creates exposed soil, which serves as sites for seedling germination and establishment. Burrowing by animals (crayfishes, voles, salamanders, snakes, insects) also disturbs the soil surface and creates. Large herbivores may also disturb the soil, and their selection of forage may favor certain less competitive plant species. Long periods of soil saturation or inundation may kill some plants; deposition of sediment by floodwaters may create sites for colonization by seedlings. The movement of stream channels may also create disturbance by eroding banks and changing drainage patterns.

Vegetation: The vegetation of wet typic prairie is a relatively diverse mixture of grasses and forbs. Plant species richness is lower than in upland typic prairie, but some of the better drained sites can support a diverse assemblage of grasses, sedges, and forbs. Peaks in flowering are less pronounced than in upland typic prairie, and tend to be dominated by monotypic stands of one species. However, the flowering season can extend from late April to early October, as in upland typic prairie. Most flowering grasses regularly exceed 1-1.5 meters in height, and can exceed 2 meters.

Dominant grasses include prairie cordgrass (*Spartina pectinata*), big bluestem (*Andropogon gerardii*), and switchgrass (*Panicum virgatum*), with bluejoint (*Calamagrostis canadensis*) on wetter sites. Both Canada wild-rye (*Elymus canadensis*) and Virginia wild-rye (*Elymus virginicus*) may be present where there has been disturbance. Prairie dropseed (*Sporobolus heterolepis*) is occasional in wet typic prairie; other occasional grasses include vanilla grass (*Hierochloë odorata*) and wedge grass (*Sphenopholis intermedia*). Sedges are an important component of wet typic prairie; some characteristic species include *Carex granularis*, *C. tetanica*, *C. suberecta*, *C. trichocarpa*, *C. pellita*, and *C. brevior*.

Spring-flowering forbs of wet typic prairie include hairy valerian (*Valeriana edulis ciliata*), balsam ragwort (*Senecio pauperculus*), marsh vetchling (*Lathyrus palustris*), meadow anemone (*Anemone canadensis*), yellow star-grass (*Hypoxis hirsuta*), wild strawberry (*Fragaria virginica*), and golden alexanders (*Zizia aurea*). Later in spring, marsh phlox (*Phlox glaberrima interior*), Canada wild onion (*Allium canadense*), tall meadow-rue (*Thalictrum dasycarpum*), prairie sundrops (*Oenothera pilosella*), and foxglove beardtongue (*Penstemon digitalis*) come into flower. During early summer, increasing numbers of forbs flower, including prairie milkweed (*Aclepias sullivantii*), dogbanes (*Apocynum* spp.), prairie Indian plantain (*Cacalia plantaginifolia*), marsh hedge nettle (*Stachys tenuifolius hispidus*), prairie loosestrife (*Lysimachia quadriflora*), and Michigan lily (*Lilium michiganense*). Flowering peaks during middle to late summer with marsh blazing-star (*Liatris spicata*), cup-plant (*Silphium perfoliatum*), early goldenrod (*Solidago juncea*), prairie dock (*Silphium terebenthinaceum*), cowbane (*Oxypolis*

rigidior), Culver's-root (*Veronicastrum virginicum*), and common mountain-mint (*Pycnanthemum virginianum*). By late summer, composites dominate, with New England aster (*Aster novae-angliae*), panicled aster (*Aster simplex*), Riddell's goldenrod (*Solidago riddellii*), giant goldenrod (*Solidago gigantea*), common boneset (*Eupatorium perfoliatum*), glaucous white lettuce (*Prenanthes racemosa*), saw-toothed sunflower (*Helianthus grosseserratus*), and late sneezeweed (*Helenium autumnale*). Bottle gentain (*Gentiana andrewsii*) and slender false-foxglove (*Agalinis tenuifolius*) are among the last non-composite prairie forbs to flower in wet typic prairie. Where there has been some surface disturbance, certain annual herbs may be locally common (*Bidens aristosa*, *Epilobium coloratum*, *Erigeron philadelphicus*, *Erechtites hieracifolia*)

When present on outwash plains, wet typic prairie often contains some elements of dolomite prairies, sand prairies, and fens. Low calamint (*Satureja arkansana*), flattened spikerush (*Eleocharis compressa*), Illinois bundle-flower (*Desmanthus illinoensis*), sweet coneflower (*Rudbeckia subtomentosa*), Sullivan's coneflower (*Rudbeckia fulgida sullivantii*), and spotted Joe-Pye-weed (*Eupatorium maculatum*) are among the species present. A few upland prairie forbs may also be present, such as compass plant (*Silphium laciniatum*), nodding wild-onion (*Allium cernuum*), spiked lobelia (*Lobelia spicata*), and white prairie-clover (*Dalea candida*).

Woody plants are present in wet typic prairie, but as only a rare element. Few shrubs are widespread, but there may be occasional thickets formed by shrubby willows (*Salix* spp.), hardhack (*Spiraea alba*), nannyberry (*Viburnum lentago*), false indigo-bush (*Amorpha fruticosa*), and dogwoods (*Cornus obliqua* and *C. sericea*). Prairie forbs and grasses may grow interspersed with or under these shrubs, especially bluejoint grass.

Wet typic prairies present in floodplains tend to be dominated by extensive stands of rhizomatous graminoids, possibly favored by occasional sediment deposition. In addition to tall prairie grasses (switchgrass, big bluestem, prairie cordgrass, Canada wild-rye) other graminoids in floodplain prairies include Virginia wild-rye (*Elymus canadensis*), riverbank wild-rye (*Elymus riparius*), leafy satin grass (*Muhlenbergia mexicana*), and sedges (*Carex trichocarpus*, *C. lacustris*). Many forbs present in floodplain prairies are also associated with savanna or floodplain forests. Some floodplain prairie forbs include meadow anemone, Canada wild onion, golden alexanders, great blue lobelia (*Lobelia siphilitica*), cup-plant, giant goldenrod, tall meadow-rue, sweet coneflower, frenchgrass (*Psoralea onobrychis*), glade mallow (*Napaea dioica*), prairie sundrops, tall coneflower (*Rudbeckia laciniata*), yellow crownbeard (*Verbesina alternifolia*), and Jerusalem artichoke (*Helianthus tuberosus*).

Restoration: Wet typic prairie will be restored on hydric mollisols in which the depth to bedrock is >50 cm. This includes many areas on the outwash plain where other soil characteristics (clay layers, dissolved magnesium) may create

soil conditions mimicking dolomite prairie. Some wet typical prairie may be restored on transition soils and alfisols where there is no evidence of recent occupancy by savannas or woodlands. Wet typical prairie will also be restored in floodplains and riparian areas. Given conditions on Midewin, it should be possible to restore a full range of moisture classes (wet-mesic, and wet typical prairie). Wet typical prairie will be often dominated by prairie cordgrass and bluejoint grass, but other graminoids will be present. Overall species diversity is lower than in upland typical prairie, but the better-drained wet prairies will support a rich flora. Periodic overseeding and supplemental planting may be required to establish the desired range of species.

SEDGE MEADOW

Synonyms: Includes sedge meadow natural community of White and Madany (1978) and Ecological Services (1995).

Physical Environment: This habitat occurs on relatively deep (>50 cm to bedrock), poorly-drained soils, but may occur on shallower soils if soil moisture remains high throughout the growing season. Soils are usually saturated within 6 inches of the surface throughout the growing season. Sedge meadows are often inundated during the spring, and for brief periods after a heavy summer rainfall. The soils may be derived from glacial till, post-glacial lacustrine deposits, outwash, and alluvium, with relatively small amounts of organic matter.

East of IL 53, sedge meadow was present on hydric soils derived from glacial till, post-glacial lacustrine deposits, and alluvium. Typical sites include broad swales, overflow channels along streams, shallow stream channels, and potholes. West of IL 53, sedge meadows are largely confined to depressions and abandoned stream meanders. Sedge meadows may also occur in association with seeps and on floodplains of larger streams. Some sedge meadows may have soils with a high content of organic matter, sand, or dolomite fragments.

Natural disturbances are important factors in sedge meadows. Fire removes accumulated litter, top kills shrubs, and creates exposed soil, which serves as sites for seedling germination and establishment. Burrowing by crayfish and insects also disturbs the soil surface. Large herbivores may also disturb the soil, and their selection of forage may favor certain less competitive plant species. Exceedingly long inundation or deposition of sediment may kill some vegetation and favor the establishment of other species. Beavers may change the vegetation of some sedge meadows by causing long-term inundation.

Vegetation: Sedge meadows are usually dominated by large, perennial, hummock-forming sedges. The most frequent species is common tussock sedge (*Carex stricta*); on outwash plains or on other moist, sandy soils, long-scaled tussock sedge (*Carex haydenii*) may also be common or may be the dominant sedge species. Riparian sedge meadows may support either species, but riverbank sedge (*Carex emoryi*) is more often dominant. There are other sedge

species present in hummocky sedge meadows, including certain sedges that may increase after disturbance. These other sedges include *Carex annectans*, *C. vulpinoidea*, *C. lupulina*, *C. squarrosa*, *C. stipitata*, *C. scoparia*, *C. trichocarpa*, *C. tribuloides*, *C. cristatella*, and *C. pellita*. A few of these species may be locally common or even dominant under certain conditions, such as in floodplain and early successional sedge meadows.

Some sedge meadows are dominated by rhizomatous graminoids that do not usually form large hummocks. Rhizomatous graminoids include sedges (*Carex lacustris*, *C. atherodes*, *C. pellita*, *C. trichocarpa*), spikerushes (*Eleocharis erythropoda*), Dudley's rush (*Juncus dudleyi*), green bulrush (*Scirpus atrovirens*), chairmaker's rush (*Scirpus pungens*), red bulrush (*Scirpus pendulus*), bluejoint grass (*Calamagrostis canadensis*), and fowl manna grass (*Glyceria striata*).

Forb species richness in sedge meadows is often lower than in wet typical prairie, although many of the same species are present. Common forbs include winged loosestrife (*Lythrum alatum*), late sneezeweed (*Helenium autumnale*), panicked aster (*Aster simplex*), northern bugleweed (*Lycopus uniflorus*), common water horehound (*Lycopus americanus*), common boneset (*Eupatorium perfoliatum*), swamp milkweed (*Asclepias incarnata*), blue vervain (*Verbena hastata*), field horsetail (*Equisetum arvense*), water hemlock (*Cicuta maculata*), marsh saxifrage (*Saxifraga pensylvanica*), cowbane (*Oxypolis rigidior*), wild blue iris (*Iris virginicus shrevei*), scarlet smartweed (*Polygonum coccineum*), prairie dogbane (*Apocynum sibiricum*), wild mint (*Mentha arvensis villosa*), rough avens (*Geum laciniatum*), and woundwort (*Stachys palustris homotricha*).

Where there has been surface soil disturbance, certain annual herbs may be common, including rice-cut grass (*Leersia oryzoides*), orange jewelweed (*Impatiens capensis*), nodding bur-marigold (*Bidens cernua*), cinnamon willow-herb (*Epilobium coloratum*), and fireweed (*Erechtites hieracifolia*).

Restoration: Sedge meadows will be restored on hydric mollisols and other hydric soils where there is inundation in spring and saturation persists through the summer. Likely sites include upland depressions, shallow swales, outflows from seeps, and depressions in floodplains. Sedge meadows will often be dominated by large, perennial, tussock-forming sedges, especially *Carex stricta* and *C. haydenii*. In early stages of restoration, however, other sedge species may be predominant, especially *Carex vulpinodea*, *C. annectans*, *C. trichocarpa*, and *C. cristatella*. Supplemental seeding and planting may be required to establish dominant sedges.

MARSH

Synonyms: Includes marsh natural community of White and Madany (1978) and Ecological Services (1995), and both shallow marsh and deep marsh communities described by The Wetlands Initiative (1999). On Midewin, this classification may include some small, natural ponds.

Physical Environment: This habitat occurs on poorly-drained soils that remain inundated for at least half of the growing season. Even during extreme droughts, soils usually remain saturated within 6 inches of the surface throughout the growing season. Marsh soils may be derived from glacial till, post-glacial lacustrine deposits, outwash, and alluvium, with relatively small amounts of organic matter.

East of IL 53, marshes were probably restricted to the wettest hydric soils derived from glacial till, post-glacial lacustrine deposits, and alluvium. Typical sites include overflow channels along streams and relatively deep potholes; marshes may have been present in other sites, where a natural drainage restriction may have backed up surface flow. Marshes may also form behind beaver dams. West of IL 53, marshes are associated with abandoned stream channels and large depressions. Marsh-like vegetation may also occur in association with seeps.

Natural disturbances are important factors in marshes. Seasonal climatic extremes may kill vegetation because of drought or prolonged inundation, and may also create sites for seedling recruitment (exposed mud flats). Fire removes accumulated litter and top kills young trees and shrubs. Beavers dig channels, remove woody plants, and change hydrology, often increasing depth and duration of inundation. Muskrats destroy beds of emergent vegetation, creating patches of open water.

Vegetation: Marsh vegetation is typically dominated by a series of overlapping but relatively monotypic stands of herbaceous, emergent perennials. In shallower marshes, the dominants are usually graminoids, including common cat-tail (*Typha latifolia*), common bur-reed (*Sparganium eurycarpum*), great bulrush (*Scirpus validus*), river bulrush (*Scirpus fluviatilis*), and common arrowhead (*Sagittaria latifolia*). Common associated plants include water parsnip (*Sium suave*), common boneset (*Eupatorium perfoliatum*), swamp milkweed (*Asclepias incarnata*), mad-dog skullcap (*Scutellaria lateriflora*), mild water pepper (*Polygonum hydropiperoides*), willow aster (*Aster praealtus*), blue vervain (*Verbena hastata*), chairmaker's rush (*Scirpus pungens*), water stonecrop (*Penthorum sedoides*), and orange jewelweed (*Impatiens capensis*).

In deeper areas, the vegetation is dominated by floating or submersed plants, including yellow pond-lily (*Nuphar advena*), water heartease (*Polygonum amphibium stipulaceum*), white water-lily (*Nymphaea odorata*), white water-crowfoot (*Ranunculus longirostris*), and duckweeds (*Spirodela polyrhiza*, *Lemna* spp.). There are also tracts of open water; if these are exposed during dry periods, they are often colonized by annuals, including rice-cut grass (*Leersia oryzoides*), smartweeds (*Polygonum pensylvanicum*), marsh yellow cress (*Rorippa palustris fernaldiana*), and nutsedges (*Cyperus* spp.). Other species growing on exposed mud include spikerushes (*Eleocharis obtusata*, *E. acicularis*), water-plaintain (*Alisma subcordatum*), and lake cress (*Amoracia*

lacustris).

Restoration: Marshes will be managed so as to prevent dominance by a few invasive plants such as common reed and narrowleaf cat-tail. Marshes will be restored on hydric soils where inundation persists into early summer, and may continue through the growing season in years of average precipitation. Marshes may include some areas of open water, which often remain inundated throughout the year; other areas will become exposed mud by late summer. Preferred sites for marsh restoration will include abandoned stream channels, natural potholes, etc. Some modified sites, such as the margins of artificial ponds and impoundments, may best managed with natural marsh vegetation.

SEEP

Synonyms: Includes seep community of White and Madany (1978) and Ecological Services (1995); and fen/seep communities described by The Wetlands Initiative (1999). Based on soils (oxidized peat) and surviving vegetation, some seeps on Midewin may have been graminoid and forested fen communities (White and Madany 1978), but have been severely disturbed, almost beyond recognition (Ecological Services 1995).

Physical Environment: This habitat occurs on soils saturated by ground water, usually emerging as a diffuse flow. Soils usually remain saturated throughout the year, and seeps may remain unfrozen throughout the winter. Seep soils may be derived from glacial till, post-glacial lacustrine deposits, outwash, alluvium, loess and organic matter. At Midewin, they are often associated with buried layers of clay, gravel, or bedrock that enhance water emergence in a relatively concentrated area.

Seeps are extremely localized at Midewin, most often occurring on the slopes of glacial end moraines, outwash terraces, and valley sides above stream floodplains; the vegetation associated with the seep usually extends down slope onto adjacent alluvium. Most seeps are very small (<0.1 acre), but some large seep complexes were present where the glacial till uplands rise from the outwash plain.

Natural disturbances are important factors in seeps. Seasonal climatic extremes may reduce the area influenced by the seep, and some plant species may decline as others invade the seep. Fire removes accumulated litter and top kills shrubs and trees. Erosion or soil slumps may change the surface, often exposing mineral subsoil.

Vegetation: Most forested seeps on Midewin are shaded by trees at the edges of or outside of the wetland; canopy species include bur oak (*Quercus macrocarpa*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), northern red oak (*Quercus rubra*), eastern cottonwood (*Populus deltoides*), Kentucky coffee-tree (*Gymnocladus dioica*), and sugar maple (*Acer*

saccharum). Only a few seeps are shaded by trees that are rooted in the seep, usually black ash (*Fraxinus nigra*) or an occasional green ash or American elm. Shrubs are present in some seeps, most often willows (*Salix eriocephalus*), dogwoods (*Cornus* spp.), prickly-ash (*Zanthoxylum americanum*), wild black currant (*Ribes americanum*), and nannyberry (*Viburnum lentago*).

Herbaceous species in shaded seeps include skunk cabbage (*Symplocarpos foetidus*), marsh-marigold (*Caltha palustris*), bulbous spring-cress (*Cardamine bulbosa*), golden ragwort (*Senecio aureus*), false nettle (*Boehmeria cylindrica*), lizard's-tail (*Saururus cernuus*), clearweed (*Pilea pumila*), fowl manna-grass (*Glyceria striata*), orange jewelweed (*Impatiens capensis*), and swamp goldenrod (*Solidago patula*).

Unshaded seeps are often dominated by graminoids, including sedges (*Carex stricta*, *C. hystericina*), green bulrush (*Scirpus atrovirens*), winter souring-rush (*Equisetum hyemale*), and fowl manna grass. Typical forbs include spotted Joe-Pye weed (*Eupatorium maculatum*), great water dock (*Rumex orbiculatus*), turtlehead (*Chelone glabra*), great angelica (*Angelica atropurpurea*), red-stemmed aster (*Aster puniceus*), monkeyflower (*Mimulus ringens*), and marsh bellflower (*Campanula aparinoides*).

Restoration: Seeps will be restored where diffuse groundwater reaches the surface. At some localities, seeps may appear as drainage tiles are removed, because groundwater flow is longer intercepted and carried away to drainage ditches. These sites will be restored as appropriate with surrounding vegetation. As seep soils are protected from disturbance, peat and marl substrates may redevelop in some seeps, and they may become fen-like. If a given seep develops fen characteristics, then appropriate plant species may be introduced into the seep.

SAVANNA

Synonyms: Includes dry-mesic savanna, mesic savanna, and wet-mesic savanna moisture classes of White and Madany (1978) and Ecological Services (1995). We have combined these natural communities under one heading (savanna) because they are structurally similar, and one moisture class, mesic savanna, accounted for over 95% of all savannas on Midewin.

Physical Environment: Savannas are grasslands with scattered trees. The trees are characteristically open-grown, with spreading lower limbs. Canopy coverage by these trees is <50%. This habitat occurs on relatively deep (>50 cm to bedrock), somewhat poorly drained to excessively well-drained soils. Some savannas with stunted trees may have been present on shallower soils. Wetter sites either cannot support trees, or support woodland/forest communities (because fire periodicity becomes too infrequent to maintain savanna structure). The soils may be derived from glacial till, post-glacial lacustrine deposits, outwash, alluvium, or loess. Wet-mesic savannas may have soils temporarily

inundated in spring, but soil saturation does not persist into early summer. Glacial erratics (sandstone, granite, quartzite) are occasionally present at the surface, where they and tree bark provide substrate for lichens and bryophytes not found on soil. Bedrock exposures (dolomite) are rare, and occur usually near streams.

East of IL 53, savannas were present on upland soils derived from glacial till, post-glacial lacustrine deposits, and loess, and on well-drained alluvium in riparian areas. Savannas were concentrated along Prairie Creek, usually on soils with slopes >2-3% and they exist as an ecotone between prairie groves (such as Starr Grove) and the surrounding prairie. Some savannas were probably present within the floodplain of Prairie Creek. Soils indicate that savannas may have been present around the upper reaches of Grant Creek, and on some slopes immediately east of IL 53.

West of IL 53, savannas were present on loamy and sandy soils on the outwash plain. Some sites had excessively well-drained soils with a relatively high sand or gravel content; these sites are at the margins of post-glacial terraces, and may have supported dry-mesic savanna. Savannas were also present along Prairie Creek, often where abandoned or existing stream channels acted as firebreaks. Savanna existed along Jackson Creek, usually as an ecotone between the open prairie to the south and the forests and woodlands on the slopes and terraces associated with the stream. Some wet-mesic savanna was present in the floodplain of Jackson Creek.

Natural disturbances are important factors in savanna. Fire removes accumulated litter, top kills shrubs, and creates exposed soil, which serves as sites for seedling germination and establishment. Without fire, the savanna understory quickly fills in with shrubs, woody vines and tree saplings. Some savanna trees may be killed by prolonged droughts, intense fires or insect infestations. Burrowing by vertebrates (ground squirrels, foxes, moles, woodchucks) and insects also disturbs the soil surface. Large herbivores may also disturb the soil, and their selection of browse may favor herbaceous species over woody plants.

Vegetation: The most prevalent tree species in savannas throughout Midewin is bur oak (*Quercus macrocarpa*). On well-drained sites, some white oaks (*Quercus alba*) and shagbark hickory (*Carya ovata*) may be present, with black oak (*Quercus velutina*) on sandy loams. In addition to bur oak, wetter sites may support swamp white oaks (*Quercus bicolor*), with a few eastern hackberries (*Celtis occidentalis*), American elms (*Ulmus americana*), black walnuts (*Juglans nigra*) and eastern cottonwoods (*Populus deltoides*) present in riparian savannas.

Understory shrubs are scattered or absent. The most frequent shrub species is American hazel (*Corylus americana*), but other species present include pasture rose (*Rosa carolina*), wild blackberries (*Rubus* spp.), New Jersey tea (*Ceanothus*

americanus), hawthorns (*Crataegus* spp.), prairie crabapple (*Malus ioensis*), common elderberry (*Sambucus canadensis*), gray dogwood (*Cornus racemosa*), and nannyberry (*Viburnum lentago*). A few vines may be present, including American bitterwsweet (*Celastrus scandens*), riverbank grape (*Vitis riparia*), and bristly catbrier (*Smilax hispida*).

Herbaceous species include many species typical of tallgrass prairie. Openings between trees are dominated by little bluestem (*Andropogon scoparius*), big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), Canada wild rye (*Elymus canadensis*), prairie dropseed (*Sporobolus heterolepis*), prairie cordgrass (*Spartina pectinata*), and bluejoint grass (*Calamagrostis canadensis*). Some of these grasses may be present under the tree canopies, especially little bluestem, Canada wild rye, prairie cordgrass, and bluejoint grass. Other graminoids present where there is some shade include wood reed (*Cinna arundinacea*), Virginia wild rye (*Elymus virginicus*), and sedges (*Carex pensylvanicus*, *C. cephalophora*, *C. lupulina*, *C. trichocarpa*).

Forbs present include many species common in upland or wet typic prairie, but with the addition of many woodland species. Common spring-flowering forbs include spring-beauty (*Claytonia virginica*), wild hyacinth (*Camassia scilloides*), wild geranium (*Geranium maculatum*), shooting-star (*Dodecatheon meadia*), Virginia waterleaf (*Hydrophyllum virginianum*), starry solomon's-seal (*Smilacina stellata*), alumroot (*Heuchera richardsonii*), and golden alexanders (*Zizia aurea*). In early summer, flowering forbs include cow parsnip (*Heracleum lanatum*), tall spiderwort (*Tradescantia ohioensis*), false-sunflower (*Heliopsis helianthoides*), smooth beardtongue (*Penstemon calycosus*), and white wild indigo (*Baptisia leucantha*). Into late summer and fall, composites make up the vast majority of flowering herbs, including purple Joe-Pye weed (*Eupatorium purpureum*), wild quinine (*Parthenium integrifolium*), rosinweed (*Silphium integrifolium*), hairy sunflower (*Helianthus hirsutus*), pale Indian-plaintain (*Cacalia atriplicifolia*), Sullivant's coneflower (*Rudeckia fulgida sullivantii*), smooth blue aster (*Aster laevis*), calico aster (*Aster lateriflorus*), early goldenrod (*Solidago juncea*), and elm-leaved goldenrod (*Solidago ulmifolia*). Other summer and fall flowering herbs include Culver's-root (*Veronicastrum virginicum*), nodding wild-onion (*Allium cernuum*), and mullein foxglove (*Dasistoma macrophylla*).

On floodplains and in riparian areas, additional herbaceous species include cup-plant (*Silphium perfoliatum*), giant goldenrod (*Solidago gigantea*), tall meadow-rue (*Thalictrum dasycarpum*), glade mallow (*Napaea dioica*), tall coneflower (*Rudbeckia laciniata*), yellow crownbeard (*Verbesina alternifolia*), saw-toothed sunflower (*Helianthus grosseserratus*), Jerusalem artichoke (*Helianthus tuberosus*), and tall nettle (*Urtica dioica*).

Restoration: Savannas will be restored on transition soils and alfisols where evidence (including topography) suggests the past presence of trees. Savannas may also be restored on mollisols where there is evidence (historical or surviving

oaks) suggesting a former savanna. There may be special cases where savanna is used as a model for planting where some shade is required (e.g., certain public-use areas, riparian areas) and savanna is not incompatible with other site objectives. Given site conditions, it should be possible to restore the following savanna moisture classes on Midewin: dry-mesic, mesic, and wet-mesic savannas. Overall, canopy cover by trees in savannas is expected not to exceed 50%. The dominant savanna tree is bur oak, but some other oak species may be present. The understory will be relatively open with scattered shrubs and vines, including American hazel. Because most remnant savannas on Midewin now contain a dense understory of shrubs and young trees, intensive management (burning and shrub removal) may be required to restore savanna structure. Additionally, some areas now considered to represent woodland vegetation may have been savannas, and may be restored as such.

WOODLAND/FOREST

Synonyms: Includes dry-mesic upland forest, mesic upland forest, wet-mesic upland forest, mesic floodplain forest, wet-mesic floodplain forest, and wet floodplain forest moisture classes of White and Madany (1978) plus dry-mesic woodland, mesic woodland, and wet-mesic woodland moisture classes of Ecological services (1995). We have combined these natural communities under one heading (woodland/forest) because they consist of less than 4% of the potential natural vegetation of Midewin. Additionally, upland forests, floodplain forests, and woodland usually occur in close association on Midewin, because their development is controlled by topographic features found along streams (valley slopes, side ravines, and floodplains).

Physical Environment: Woodlands are relatively open, with canopy closure of 50-80%. They are present on soils derived from glacial till, outwash, loess, and alluvium. Small areas of woodland may occur on soils that are temporarily inundated or saturated during the spring, either in depressions or riparian areas. Most woodlands are on well-drained soils, often with a slope >2-3 percent.

Forests (both upland and floodplain) are relatively closed, with canopy closure of >80%. They are present on soils derived from glacial till, outwash, loess, and alluvium. Small areas of upland forest may be on soils that are temporarily inundated or saturated during the spring, usually in depressions or adjacent to seeps. Otherwise, upland forests are on well-drained soils with a slope >2-3 percent.

Floodplain forests occur within the flood zone of streams; soils are derived from alluvium, but drainage may vary with substrate, which may include varying amounts of gravel, sand, silt, or clay. Although floodplain forests are relatively poorly drained, small changes in topography can strongly influence the duration of inundation, soil saturation, and sediment deposition. Sites on terraces and natural levees are the best drained, while those in or adjacent to overflow channels may be the “wettest”, with strongly hydric soils.

Woodlands and forests are typically concentrated along streams in a prairie landscape, usually where streams or other features (such as steep slopes) act to reduce fire duration and intensity. Woodlands may be present as an ecotone between forest and savanna or prairie vegetation. They are also present on sloping uplands above ravines or steep slopes that support forests, or on excessively well-drained ridges amid more mesic vegetation. Upland forests occur in ravines and on slopes that were protected from frequent, high intensity fires. They may also be present on erosional remnants and high terraces that are surrounded by floodplains. Floodplain forests occur within the floodplains of perennial streams, but do not occupy the entire floodplain, especially where fire could easily enter from adjacent uplands.

Natural disturbances are important factors in woodlands and forests. Fire removes accumulated litter, top kills shrubs, and creates exposed soil, which serves as sites for seedling germination and establishment. The seedlings of certain tree species are highly vulnerable to fire; others require periodic fires to create conditions suitable for germination and establishment. Without fire, the woodland understory becomes increasingly dense with shrubs, woody vines and tree saplings. Burrowing by vertebrates (ground squirrels, moles, woodchucks, and salamanders) and insects also disturbs the soil surface. Large herbivores may also disturb the soil, and their selection of browse may favor herbaceous species over woody plants. Hillside slumps and windthrows expose mineral soil. Some canopy trees may be killed by prolonged droughts, intense fires or insect infestations. In floodplain forests, canopy trees may be killed by prolonged flooding or sediment deposition. The deposit of sediment may change the flow and duration of flood waters in floodplain forest, and create sites for establishment of new plants. Lateral movement of stream channels will undercut some canopy trees and expose soils.

Vegetation: The predominant canopy trees in forests and woodlands on Midewin include bur oak (*Quercus macrocarpa*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), and American basswood (*Tilia americana*). On the most well-drained sites, often with sandy soils, black oak (*Quercus velutina*) is frequent with bur oak and white oak. Where soils are strongly calcareous, chinkapin oak (*Quercus muhlenbergii*), Kentucky coffee-tree (*Gymnocladus dioica*), black maple (*Acer nigrum*), and blue ash (*Fraxinus quadrangulata*) occur with more widespread tree species. On mesic sites in ravines and on north-facing slopes, sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and bitternut hickory (*Carya cordiformis*) are present.

On well-drained floodplain and riparian sites, predominant canopy trees include bur oak and black walnut (*Juglans nigra*), with occasional eastern hackberry (*Celtis occidentalis*) and American elm (*Ulmus americanus*). Wetter sites may support swamp white oak (*Quercus bicolor*), but also green ash (*Fraxinus*

pennsylvanicus), eastern cottonwood (*Populus deltoides*), and willows (*Salix nigra* and *S. amygdaloides*).

Understory trees in woodlands and forests consist mostly of saplings of canopy tree species. On well-drained, often sandy or rocky sites, additional small trees present include ironwood (*Ostrya virginiana*), hawthorns (*Crataegus* spp.), prairie crabapple (*Malus ioensis*), and sassafras (*Sassafras albidum*).

Understory trees present on mesic sites include black cherry (*Prunus serotina*) and American hornbeam (*Carpinus caroliniana*). One locally predominant understory tree in floodplains is red haw (*Crataegus mollis*), but the understory of most floodplain forests and riparian woodlands are relatively open.

Shrub density is often variable in forests and woodlands, often as a consequence of fire frequency; some woodlands lack a well developed shrub stratum. Common shrub species on upland sites may include American hazel (*Corylus americana*), New Jersey tea (*Ceanothus americanus*), pasture rose (*Rosa carolina*), wild blackberries (*Rubus* spp.), and choke cherry (*Prunus virginiana*). On mesic sites, bladdernut (*Staphylea trifolia*) may be locally common; other mesic forest shrubs include wahoo (*Euonymus atropurpureus*) and blackhaw (*Viburnum prunifolium*). Native shrubs are rare in floodplain situations, with local thickets of elderberry (*Sambucus canadensis*) and dogwoods (*Cornus obliqua*, *C. racemosa*).

Vines are present in both forests and woodlands; they are most abundant in floodplain and riparian forests. The most frequent species are riverbank grape (*Vitis riparius*) and creepers (*Parthenocissus incerta* and *P. quinquefolius*). Poison-ivy (*Toxicodendron radicans*) can be locally common, primarily in floodplain and riparian areas with low fire frequencies. Other vines include bristly catbrier (*Smilax hispida*), virgin's-bower (*Clematis virginiana*), and American bittersweet (*Celastrus scandens*).

Graminoids are an important component of the flora; the understory of woodlands includes bottlebrush grass (*Elymus hystrix*), other wild ryes (*Elymus* spp.), woodland brome grass (*Bromus pubescens*), wood rush (*Luzula multiflora*), poverty oat grass (*Danthonia spicata*), and sedges (*Carex radiata*, *C. rosea*, *C. jamesii*, *C. pensylvanica*). Relatively few grass species occur in wooded floodplains, but a few species may be very common, including beak grass (*Diarrhena obovata*), silky wild rye (*Elymus villosus*), Virginia wild rye (*Elymus virginicus*) and wood reed (*Cinna arundinacea*). Sedges present in moist forests and woodlands include *Carex blanda*, *C. grayi*, *C. grisea*, *C. jamesii*, *C. laxiculmis*, *C. jamesii*, *C. davisii*, and *C. albursina*. A few fern species may be present; most frequently on the fragile fern (*Cystopteris protrusa*).

The herbaceous flora within forests and woodlands is often very diverse, but the greatest number of species flower in spring. Where the canopy is open,

however, there may be a good assemblage of summer and fall-flowering forbs. Common spring-flowering species include spring-beauty (*Claytonia virginica*), toothwort (*Dentaria laciniata*), wild hyacinth (*Camassia scilloides*), woodland blue phlox (*Phlox divaricata*), wild geranium (*Geranium maculatum*), shooting-star (*Dodecatheon meadia*), Virginia bluebells (*Mertensia virginica*), Dutchman's breeches (*Dicentra cucullaria*), wild leek (*Allium tricoccum burdickii*), dogtooth lily (*Erythronium albidum*), trilliums (*Trillium recurvatum* and *T. sessile*), Virginia waterleaf (*Hydrophyllum virginianum*), false solomon's-seal (*Smilacina racemosa*), yellow violet (*Viola pubescens*), hairy blue violet (*Viola sororia*), false-mermaid (*Floerkea proserpinicoides*), mayapple (*Podophyllum peltatum*), and blue cohosh (*Caulophyllum thalictroides*). In early summer, flowering forbs include fire pink (*Silene virginica*), shining bedstraw (*Galium concinnum*), early figwort (*Scrophularia lanceolata*), sweet cicely (*Osmorhiza* spp.), veiny pea (*Lathyrus venosus*), horse-gentians (*Triosteum* spp.), Virginia snakeroot (*Aristolochia serpentaria*), clustered black snakeroot (*Sanicula odorata*), and starry campion (*Silene stellata*). Conspicuous flowering forbs from middle summer into fall include broad-leaved purple coneflower (*Echinacea purpurea*), purple Joe-Pye weed (*Eupatorium purpureum*), tall bellflower (*Campanula americana*), woodland sunflower (*Helianthus divaricatus*), Culver's-root (*Veronicastrum virginicum*), pale Indian-plaintain (*Cacalia atriplicifolia*), white snakeroot (*Eupatorium rugosum*), Short's aster (*Aster shortii*), calico aster (*Aster lateriflorus*), woodland white lettuce (*Prenanthes alba*), zigzag goldenrod (*Solidago flexicaulis*), and elm-leaved goldenrod (*Solidago ulmifolia*).

On floodplains and in riparian areas, additional herbaceous species include blue violets (*Viola* spp.), wild chervil (*Chaerophyllum procumbens*), late figwort (*Scrophularia marilandica*), cup-plant (*Silphium perfoliatum*), tall meadow-rue (*Thalictrum dasycarpum*), glade mallow (*Napaea dioica*), tall coneflower (*Rudbeckia laciniata*), yellow crownbeard (*Verbesina alternifolia*), Jerusalem artichoke (*Helianthus tuberosus*), jewelweeds (*Impatiens* spp.), wood nettle (*Laportea canadensis*), and tall nettle (*Urtica dioica*).

Restoration: Woodlands and forests will be restored on alfisols and in floodplains where existing vegetation, historical evidence, and topography support the existence of closed vegetation dominated by trees, instead of savanna. Given site conditions, it should be possible to restore the following classes on Midewin: dry-mesic woodland, mesic woodland, wet-mesic woodland, dry-mesic upland forest, mesic upland forest, wet-mesic upland forest, mesic floodplain forest, wet-mesic floodplain forest, and wet floodplain forest. Overall, canopy cover by trees in woodland is expected to vary between 50-80%; in forests, canopy cover by trees is expected to exceed 80%. The tree diversity of woodlands and forests is higher than that of savannas, but oaks are often dominant canopy trees. Woodlands and floodplain forests both have a relatively open understory, but species composition is often very different. Native shrubs, especially American hazel, are an important component of the woodland understory. Upland forests have a relatively closed understory, with several

distinct strata. Because most remnant woodlands on Midewin now contain a dense understory of shrubs and young trees, intensive management may be required to restore woodland structure. Additionally, some areas now considered to represent forest vegetation may have been woodlands, and may be restored as such.

PERENNIAL STREAM

Synonyms: Perennial streams on site would fit within the medium-gradient creek and low-gradient creek classes of White and Madany (1978).

Physical Environment: Included here are all vegetated and unvegetated areas within the channels of Prairie, Jackson, Grant, and Jordan creeks; typical channel features include riffles, raceways, pools, gravel bars, rubble bars, and stream banks. Stream flow is perennial, but may be restricted to subsurface flow in some reaches during droughts. Stream channels may be shaded or exposed to sun; this is dependent on adjacent riparian vegetation, but some trees occur on the banks and within the channel.

Natural disturbance is frequent within this physically dynamic environment. Banks may be undercut and new point bars deposited as stream channels undergo lateral movement through the floodplain. Debris and sediment is accumulates, then is moved and deposited elsewhere by stream flow. Beds of emergent and riparian plants are buried or uprooted by deposition and stream flow. Stream flow changes through the season, with changes in depth, volume, temperature, and turbidity. Beavers may dam streams, changing stream characteristics and allowing establishment of emergent vegetation.

Vegetation: Water willow (*Justicia americana*) is a fairly common and characteristic herb growing in the stream channel, often associated with gravel bars. Where deeper, less turbulent pools are present, floating herbs include yellow pond-lily (*Nuphar advena*) and pondweed (*Potamogeton nodosus*). On gravel bars and on stream banks, there may be extensive stands of rhizomatous graminoids, including riverbank sedge (*Carex emoryi*), lake sedge (*Carex lacustris*), prairie cordgrass (*Spartina pectinata*), chairmaker's rush (*Scirpus pungens*), and winter scouring-rush (*Equisetum hyemale*).

The stream channel may be open, or have a canopy of trees. Most of these trees are growing in adjacent vegetation, including floodplain phases of savanna, woodland, and forest. However, certain trees may be growing on the stream banks or on stabilized point bars, including black willow (*Salix nigra*), eastern cottonwood (*Populus deltoides*), box elder (*Acer negundo*), eastern sycamore (*Platanus occidentalis*), and silver maple (*Acer saccharinum*). Shrubs growing in or along the stream channel include sandbar willow (*Salix interior*), false indigo-bush (*Amorpha fruticosa*), and blue dogwood (*Cornus obliqua*). Certain herbaceous species present in adjacent prairie, wetland, savanna, and woodland vegetation may be present on the banks and bars within the channel such as

Switchgrass (*Panicum virgatum*), common arrowhead (*Sagittaria latifolia*), tall coneflower (*Rudbeckia laciniata*), monkeyflower (*Mimulus ringens*), orange jewelweed (*Impatiens capensis*), and tall nettle (*Urtica dioica*).

Restoration: Perennial stream vegetation will be restored in stream channels and on banks as hydrologic conditions permit. In many cases, desired species may spread out from remnant populations, or from adjacent restored populations in riparian prairies and wetland. Because the present vegetation of most riparian areas is highly altered from the pre-1830 condition, intensive restoration activities may be needed to restore site conditions.

SHORT-STATURE GRASSLAND

Synonyms: Also could be referred to as pasture, short grassland, or grazed agricultural grassland.

Physical Environment: These grasslands are present on moderate to excessively well-drained soils; short stature grassland may be drained artificially through tile or ditch systems. Short-stature grassland should occur in contiguous tracts not less than 75 acres in size; fragmenting features include fencerows, hedgerows, roads, buildings, and groves of trees.

Vegetation: Dominated by grasses 10-30 cm in height, with approximately half of grass cover <10-20 cm. Grassland composition not important; may be non-native pasture grasses (*Poa pratensis*, *Agrostis alba*, *Bromus inermis*, *Festuca* sp.) or natives (perhaps *Sporobolus heterolepis*, *Andropogon scoparius*, *Stipa spartea*). The density and diversity of forbs may be important under certain conditions. Scattered shrubs <1m in height should not exceed 5% of total cover; shrubs 1-2m in height should be concentrated near margins of contiguous grassland tracts (<100m from nearest woody edge). Typical shrub species include hawthorns (*Craetagus* spp.), Osage-orange (*Maclura pomifera*), prairie crabapple (*Malus ioensis*), wild plum (*Prunus americana*), coralberry (*Symphoricarpos orbiculatus*), and wild roses (*Rosa* spp.).

Restoration: Short-stature grassland will be established or maintained on well-drained soils; artificial drainage may be maintained by existing tile and ditch systems. Agricultural grasslands will be managed (grazing, mowing, hay-cutting, and prescribed burning) to meet habitat objectives until Midewin staff can demonstrate that restored prairie can be managed to meet the same objectives.

MEDIUM-STATURE GRASSLAND

Synonyms: Also could be referred to as hayland, hayfield, low-intensity pasture, medium-height grassland, or hayed agricultural grassland.

Physical Environment: These grasslands are present on moderate to excessively well-drained soils; medium stature grassland may be drained artificially through tile or ditch systems. Medium-stature grassland should occur

in contiguous tracts not less than 75 acres in size; fragmenting features include fencerows, hedgerows, roads, buildings, and groves of trees.

Vegetation: Dominated by grasses 20-35cm in height during late May/early June. Grass composition not important; may be exotic pasture grasses (*Poa pratensis*, *Agrostis alba*, *Bromus inermis*, *Festuca* sp.) and legumes (*Trifolium* spp.) or native grasses (*Andropogon scoparius*, *A. gerardii*, *Sorghastrum nutans*, *Panicum virgatum*, *Sporobolus heterolepis*) and forbs. Scattered shrubs/small trees (>1m in height) may be present at very low densities (<1/ha) within 100m of woody edge. Litter depth (1-2 cm) and presence important.

Restoration: Medium-stature grassland will be established or maintained on well-drained soils; in some cases, drainage will be maintained by existing tile and ditch systems. Agricultural grasslands will be managed (grazing, mowing, hay-cutting, and prescribed burning) to meet habitat objectives until Midewin staff can demonstrate that restored prairie can be managed to meet the same objectives.

TALL-STATURE GRASSLAND

Synonyms: Also could be referred to as non-native grassland, typic prairie (upland or wet), fallow hayland, fallow pasture, tall-height grassland, or fallow pasture; may include some sedge meadow and dolomite prairie.

Physical Environment: These grasslands are present on wide range of soils, from poorly drained to well-drained soils; grassland may be drained artificially through tile or ditch systems. Tall-stature grassland should occur in contiguous tracts not less than 75 acres in size; fragmenting features include fencerows, hedgerows, roads, buildings, and groves of trees.

Vegetation: Dominated by live grasses or standing dead grasses >35-40cm in height during late May/early June. Grass composition not important; may be taller non-native pasture grasses (*Poa pratensis*, *Agrostis alba*, *Bromus inermis*) and legumes (*Trifolium* spp.) or native grasses (*Andropogon scoparius*, *A. gerardii*, *Sorghastrum nutans*, *Panicum virgatum*, *Sporobolus heterolepis*) and forbs. May be tallgrass prairie vegetation (natural or restored). Scattered shrubs/small trees (>1m in height) may be present at very low densities (<1/ha) within 100m of woody edge. Litter depth (>2 cm) and presence important.

Restoration: Tall-stature grassland will be established as restored prairie, or can be created by management of agricultural grasslands. Agricultural grasslands can be managed with proper timing and periodicity of burning, mowing, or hay-cutting to meet habitat objectives until Midewin staff restore sufficient prairie to meet the same objectives.