Management Plan for Downs Forest, a Bottomland Forest in Central Illinois

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Introduction

This management/restoration plan has been produced for Downs forest, a 36-acre bottomland forest located on the northern edge of the village of Downs (Appendix 1). The forested area is owned by the village of Downs. The purpose of this management plan is to provide guidance to the city as to how to best manage the area and to determine how to best mitigate damage to the vegetation caused by the installation of sewer lines, which are proposed to be located within the forest. Minimizing damage to high quality extant vegetation at the site will be a high priority. Another priority in this area is to maintain the quality of the site for breeding bird populations, which requires that large trees within the forest be preserved, the structural diversity of the forest remains intact (or be improved), and that the forest not be further fragmented.

Specific goals for this management plan are to mitigate damage/disturbance caused by sewage line installation and to maintain diversity of canopy and herbaceous layer. The second goal is to restore the composition of the tree canopy to that of high quality floodplain forests and/or historic vegetation. The final goal is to maintain/improve habitat for breeding bird populations with sensitive habitat requirements.

Study Site

Downs Woods is a 36-acre floodplain forest located along Kickapoo Creek, approximately 10 miles southeast of Bloomington in McLean County, Illinois. The forest is located on the east side of Kickapoo Creek on the northern edge of the village of Downs (Appendix 1). The area falls on the border between Downs (T22N, R3E) and Old Town (T23, R3E) townships. The topography of the area is relatively level with exception to the south and east borders, where there are north and west-facing slopes (Appendix 2). Frequent flooding leads to drastic differences in soil moisture over the course of the year in this forest. Soil moisture conditions can be waterlogged in the spring when flood frequency is high but relatively dry during the late summer months and other times of the year. Three soil associations occur on the site which includes Lawson Silt Loam, Warsaw Loam, and Miami and Hennepin soil associations (USDA 2002). Soils are composed primarily of silty loam and sand and clay substratum. These soils range from somewhat poorly drained (Lawson Silt Loam) in level areas near the creek to being well-drained on the slopes (USDA 2002). Each of the soils is associated with floodplains which are typically unstable and weakly developed because of the continual deposition of new material and the removal of old material (Leitner and Jackson 1981).

According to Government Land Office records from 1821-1824, Downs Woods was historically categorized as closed forest (Appendix 4, Rodgers and Anderson 1979). Historically, closed forests typically occurred in floodplains, isolated groves and areas of rugged topography (Rodgers and Anderson 1978, Adams and Anderson 1980). In southern Illinois, bottomland forests were originally dominated by elm, ash, cottonwood, oak, hickory and maple species (Leitner and Jackson 1981). Witness trees in the GLO records of closed forests in Downs township and Old Town township included overcup oak, white oak, red oak, black oak, hickory, and elm. Overcup oak may have been misidentified, and may actually be bur oak. Currently, overcup oak is not distributed as far north as Central Illinois, but bur oak is common throughout the state. Bur oak is adapted to periodic flooding and is a common species in bottomland forests.

The composition of the forest is similar to other floodplain forests in Illinois (Crites and Ebinger 1968, Bell 1974, Adams and Anderson 1980) with hackberry, ash, and elm as dominant canopy trees in wet-mesic areas and sycamore, ash, silver maple and cottonwood as dominant

species in floodplains. Floodplain forests are constantly changing habitats and hydrophytic tree species typically do well in these areas. The site is highly disturbed by frequent flooding and contains a great deal of woody debris and standing dead trees. Less desired tree species such as osage orange are abundant throughout the forest. Paw paw, box elder and sugar maple compose the understory. There are a number of sycamore, silver maple, cottonwood, bur oak and red oak trees of notable size in the forest. Area 1 contains somewhat higher quality vegetation than does Area 2 with respect to both the woody species and herbaceous species (Appendix 5) and does not appear to be as disturbed as Area 2.

Potential Threats

The most notable threat to the health and integrity of the forest is the invasion of exotic plant species. If left uncontrolled, these invasive plant species will likely have negative effects on native plant diversity which will then result in negative effects on other organisms dependent on these native plants species. The three invasive plant species that pose the greatest threat to the site include honeysuckle (*Lonicera mackii*), garlic mustard (*Alliaria petiolata*), and reed canary grass (*Phalaris arundinaceae*).

Disturbance caused by sewer line installation in the interior of the forest poses a threat to the integrity and health of the site as it will impact the vegetation in the area and the bird species that utilize it. Heavy machinery will be moving in and out of the forest when the sewer lines are being installed, thus creating a great deal of disturbance. Further fragmentation of the forest may have detrimental effects on birds that use the area for nesting. If sewer line construction results in results in fragmentation of the forest, drastic losses of large trees and/or losses in structural diversity in the forest, certain bird species may be adversely affected.

Deer browsing may pose a threat to the integrity of the site, but we did not evaluate the effects of deer browsing for the purposes of this report. Overabundance of deer in the area negatively impacts certain herbaceous plant species that deer prefer. Deer browsing may also alter structural diversity in the forest and may result in changes in tree composition (Strole and Anderson 1992). There are also areas along the trail that are badly eroded. Erosion on the trail is primarily a problem in where the creek bends around and the forest narrows near residential houses. Multiple trails run straight up the steep terrain and are heavily eroded. The vegetation in this area (red oak trees and herbaceous species) is negatively effected by the continued erosion in this area.

Methods

Sampling Vegetation. Trees and shrubs were sampled in nested circular quadrats 0.01 hectares (radius = 5.64m) and 0.0003 hectares (radius = 1m) in area, respectively. Shrubs were only sampled in Area 1. Trees were sampled in Area 1 and Area 2. Sampling points were located along transects at 40 meter intervals. The first sampling point on each transect was established 5.6 meters from the bank of the creek. Transects were located 60 meters apart. Diameter at breast height (dbh) of all trees (dbh > 2.5cm) located within the quadrat was measured and recorded by species. The number of stems for each shrub species (<2.5cm dbh) located within the 0.0003 ha quadrat was also recorded. Fifty-two quadrats (0.52 ha) were sampled for trees. Thirty-nine sampling points were located in Area 1 and thirteen sampling points were located in Area 2. Sixty five 0.25 by 0.25m quadrats were sampled for percent cover of all herbaceous plant species and tree seedlings rooted within the quadrat. Percent cover of all species was estimated to the nearest ten percent. In the eastern portion of the site quadrats were evenly

spaced along seven parallel transects running from northeast to southwest ("Area 1" in Appendix 5). In the western portion ("Area 2" in Appendix 5) the shape of the site made it difficult to follow a regular pattern, but quadrats were placed so that the vegetation of the site would be thoroughly and randomly sampled.

Data Analysis. Density (trees/ha), relative density, dominance (basal area in m^2/ha), relative dominance, and importance values ((relative density + relative dominance)/2) were calculated for all tree species. The total number of trees per hectare was calculated by dividing the total number of stems for all species sampled by the total area sampled (0.52 ha). The Shannon Wiener diversity index was calculated for the tree species in the forest. The importance values for each tree species was used to calculate the diversity indices. The percent occurrence of each shrub species was calculated by dividing the number of quadrats that contained the shrub by the total number of quadrats sampled. The mean number of honeysuckle stems sampled in quadrats was also calculated. For the herbaceous vegetation weighted mean fidelity (WMF) was calculated for each plot. WMF uses coefficient of conservativism (CC) values to estimate quality of the vegetation at a site. CC values are a measure of a plants fidelity to high quality natural areas. We used the values published in Swink and Wilhelm (1994).

Results

Our data indicate that Downs Woods is a closed forest (Trees/ha = 648.1). Hackberry, ash, black walnut and sycamore were the overall leading species in the tree canopy but similarity in importance values for these species indicates that there is no clear dominant tree species in the area that we sampled (Table 1). This is also demonstrated by the high degree of evenness (J = 0.91) in the tree canopy of the forest as determined by the Shannon-Wiener diversity index. The species composition of Downs forest is consistent with the findings of Adams and Anderson (1980) in their characterization of wet-mesic and wet lowland forests of Central Illinois. They found that the dominant tree species of wet-mesic forests include American elm, red elm, bur oak, hackberry, and Ohio buckeye and the most important tree species in floodplain forests are sycamore, green ash, silver maple and cottonwood (Adams and Anderson 1980). This forest consists of the hackberry-ash-elm community association type typical of many bottomland forests and that the forest has relatively high species diversity as a whole (H' = 2.53).

Hackberry has high relative density and relative dominance in both areas of the forest, indicating that this species is found frequently in the site and contains a number of individual trees of considerable size (Tables 1, 2, & 3). Sycamore on the other hand has low relative density and high relative dominance, indicating that there are just a few individuals that are large in size (Tables 1 & 3). Paw paw, box elder, sugar maple, and hawthorn make up the majority of the understory in the forest in Area 1. These species have high relative densities but relatively low relative dominance values (Table 1). Paw paw and sugar maple have not established in the understory in Area 2, which could be attributed to differences in soil moisture between these two areas. Area 2 is probably flooded more frequently than are portions of Area 1 where paw paw and sugar maple are abundant.

There is some degree of structural diversity in this forest, which is beneficial for many of the bird species that nest in this habitat. We estimated 679 trees/hectare in Area 1 and 554 trees/hectare in Area 2, indicating that Area 2 (H' = 2.13) is characteristically much more open and somewhat less diverse than Area 1 (H' = 2.48). Our data indicate that much of the structural diversity in the forest is found in Area 1, although most of the large sycamore trees are found in

Area 2 (dbh = 73.2 cm, 86.4 cm, 95.2 cm, 97 cm, 140 cm, 163.2 cm). Areas one and two also differ somewhat in species composition. Hackberry (IV = 14.4), black walnut (IV = 12.65) and ash (IV = 10.95) are the leading canopy species in Area 1. Sycamore has the highest importance value in this Area 2 (IV = 27.11) followed by hackberry (IV = 10.77), ash (IV = 15.8) and black walnut (IV = 9.01).

Red oak trees occur in more upland areas, along the eastern edge of the forest and at higher elevations such as the narrow corridor that adjoins Areas 1 and 2. The soils in these areas are most likely better drained, creating more mesic conditions. However, sugar maple appears to be invading these more upland mesic sites where red oak is common, and may require control. Bur oak trees are sparse in the forest and most are relatively small (Table 1). There is, however, one very large open grown bur oak tree located in Area 1 although this tree did not fall within any of the sampled plots. Although not sampled in any of the plots, large cottonwood trees (dbh = 104.5 cm) were also found on the western edge of Area 2.

Osage orange is an exotic species that can quickly dominate a site if not controlled. Osage orange is a common tree species located throughout the forest (IV = 7.94), but is one of the least desirable tree species in the forest. Osage orange trees in the forest are relatively large, but are fairly weedy and may have detrimental effects on other tree species and/or herbaceous vegetation in the area. Sugar maple appears to be invading the more upland mesic areas of the forest (located only in Area 1, mostly on the eastern side of the forest).

Table 1. Relative density, relative dominance, and importance value for each tree species sampled (S = 16) across the **entire forest**.

Species		# Stems	Relative Density	Relative Dominance	IV
Hackberry	*Celtis occidentalis*	43	12.95	13.63	13.29
Paw Paw	*Asimina triloba*	77	23.19	1.83	12.51
Ash	*Fraxinus*	37	11.14	12.67	11.91
Black Walnut	*Juglans nigra*	26	7.83	13.70	10.76
Sycamore	*Platanus occidentalis*	6	1.81	17.83	9.82
Osage Orange	*Maclura pomifera*	17	5.12	10.76	7.94
Box Elder	*Acer negundo*	32	9.64	4.44	7.04
Elm	*Ulmus spp*	24	7.23	4.54	5.89
Sugar Maple	*Acer saccharum*	28	8.43	2.43	5.43
Silver Maple	*Acer saccharinum*	9	2.71	7.33	5.02
Hawthorn	*Crataegus*	15	4.52	1.31	2.91
Honey Locust	*Gleditsia triacanthos*	4	1.20	2.82	2.01
Bur Oak	*Quercus macrocarpa*	3	0.90	2.45	1.68
Black Cherry	*Prunus serotina*	6	1.81	1.12	1.46
Red Oak	*Quercus rubra*	2	0.60	2.21	1.40
Cottonwood	*Populus deltoides*	3	0.90	0.93	0.92

Table 2. Relative density, relative dominance, and importance values for each tree species sampled in **Area 1** (S=16).

Species		# Stems	Relative Density	Relative Dominance	IV
Paw Paw	*Asimina triloba*	77	29.50	2.79	16.14
Hackberry	*Celtis occidentalis*	35	13.41	15.39	14.40
Black Walnut	*Juglans nigra*	15	5.75	19.55	12.65
Ash	*Fraxinus*	23	8.81	13.09	10.95
Sugar Maple	*Acer saccharum*	28	10.73	3.70	7.21
Box Elder	*Acer negundo*	23	8.81	5.56	7.19
Elm	*Ulmus spp*	21	8.05	6.03	7.04
Osage Orange	*Maclura pomifera*	12	4.60	9.01	6.80
Silver Maple	*Acer saccharinum*	2	0.77	8.88	4.82
Hawthorn	*Crataegus*	8	3.07	1.75	2.41
Honey Locust	*Gleditsia triacanthos*	3	1.15	3.57	2.36
Red Oak	*Quercus rubra*	2	0.77	3.36	2.06
Black Cherry	*Prunus serotina*	6	2.30	1.70	2.00
Sycamore	*Platanus occidentalis*	1	0.38	2.44	1.41
Cottonwood	*Populus deltoides*	3	1.15	1.42	1.28
Bur Oak	*Quercus macrocarpa*	2	0.77	1.75	1.26

Table 3. Relative density, relative dominance, and importance values for each tree species sampled in **Area 2** (S=11).

Species		# Stems	Relative Density	Relative Dominance	IV
Sycamore	*Platanus occidentalis*	5	7.04	47.18	27.11
Ash	*Fraxinus*	14	19.72	11.88	15.80
Hackberry	*Celtis occidentalis*	8	11.27	10.28	10.77
Osage Orange	*Maclura pomifera*	5	7.04	14.11	10.58
Black Walnut	*Juglans nigra*	11	15.49	2.53	9.01
Box Elder	*Acer negundo*	9	12.68	2.29	7.48
Silver Maple	*Acer saccharinum*	7	9.86	4.39	7.12
Hawthorn	*Crataegus*	7	9.86	0.47	5.17
Elm	*Ulmus spp*	3	4.23	1.71	2.97
Bur Oak	*Quercus macrocarpa*	1	1.41	3.78	2.59
Honey Locust	*Gleditsia triacanthos*	1	1.41	1.37	1.39

The shrub layer in Downs Woods is relatively open and lacks diversity. We sampled just four species of shrubs, which include gooseberry, black raspberry, greenbriar, and honeysuckle. Three of the four species are native, with the exception of honeysuckle, which is an aggressive exotic invader. Gooseberry was sampled in just 15% of the plots, while black raspberry and greenbriar were each sampled in less than 5% of the plots. The highest density of shrubs was located in close proximity to the creek, but the overall abundance of each of these shrubs was very low. Honeysuckle was sampled in 35% of the plots and was the most abundant shrub species in the forest. It appears that honeysuckle is just beginning to invade (mean # stems/plot = 10).

Patches of good quality vegetation are located through out the site. Although the WMF values do not suggest major differences between sites, there are differences in the species composition between sites (Table 2) and differences in our impressions of the floristic quality of different areas of the site. As the map indicates (Appendix 6) the quality of the herbaceous vegetation is variable throughout the site. This was quite noticeable to us in Area 1 (see appendix 5 for location). Throughout this area there are patches of high quality woodland vegetation including spring ephemerals such as white and yellow trout lilies (*Erythronium albidum* and *E. americanum*), Virginia bluebells (*Mertensia virginica*), wild ginger (*Asarum canadense*), wild geranium (*Geranium macculatum*), and Dutchman's britches (*Dicentra cucullaria*). This area also contains other good quality woodland species such as wingstem (*Verbesina alternifolia*) and cutleaf coneflower (*Rudbeckia laciniata*). The WMF may have underestimated the quality of the site overall, but especially area 1, because identification of sedges (*Carex spp.*) is difficult in the field. However, sedges were abundant and diverse in area 1. Many sedges have high CC values, but were not included in the analysis because they could not be identified to species. Although many patches support good quality vegetation, there are bare patches. Some are likely a result of the heavy shade produced by dense, young sugar maples. There are also some areas dominated by garlic mustard and reed canary grass. Unfortunately garlic mustard is quite abundant in this portion accounting for 24.4% of the cover of herbaceous plants. Honeysuckle is also present around the edges and is likely to negatively impact the site if left uncontrolled. At the time of sampling reed canary grass was not abundant in this portion of the site. However, it is quite likely that this species will benefit from the disturbance and increased sunlight produced by the installation of the sewer lines. Seeding appropriate native species could help prevent reed canary from dominating this portion of the site and help keep garlic mustard in check following the disturbance caused by the sewer line.

The quality of the vegetation in the eastern part of area 2 is somewhat different from the rest of area 2 and from area 1. This area is located along a narrow slope near the river and contains many of the same species as the rest of the site, but also large patches of starry Solomon's seal (*Smilicina stellata*), mayapple (*Podophyllum peltatum*), gooseberry (*Ribes sp.*), and wild rye (*Elymus sp.*). Portions of this area are highly eroded, but stable areas support good quality herbaceous species.

Past the slope in area two Canadian wood nettle (*Laportea candensis*), reed canary grass and garlic mustard are important species in the understory. Our data suggests that wild ginger and nettles (*Urtica sp.*) are also important in this area, however these only occur in a few dense patches that were sampled and, as a result, these species are overrepresented in our sample. Overall garlic mustard, Canadian wood nettle, and reed canary grass are the most important species in this portion of the site. Although good quality plants are present in portions of this site and the WMF values are similar to area 1, while working at the site our impression of area 2 was that the diversity and quality was not as high as in area 1. This is clear in the number of species sampled in each area, the total number of species recorded in each area and the dominance by two invasive species, garlic mustard and reed canary grass.

Table 2. Herbaceous species and sapling sampled in 0.25 by 0.25m quadrats. First species are listed in order of relative abundance, then species present in the area, but not sampled, are listed in alphabetical order.

Area 1			Area 2	
species sampled		species outside quadrats	all species in area two	
Alliaria petiolata	24.4%	*Asimina triloba*	*Laportea canadensis*	25.7%
Laportea canadensis	16.7%	*Cardamine concatenata*	*Alliaria petiolata*	16.9%
Viola spp.	7.4%	*Chenopodium album*	*Asarum canadense*	12.8%
Verbesina alternifolia	5.9%	*Claytonia virginica*	*Phlaris arundinacea*	10.1%
Lonicera sp.	4.8%	*Dicentra cucullaria*	*Gallium aparine*	9.5%
Gallium aparine	4.5%	*Geranium maculatum*	*Urtica sp.*	6.8%
Carex spp.	3.9%	*Hydrophyllum virginianum*	*Rudbeckia laciniata*	3.4%
Poa sp.	3.6%	*Osmorhizza sp.*	*Chaerophyllium procumbens*	2.0%
Polygonum virginianum	3.2%	*Phlox divaricata*	*Verbesina alternifolia*	1.4%
Rudbeckia laciniata	3.0%	*Podophyllum peltatum*	*Viola sp.*	1.4%
Mertensia virginica	2.5%	*Ranunculus abortivus*	*Geum canadensis*	1.4%
Ribes sp.	2.5%	*Ranunculus hispidus*	*Allium canadensis*	1.4%
Polygonatum sp.	2.2%	*Rosa multiflora*	*Polygonatum sp.*	0.68%
Asarum canadense	2.0%	*Sanicula gregaria*	*Ranunclulus abortivus*	0.68%
Unknown	1.7%	*Senecio sp.*	*Geranium macculatum*	0.68%
Allium canadense	1.5%	*Taraxacum officinale*	*Convolvulsu sp.*	0.68%
Hydrophyllum appendiculatum	1.3%	*Thalictrum sp.*	*Carex spp.*	
Geum canadensis	1.3%	*Urtica sp.*	*Chenopodium album*	
Erythronium spp.	1.1%		*Cryptotaenia canadensis*	
Acer saccharum	0.81%		*Hemerocallis fulva*	
Pilea pumila	0.63%		*Impatiens sp.*	
Impatiens sp.	0.54%		*Lonicera sp.*	
Fraxinus sp.	0.36%		*Parthenocissus sp.*	
Chaerophyllum procumbens	0.36%		*Phlox divaricata*	
Convolvulus sp.	0.36%		*Poa sp.*	
Cryptotaenia canadensis	0.36%		*Polygonum virginianum*	
Toxicodendron radicans	0.36%		*Rhubus sp.*	
Phalaris arundinacea	0.36%		*Sanicula gregaria*	
Smilix hispida	0.36%		*Smilax hispida*	
Solidago sp.	0.36%		*Solidago sp.*	
Acer negundo	0.18%		*Taraxacum officinale*	
Elymus sp.	0.18%		*Toxicodendron radicans*	
Geum virnum	0.18%			
Hacklia virginica	0.18%			
Trillium recurvatum	0.18%			
Parthenocissus sp.	0.18%			
Vitis riparia	0.09%			

Although we did not quantify the effects of deer browsing at the site, we did notice a number of plants that had been browsed. High abundances of deer may very well be having adverse effects on the herbaceous species in this forest.

Management Activities

To maintain the diversity of the herbaceous layer and to improve the integrity and health of Downs Woods it will be necessary to control the invasive plant species that occur in the area. To restore vegetation at the site to that of high quality floodplain forests and to restore the vegetation to historic conditions, it will also be necessary to remove the tree species that are not native to the site such as Osage orange. If not removed, this species can create monospecific

stands and out-shade other tree species, reducing the species and structural diversity of the forest. We are also proposing that bur oak be planted in the forest to restore the historic vegetation at the site and to improve the quality of the habitat for wildlife. If the site goes unmanaged, the invasive plant species in the forest will undoubtedly increase in abundance and reduce the overall diversity of the site. The site should to be monitored annually for changes taking place within the forest.

Honeysuckle will need to be removed from the site. This invasive shrub is distributed throughout the forest, but is most abundant near the creek. The recommended control method for this species is to cut the stems close to the ground, followed by herbicide treatment of the freshly cut stumps. Herbicide treatment of the stumps is necessary after cutting, otherwise stems will vigorously re-sprout. This treatment can be applied year-round, but is probably most effective in the fall. Currently, honeysuckle abundance is relatively low, however if management of this species is not initiated within the next couple of years, it will spread throughout the site and become a much larger problem.

Garlic mustard will also need to be controlled in the forest. Although eradication of this species may not be possible at this point, control efforts need to be initiated to mitigate damage. The most viable and effective option for controlling the garlic mustard is aggressively spot-treating first year garlic mustard plants with glyphosate herbicide. This should be done in the winter (Nov-Feb) when many of the other native herbaceous species are dormant. An alternative to herbicide treatment is hand-pulling in the spring prior to seed set. Plants need to be bagged and removed from the site if they are pulled after the plant begins flowering. Hand-pulling next spring (2008) will likely be very labor-intensive considering the high projected abundance of second year garlic mustard plants next spring. Garlic mustard will need to be controlled for several years because the seeds remain viable in the soil for 5-6 years, although they have relatively weak viability after the second year (Baskin and Baskin 1992). While it will be beneficial to try to control garlic mustard, it is probably more important at this point in time to control the honeysuckle. If honeysuckle becomes established at the site, it will do far more harm than will garlic mustard.

Reed canary grass is a very aggressive grass species that invades wetlands. This species is particularly difficult to control once established. The most viable option for this species is to spot treatment with glyphosate herbicide in the spring and summer, before it sets seed. Aggressive herbicide treatment of this species will be necessary for several years keep its abundance relatively low.

Removal of osage orange can be accomplished through felling or girdling. We recommend felling of trees smaller than 15 cm dbh and girdling of larger stems. Herbicide can be applied to the stem after felling or girdling to reduce resprouting. Many of the stems of these species are relatively large in the forest, so girdling will be the most viable option. Girdling is also less costly than is felling.

Reintroduction of bur oak to the site will require individual planting of approximately 300 bur oak seedlings in both areas. More trees should be planted than necessary because many of them will not survive. Wire cages should be placed around each of the seedlings after they are planted to prevent browsing of the stems by deer. The oaks should be placed in areas where there are openings in the canopy, such as areas in which there is dead standing vegetation. In Area 2, reed canary is abundant. It may be possible to eliminate the reed canary with herbicide in areas that are 3-4 feet in diameter and plant the bur oak seedlings in these areas. It will probably be necessary to cut the reed canary grass around the trees for a few years until they are tall enough

to shade the grass. Once the trees get large enough they will most likely reduce the abundance of reed canary grass.

It will be beneficial to remove sugar maple saplings in the northeast section of Area 1 to encourage the regeneration of red oak in this area. As sugar maple becomes more dominant in the canopy it creates shady conditions, making it more difficult for relatively shade-intolerant oaks to regenerate. Increased shade from sugar maple may also cause a loss of diversity in the ground layer species. This may already be occurring. The herbaceous layer under the sugar maple trees is currently very sparse. Most of the sugar maple stems are less than 15cm in size so felling is the most viable option for control.

The installation of sewer lines through the forest is an issue of concern because it will undoubtedly cause a great deal of disturbance in the site. To mitigate damage caused by installation of these sewer lines, routing of the lines should be placed in areas with the lowest quality tree and herbaceous vegetation. This will be difficult in Area 1, as herbaceous plants cover much of the area. Large trees, with exception of osage orange should be avoided to maintain structural diversity in the forest and to maintain habitat for breeding bird species. Disturbing the narrowest possible path during the sewer line installation will be necessary. Once the sewer line is in place we recommend that you consult with a botanist before re-seeding the area. Seed mixes may contain aggressive non-native species that could cause further damage to the forest.

If the area is to be used for recreation, a trail could be established on some of the areas that have been cleared for the sewer line. There is currently a walking path along the creek, but the trail disappears in some areas, especially in the late summer when the herbaceous vegetation is tall. The forest is also a great recreational and educational resource for the community. An interpretive trail could be established in the area that could be utilized by local schools.

Public Issues

This forest appears to receive relatively little use by the public. The forest is not very accessible in that there is only one pull-off area for parking. Only one car can be parked in this pull-off at a time. If recreational use of the park is a goal, then more parking spaces will need to be established. However, this may be difficult in this area. The forest is a great educational resource for local schools and could be developed to be compatible with this use. Interpretive signs could be located along the trail about the native vegetation in the forest, the animals that live there, floodplain forests in general, and information about the Kickapoo Creek and water quality. This would require maintenance of the trail, which could be placed where the sewer lines are placed to mitigate damage. This will, however, depend on the placement of the sewer lines.

To control the deer populations in the forest, deer hunting may need to be established. This will probably be difficult, though, because the forest is located on the northern edge of town. It may be possible to allow bow hunting in the forest, instead of shotguns. It appears as though deer may be hunted on the property on the west side of the creek as we noticed at least one deer stand in the trees. Control of the deer population will need to be discussed by the residents of the community.

Summary

Downs Woods is a relatively high quality floodplain forest in Central Illinois. Although the site is in need of some degree of management, it is a relatively high quality bottomland forest with a diverse herbaceous and tree layer. The site provides good habitat for wildlife. Maintaining

the diversity and mitigating the impacts of human disturbance and invasive species in this forest will be key factors in future years. The tree stratum in the forest is well developed and includes a number of older, large trees. Adding oak species to the tree strata and removing less desirable tree species such as sugar maple and osage orange will benefit wildlife and will serve to increase the diversity of the forest.

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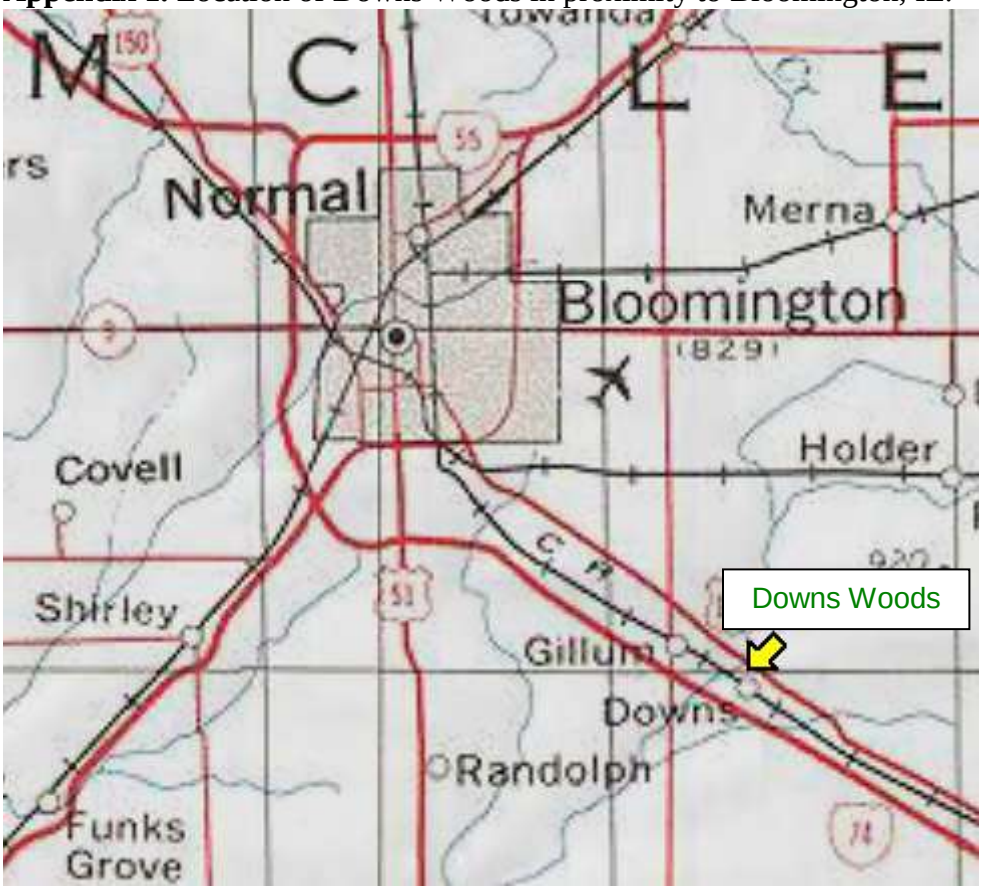
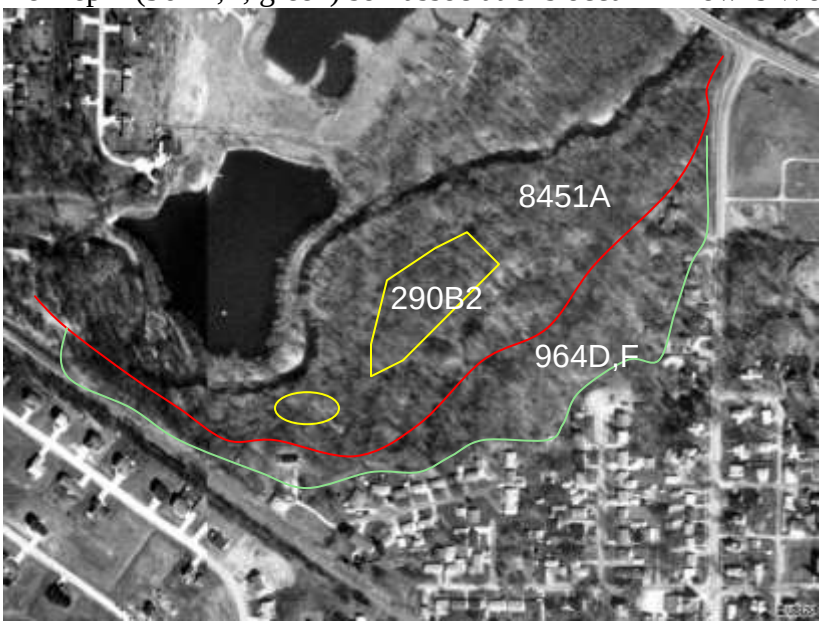
Appendix 1. Location of Downs Woods in proximity to Bloomington, IL.

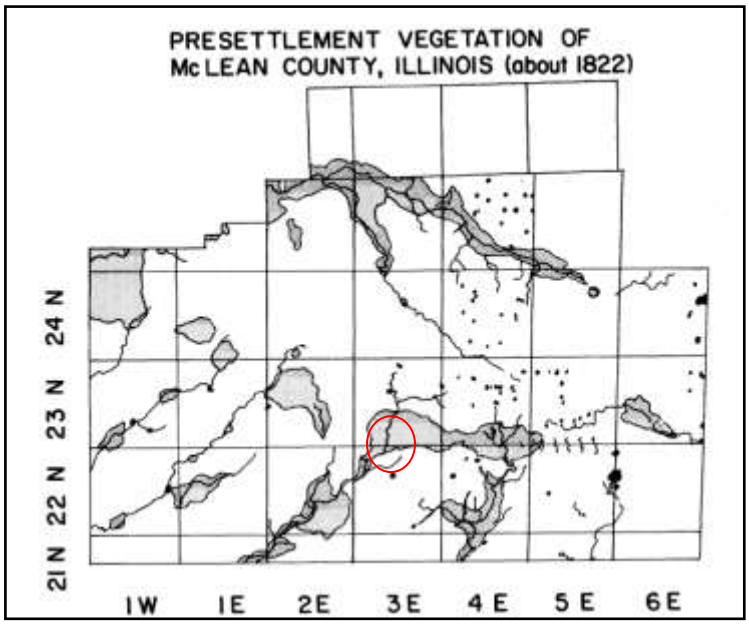


Appendix 2. Topographic Map of Downs Woods. The area highlighted in blue marks the boundaries of the woods.

Appendix 3. Map of soils located within the forest, as adapted from the Soil Survey of McLean County. Lawson Silt Loam (8451A, red), Warsaw Loam (290B2, yellow), and Miami and Hennepin (964D,F, green) soil associations occur in Downs Woods.



Appendix 4. Map of presettlement vegetation of McLean County, IL. Adapted from Rodgers and Anderson 1978. Shaded areas indicate areas of closed forests and the red circle shows the location of Downs Woods within McLean County.



Appendix 5. Area 1 is the portion of the site that was sampled. Area 2 was not sampled, but contains a number of large sycamore trees. Map adapted from google maps.

Appendix 6: Map of quadrats sampled showing WMF calculations for each plot.