Migrant Bird Habitat Study
Executive Summary
September 30, 2004

The Migrant Bird Habitat Study was planned by the *Urban Conservation Treaty for Migratory Birds* partnership. The goal of the study was to identify tree species that are used more often than others by foraging migrant birds in spring, in order to provide better information to those wishing to improve habitat for migrants.

In April and May of 2001, 2002, and 2003, 31 volunteers conducted the study at 18 sites in the Chicago Wilderness Region. A minimum of three visits per year were made to each sample location (late April, early May, late May) and the following information was recorded: bird species and tree species for all migrant birds observed foraging in trees, phenology of all tree species (flowering, fruiting, budding, size of leaf, etc.), weather, time spent monitoring, and general proximity of each bird to water.

Data were analyzed by comparing the observed and expected frequencies with which birds were found in a particular tree species. We analyzed the data on a site-by-site level, as well as combining all data across all sites. We also compared tree use by individual bird species, to identify any affinity certain bird species might have for particular tree species.

Tree species that were preferentially used by birds in the study are American elm, bur oak, hawthorn species, and sugar maple. Those that were underutilized are Norway maple, swamp white oak, eastern cottonwood, black locust, silver maple, American basswood, and green ash. The sugar maple preference was due to data from a single site where birds preferred this species. At all other sites, sugar maple was underutilized.

Oaks as a group were found to play a critical role for certain species. The following table shows the bird species found to use oaks most heavily, and those that underused oaks.

Birds that heavily used oaks	**Birds that used oaks infrequently**
Rose-breasted Grosbeak	Wilson's Warbler
Blackburnian Warbler	American Redstart
Bay-breasted Warbler	Yellow Warbler
Palm Warbler	Chestnut-sided Warbler
Baltimore Oriole	Magnolia Warbler
Blue-gray Gnatcatcher	Canada Warbler
Tennessee Warbler	Ruby-crowned Kinglet
Black-throated Green Warbler	Yellow-rumped Warbler

As spring progresses, trees leaf out and flower; the timing of these phenological changes varies across tree species and across years within tree species. These changes strongly affect migrant bird foraging choices, and our data reflect these changes. We found variations across year, season, day, time of day, among species, and among individuals within species.

Recommendations

The results of the Migrant Bird Habitat Study underscore the need for a diversity of tree species within a given park, preserve, or natural area. Specific recommendations are as follows:

1) **Elms** and **oaks** appear to be the most important genera for migrant birds in the Chicago area. **Trees that flower during the migration period**, especially **hawthorns,** but also including **horse chestnut, Ohio buckeye and crabapple**, are also used heavily while they are flowering.
2) Other trees that are used heavily enough to recommend their inclusion in planting include: **ashes, hickories, hackberry, honey locust**, and possibly sugar maple.
3) In natural areas management, the most important recommendation is to **reverse the maple takeover** in our natural areas by restoring woodland health so that oak reproduction can occur.
4) In creating or enhancing plantings for migrant habitat, plan for a **high diversity of trees**. In general, the more kinds of trees at a site, the more options that migrant birds will have in response to variable and unpredictable conditions.
5) **Use maples and lindens sparingly**.

Recommendations from other Great Lakes area studies that are likely also appropriate to our region and that were generally supported by our observations during the study:

1) **Forested riparian corridors** are important habitat for migrant birds.
2) As much as possible, plantings should be designed to provide different **layers of vegetation**, including a shrub layer (below 5 feet), a small tree layer (5-25 feet), and a canopy layer (25 feet +). The different layers attract a variety of species, and are used in different ways depending on weather conditions.
3) Birds use species most heavily when the leaves are just coming out and also use flowers (including wind-pollinated flowers). It is best to plan for a variety of species, so that a few will be in these **critical stages** in each week of the season. The period from late April through the end of May is the most important time for spring migrants.
4) Any **wooded area within 1 mile of the lakefront** is likely to be important for sustaining spring migrants, and riparian corridors anywhere in the Chicago Region will also likely play an important role.

Prepared by Judy Pollock and Karen Glennemeier, Audubon Chicago Region,
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Migrant Bird Habitat Study
Final Report

Prepared by Judy Pollock and Karen Glennemeier, Audubon Chicago Region,
and Doug Stotz, Field Museum
September 30, 2004

The Migrant Bird Habitat Study was planned by the *Urban Conservation Treaty for Migratory Birds* partners. The goal of the study was to identify tree species that are used more often than others by foraging migrant birds. Spring is a time when migrating insectivorous birds scour our area, feeding on insects that are emerging at that time. Food can be scarce, depending on weather conditions. Tree phenology varies across our region, with trees at the lakefront leafing out a week or two later than inland trees. A better understanding of how migrants are using our trees (and the insects they support) in the spring would help us to make plantings that will sustain birds during migration.
We took data in both landscaped and natural settings, so that the results could inform both urban tree planting initiatives and natural areas restoration.

In 2000, the protocol was developed by a group of local scientists, including Doug Stotz of the Field Museum, Jim Steffen of the Chicago Botanic Garden, and Rickie White of Audubon. Scott Robinson (Illinois Natural History Survey) and Chris Whelan (U.S.Forest Service) were among those who contributed. The protocol was based in part on a study done by Aaron Gabbe, a graduate student of Scott Robinson's, in Southern Illinois. Suzanne Malec of the Chicago Department of the Environment also helped with the planning. The methods were field tested in the fall of 2000. A copy of the protocol is enclosed with this report.

A few minor changes were made to the protocol after analysis of our first year data and in response to comments received from Bob Russell of the U.S. Fish and Wildlife Service and Charlie Paine of Max McGraw Wildlife Foundation. The most important change was to ask monitors for specific information about the proximity to water of trees containing foraging birds.

In winter and spring of 2001, we recruited and trained 31 volunteers to conduct the study at 18 sites. Data were collected in April and May of 2001, 2002, and 2003. To increase the amount of data collected from individual sites, monitors focused in 2003 on nine of these sites that contained a large number and diversity of tree species.

Data was analyzed by Doug Stotz and Karen Glennemeier in the winter and spring of 2004, with help from Fred Ramsey, Jeff Brawn, Jim Steffen and Dave Ewert.

General patterns regarding migration in the Chicago region

Migrant birds inhabit all parts of the Chicago region, although the timing and species composition of migrants varies across the region. Contributing strongly to this variation is a dichotomy between the lakefront and inland areas. Migrants tend to show up in lakefront

areas a bit later than inland areas; this timing is associated with a later leafout lakeside, presumably due to the lake breeze and lower daytime temperatures on the lakefront. Similarly, until mid-May or so there is a a noticeable lag in the leafout of trees in the northern part of the Chicago area compared to the southern part. Within Chicago itself, this north to south variation seems minimal.

The Migrant Bird Habitat Study has focused on spring migration because migrants are more stressed by weather and food resources in the spring. For example, warbler migration peaks near the middle of May in the spring and in mid September in the fall. Temperatures average about 10 degrees higher in mid-September than mid-May in Chicago. Additionally, insect populations are higher in the fall than spring, having built up over the summer.

Field Methods

Each monitor chose a route among the trees of a landscaped or natural wooded area. The major requirement in locating a transect was that it was a place where the monitors would find numerous birds and a good variety of trees. Sample locations included lakefront and inland parks and natural areas throughout the Chicago Wilderness region and included a wide distribution of the tree species naturally occurring and planted in the region (see Appendix). Transects were mapped so that they could be used in succeeding years by different volunteers. The species and size were recorded for all trees greater than 4-inches diameter at breast height (dbh), within five meters of the transect.

Data were collected by pairs of volunteers, one trained in tree identification and the other in bird identification, who walked the transect together and observed each tree in turn. A minimum of three visits were made to the sample location (late April, early May, late May) and the following information was recorded: bird species and tree species for all migrant birds observed foraging in trees, phenology of all tree species (flowering, fruiting, budding, size of leaf, etc.), weather, time spent monitoring, and general proximity to water.

Data Analysis

Data were analyzed by comparing the observed and expected frequencies with which birds were found in a particular tree species. For example, if a particular tree species constituted 10% of the summed diameter-at-breast-height (DBH) for all trees at all sites in the study, then the null hypothesis predicted that 10% of the observed birds would be seen foraging in trees of that species. Chi-squared analysis was used to determine whether deviations from the null prediction were statistically significant. Variables such as proximity to water or leaf phenology at time of sighting were considered in the interpretation of results.

Because birds' use of certain tree species tended to vary depending on the mix of tree species at a particular site, we also analyzed tree use on a site-by-site level. This analysis decreased our sample size but increased our ability to draw ecologically meaningful conclusions.

Data were also analyzed using tree abundance, rather than dbh, because of concerns that using dbh as an approximation of total leaf cover would overestimate the biomass of the

larger trees. Using tree abundance did not change the results significantly.

We also looked at tree use by individual bird species, to identify any affinity certain bird species might have for particular tree species. Our sample size was not large enough to perform this analysis at each site, so the data from all sites were combined, and we did not consider the relative abundance of tree species in determining bird affinities. This analysis is thus a coarse measure of species use.

Results and Discussion

During the three-year study we recorded the tree species in which a landbird migrant was observed for 1925 individual spring migrants. We recorded birds of 89 species in 44 species of trees at 19 sites in the Chicago region. The most abundant tree species varied with site, but overall oaks made up 33 percent of the tree sample (with red oak the most abundant species at 10 percent of the sample as measured by diameter at breast height (DBH)).

Tree species preferences of migrants

If we examine the entire data set, we had at least 40% more observations of migrants than expected based on the tree abundance in the sample for four tree species, and 2/3 or fewer observations than expected for seven species (Table 1)

Table 1. Tree species strongly over- or underutilized by birds in study, with percentage of expected.

Preferentially used by migrants		Underutilized by migrants	
Ulmus americanus	175%	Acer platanoides	14%
Acer saccharum	160%	Quercus palustris	25%
Crataegus sp.	142%	Populus deltoides	29%
Quercus macrocarpus	142%	Robinia pseudoacacia	34%
		Acer saccharinum	50%
		Tilia americana	53%
		Fraxinus pennsylvanica	66%

These overall numbers mask substantial variability among sites, years, and even periods within the year. However, the species that are underutilized by migrants are consistently underutilized across sites, years, and time of year. Exceptions to this are that Black Locust (*Robinia pseudoacacia*) appears to be used more heavily late in the season, and ashes (*Fraxinus*) seem to be variable across year, season, and site, without a clear pattern. The most consistently underutilized species were *Tilia americana* and *Acer saccharinum.*

Of the species that are preferentially used, one deserves particular comment. The preferential use of Sugar Maple (*Acer saccharum*) is due to data from one site, from where more than 80% of all of the maple observations came. Except at this site, sugar maples

overall were underutilized weakly. The reason for the distinctiveness of this site in the migrants' use of sugar maples is unclear.

Buckthorn greater than 4-inches DBH was rare at most sites and typically underutilized. It was abundant at one site and heavily used where it was near the water.

Tree use by individual species of migrants

There is strong variation in the tree species that different species of migrants use during migration. Much of this variation centers around oaks. A number of species use oaks much more frequently than they occur in the tree sample, and much more frequently than the average migrant. Similarly, a set of species strongly underutilizes oaks. Overall, during the study, migrants used oaks in the same proportion in which they occurred in the tree samples (33% of observations in oaks, 33% of tree DBH).

Table 2. The bird species found to use oaks most heavily. The percentage of observations in oaks, and the sample size, are given. Only species with at least 10 observations in at least one year of the study were considered.

Rose-breasted Grosbeak	83% (41)
Blackburnian Warbler	76% (31)
Bay-breasted Warbler	61% (18)
Palm Warbler	53% (77)
Baltimore Oriole	52% (44)
Blue-gray Gnatcatcher	49% (53)
Tennessee Warbler	48% (37)
Black-throated Green Warbler	47% (73)

Table 3. The species that were observed infrequently in oaks. The percentage of their observations in oaks, and their sample size, are given.

Wilson's Warbler	9% (22)
American Redstart	15% (110)
Yellow Warbler	16% (19)
Chestnut-sided Warbler	18% (98)
Magnolia Warbler	18% (94)
Canada Warbler	21% (24)
Ruby-crowned Kinglet	23% (57)
Yellow-rumped Warbler	23% (158)

Although the extent of oak use varied within these species during the three years of this study, each of these species either consistently used oaks more than average or less than average. The two exceptions to this were Blackburnian Warbler in 2001, where none of the three observations were in oaks, and Tennessee Warbler in 2002, where only two of seven observations were in oaks. The species that used oaks infrequently did not show consistent patterns across years in the species of trees that they used heavily. Chestnut-sided Warbler exemplifies this pattern. In 2001, observations were scattered across a number of tree

species, and no genus was used strongly disproportionately to its abundance, although none of the observations were in maples. In 2002, 43% of the observations were in maples (*Acer*), mainly sugar maples, and only 5% were in elms (*Ulmus*). But in 2003, 28% of the observations were in elms, and 14% in maples.

The oak preferring species include moderately common species that are not especially abundant. These are all essentially pure forest breeders, and all but one are more forest-based in winter. The oak avoiders are generally secondary habitat breeders and in winter are very tolerant of secondary conditions. So it is likely that the "oak preferrers" are more important from a conservation perspective, with respect to their global ranges.

Temporal changes in tree species use

As spring progresses, trees leaf out and flower; the timing of these phenological changes varies across tree species and across years within tree species. Migrant birds respond to these changes by altering the amount of time they spend in different species of trees.

The details of phenology provided by the study were insufficient for understanding the effect of phenology on bird plant use. However, the use of survey date (which is related to phenology) to analyze the data suggested different temporal patterns of tree use. The most consistent patterns across years were seen in oaks. In April, oaks were underutilized by migrants with 24% of the observations in oaks (ranging from 5% to 30% across the three years). During the first half of May, oaks were used preferentially by migrants, with observations in oaks making up 44% of the sample. In the last half of May, oaks were utilized at close to their abundance in the tree sample, with 31% of the observations in oaks (versus 33% in the tree sample).

Maples did not show as consistent patterns of seasonal use. In 2001, they were used preferentially in April (14%, versus 9% of tree sample), and underutilized later in the season (3%) of observations. In 2002, they were used close to their abundance in April (8%), heavily used in early May (19%), and used in close to their abundance in late May (10%). The 2003 results were similar to 2001, with preferential use in April (26%) and underutilization later in the season (6% of observations).

In the early part of migration, observations of migrants are spread among a number of species, with no particular trees seeming to be strongly preferred. In 2001 and 2002, ashes (*Fraxinus* sp.) were used preferentially in April (23% of observations in 2001 and 14 % in 2002, versus 12% of the tree sample), while they were underutilized in 2003 (6% of observations). In our 2003 April sample, migrants preferentially used maples (*Acer* sp.; 26% of observations versus 12% in tree sample), mainly sugar maple, and hackberry (*Celtis occidentalis*; 12% of observations versus 4% in tree sample). In 2001 and 2002, both these were underutilized by migrants.

In the latter half of May, as in the early part of migration, patterns vary across years. Only elms (*Ulmus* sp.) were used preferentially by migrants in all three years, and in 2001 and 2002, this effect was weak (9% of observations in both years, versus 7% of the tree sample;

14% of observations in 2003). At other times of the spring, the use of elms was variable. They were somewhat underutilized in April (all three years, 5 to 6%).

Additionally, several species that are little used earlier in the season are used more strongly in late May, although not consistently across years. These include hickories (*Carya* sp.), which are almost unused in April, but make up 3.5% of late May observations (versus 2% in tree sample), and honey locust (*Gleditsia triacanthos*), which was used preferentially in 2001 and 2003 in late May but underutilized in 2002. There were only two observations of birds in honey locusts, which are among the latest trees to leaf out, before 18 May in the three years of our study. Hawthorns (*Crataegus* sp.) showed a slightly different pattern, with somewhat heavier use late in the season all three years (2 to 4% of observations in late May, versus 2% of tree sample), but also preferential use throughout the season in 2003, when the late May use was the weakest of the three years.

A few other species showed differences across the season in their use by migrants but were never used preferentially by migrants or were extremely rare in the study.

Additional patterns

Weather on a particular day affects tree species use. When the weather is cool and windy, birds tend to concentrate near water (insects still are emerging and may collect in the somewhat warmer microclimate), and birds use shorter vegetation more on those days (again presumably a better microclimate). Although cold weather and north winds are not generally good for migration, one can get an impressive migration under such conditions if there is a strong southwesterly flow followed by a cold front moving through during the night. Birds will drop out in front of the front and then have to face poor conditions.

Flowering trees are an important resource early in the season and also under poor weather conditions. Crabapples (*Malus* sp.) and *Aesculus* sp (Ohio buckeye and horsechestnut) stand out in this regard, but various *Prunus* (cherries, plums, etc.) and hawthorns (*Crataegus* sp.) can be important as well.

Conclusions and Recommendations

Understanding the dynamics of landbird migration in the Chicago area is a challenging task. There are variations across year, season, day, time of day, among species, and among individuals within species. Different species have distinctly different ecologies. The decisions they make about foraging in particular tree species are just a subset of the many choices migrants make.

The timing of migration in birds is for the most part set by photoperiod but is influenced by weather. Ultimately, though, it is set by climate and the need to reach breeding grounds at a time that allows the birds to have the maximum food supply available to feed young. So in some sense the timing of migration through Illinois is not primarily based on what is happening in Illinois, but rather on the breeding ground. This being said, it is difficult to believe that migration peaks in early May, at the same time that the dominant oaks in Illinois woodlands are leafing out, simply by coincidence.

One of the strongest patterns noted from the Migrant Bird Habitat Study to date was a high degree of variation among sites and observation dates, in terms of which tree species are used most by migrants. This variation may be due to landscape-level influences, such as degree of fragmentation, proximity to large water bodies, or nearby traffic. Or it may be due to transect-specific factors. Certainly, weather conditions strongly affect foraging behavior. Nonetheless, we can confidently recommend that planting and maintaining a diversity of tree species and structures is the best strategy for assuring that plantings will most benefit migrating birds.

A number of question regarding migrant use of tree species are not addressed at all by this study. Among the more interesting are the following.

1) How do migrants use tree species in the fall? Spring patterns seem clearly tied to the timing of leaf out and flowering. In the fall, most insectivorous migrants are in the Chicago area while all the trees are fully leafed out, so it seems unlikely that the birds are responding to phenological patterns among the trees. Additionally, it is clear that changes in the distribution of greenery between spring and fall means that in fall, migrants are less tied to canopy trees than they are in spring. Examples include Tennessee Warblers, which in the spring are predominantly in the canopy of mature woodlands dominated by oaks, but in the fall commonly forage near the ground in goldenrods and other dense composites. Another example of such change is White-throated Sparrows, which forage at all heights in the spring, including in the canopy of elms, where they feed on insects .

2) Does the distribution of trees within a site influence their use by migrants? Within these diverse plantings, bunching together trees of the same species seems to be more attractive than scattering individuals of the same species widely. This may be most important for species with attractive flowers.

3) How does the diversity of trees at a site influence the trees on which migrants focus their attention?

4) Are native trees more useful because they harbor more native insects?

Recommendations

The results of the Migrant Bird Habitat Study underscore the need for a diversity of tree species within a given park, preserve, or natural area. Specific recommendations are as follows:

1. Elms and oaks appear to be the most important genera for migrant birds in the Chicago area. Trees that flower during the migration period, especially hawthorns, but also including horse chestnut, Ohio buckeye and crabapple, are also used heavily while they are flowering.
2. Other trees that are used heavily enough to recommend their inclusion in planting include: ashes, hickories, hackberry, honey locust, and possibly sugar maple.
3. In natural areas management, the most important recommendation is to reverse the maple takeover in our natural areas by restoring woodland health so that oak reproduction can occur.
4. In creating or enhancing plantings for migrant habitat, plan for a high diversity of trees. In general, the more kinds of trees at a site, the more options that migrant birds will have in response to variable and unpredictable conditions.
5. Use maples and lindens sparingly. Sugar maple is probably the best choice among the maples.

Recommendations from other Great Lakes area studies that are likely also appropriate to our region and that were generally supported by our observations during the study:

1. Forested riparian corridors are important habitat for migrant birds.
2. As much as possible, plantings should be designed to provide different layers of vegetation, including a shrub layer (below 5 feet), a small tree layer (5-25 feet), and a canopy layer (25 feet +). The different layers attract a variety of species, and are used in different ways depending on weather conditions. Having the layers in close proximity allows the birds to move between layers easily.
3. Birds use species most heavily when the leaves are just coming out and also use flowers (including wind-pollinated flowers). It is best to plan for a variety of species, so that a few will be in these critical stages in each week of the season. The period from late April through the end of May is the most important time for spring migrants.
4. Any wooded area within 1 mile of the lakefront is likely to be important for sustaining spring migrants, and riparian corridors anywhere in the Chicago Region will also likely play an important role.

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Tree Species that represented more than 2% of the total DBH for any transect.

Acer negundo
Acer platanoides
Acer saccharinum
Acer saccharum
Aesculus glabra
Aesculus hippocastanum
Carya cordiformis
Carya ovata
Celtis occidentalis
Crataegus
Fraxinus americana
Fraxinus pennsylvanica
Gingko biloba
Gleditsia triacanthos
Juglans nigra
Malus
Morus alba
Platanus occidentalis
Populus deltoides
Prunus serotina
Quercus alba
Quercus bicolor
Quercus rubra
Robinia pseudoacacia
Salix
Tilia americana
Ulmus americana
Ulmus pumila
Ulmus rubra

Names of volunteer monitors:
Anne Oiler, Kathy Pingry, Jerry and Jody Zamirowski, Elizabeth Plonka, Toni Spears, Karen Lustig, Donnie Dann, Jan Underwood, June Keibler, Greg Carlson, Brad and Nancy Harris, Sigrid Schmidt, Leslie Borns, Tadas Birutis, Steve Frankel, Terry Schilling, Terry Radke, Judy Pollock, Stephen Packard, Jeff Chapman, Christine Williamson, Art Plotnik, Jerry Garden, Elizabeth DeLaBaume, Marianne Kozlowski, Marian Thill, Phillip Miler, Sue Robert, Libby Hill, Mary Ann McLean, Pat Braker, John and Dorothy Collins, Wayne Svoboda, Diane Aoki, /Cindy Schweisthal, Liz Aicher, Matthew and Veronica Cook, Robert Hughes, Rickie White, Scott Carpenter, Stan Stec, Joan Bruchman, Steve Phillips, Roger Shamley, John and Jane Balaban, Julie Sacco, Doug Stotz