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Urban Bird Conservation

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URBAN BIRD CONSERVATION

by

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Dissertation

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Dedication

To Denise and the kids

Acknowledgements

Walking across the campus of Brigham Young University, I spotted a moth on the sidewalk near the main library. As I got closer, I saw that the moth was really a Black-chinned Hummingbird injured in a collision with a large plate glass windows. The bird was still breathing, though it barely stirred as I picked it up from the ground. I cupped it in my hands and walked over to sit down in the shade of a large tree.

I was struck by the senselessness of a tiny bird falling victim to our built environment. After a few minutes, the bird opened its eyes. Ten minutes later it was able to perch on my index finger. After half an hour it was actively looking around. It gave me a final look, then zoomed up to perch in the top of the tree.

The bird was gone, but it seemed to have left me with a message, and perhaps a calling. At once fragile and resilient, this little being had stirred within me a desire to help birds thrive in a world increasingly dominated by buildings, pavement, billboards, and the material trappings of our everyday life. Driving around Provo for the next few days, all I could think about was how the city must look to birds. While some birds thrived in the city, such as the California Quail nesting on campus, Sage Sparrows and others only persisted away from town. Was this the way it had to be? Might it be

possible to create urban landscapes harboring additional native birds amidst the trappings of late 20th Century humans?

The question continued to nag at me. Visions of attending law school slipped away as I started spending more and more time looking for birds along Utah's Wasatch Front. Soon my quest to better understand the life history of birds and their abilities to adapt to urbanization led me from Utah to exurban forest cabins in Montana, the industrial cities of the East Coast, and suburban communities from Coastal Washington to Central Texas and Long Island, New York. Finally, my searching led me to study zoology at the University of Texas—Arlington, and then to start graduate work at the University of Texas at Austin, where my bird conservation dreams led me to undertake coursework in geography, zoology, architecture, and community and regional planning. While a graduate student, I became engaged in local and regional bird conservation efforts, including work with the Travis Audubon Society, Audubon Texas, the Hornsby Bend Bird Observatory, and a host of other individuals and organizations working to create a better world for people and their winged neighbors.

Literally thousands of individuals have helped me in my studies and travels. In thanking those who have played the greatest part in aiding my quest, I can only apologize to those who, while unmentioned here, also played a part in helping me along the way. My academic interest in the natural world began with a fourth grade unit on reptiles and amphibians, taught by Ron Stearns. Despite my early desires to become a herpetologist, I became focused on birds after Ron Keil introduced me to birdwatching during middle school.

During the mid 1980s, Portland Audubon and the Oregon birding community encouraged my youthful interest in birds and helped lay the foundations for my continuing bird studies. Special thanks to Lynn Herring for taking me on my first Audubon field trips to Sauvie Island. My initial schooling as a birder came from tagging along with the likes of Harry Nehls, Jeff Gilligan, Owen Schmidt, David Irons, the late Mark Koninendyke, and fellow Class of '86 birding buddies David Bailey and Jim Johnson. On one birding trip, wind whistling through the wings of three of the last nine wild California Condors inspired bird conservation dreams that lay mostly dormant until rekindled by the whirring wings of an injured hummingbird. Thanks to John Gatchet for driving three teenage birders from Portland to Southern California, just to see those birds. Thanks to my parents, Gary and Marilyn Fergus, for allowing me to go on that journey, and many others. May AC-9 (Igor), one of the birds we saw, and the very last wild condor taken into the captive breeding program two years later, continue to inspire bird conservation efforts for years to come.

At Brigham Young University, John E. Clark and David C. Knowlton schooled me in social science theory and research, and have continued to inspire me over the years. Dick Hutto, Christine Paige, Dan Casey, Barry Paulson, and Don Godtel provided my first official training in ornithological fieldwork over the course of two summers in Montana. Far from the alpine meadows and lodgepole pines of the Rocky Mountains, my initial training in conservation policy work came as an intern in Washington, DC for the Endangered Species Coalition and the National Audubon Society. Many thanks to Nick Boutis, Roger Featherstone, Randy Snodgrass, Connie Mahan, and Eddie Flaherty for showing me the ropes, and convincing me to head back out into the field.

Upon arriving in Texas, my bird conservation education continued with Dede Armentrout and Sandy (Skree) Mock in the old Southwestern Regional office of the National Audubon Society. Thanks also to those I first worked with through Texas Partners in Flight and the Texas Parks and Wildlife Department: Ted Eubanks, Cecilia Riley, John Arvin, Madge Lindsey, and Cliff Shackelford.

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I spent countless hours exploring the themes of this book at the Hornsby Bend Biosolids Management Facility in Austin, Texas. Many thanks to the City of Austin Water Utility for allowing birders to remain on the scene at Hornsby Bend for almost 50 years. I have enjoyed my time associating with the staff and management of the facility, including Phil Tamez, Bill Sellstrom, David Barker, Orren West, Jody Slagle, and Rosie Chavez. I couldn't possibly express enough gratitude for my friendship and the thousands of hours spent with Kevin Anderson. Much of what I learned about community-based conservation stems from our work together.

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Urban Bird Conservation

Robby Scott Fergus, Ph.D.

The University of Texas at Austin, 2008

Supervisor: Robin W. Doughty

Birds have co-inhabited American cities since the colonial era, and as people have noticed and appreciated them, they have taken steps to make cities even more hospitable for them. This dissertation documents the history of birds in cities and efforts to create more bird-friendly urban areas. The examination starts with the commercial core of modern cities, moving outwards through the residential and industrial zones, taking note of parks and other urban oases as well as the transportation and communications networks that help shape and define American cities. Bird conservation activities in scattered cities across the country make each of these urban zones better for birds. The future of birds in American cities depends on how these zones are managed, and the ability of local governments, nonprofits, corporations, and bird enthusiasts working together to protect birds from hazards and provide additional habitat opportunities within the city.

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Chapter 1—Cities and Birds

On a clear winter morning, a flock of fifty American Robins hopped about on the ground and stripped crimson-colored berries from a *Pyracantha* bush. Suddenly, the flock exploded, with birds scattering in all directions. Spinning around to see what startled the birds, I caught the ruby-red eye of a Cooper's Hawk in full pursuit of its prey. This could have been a scene from an episode of *Nature*, but it all took place in a Michael's parking lot next to the drive-through teller lane at my local bank.

Hundreds of bird species thrive among the buildings and bustle of American cities, including Philadelphia where I live. In fact, most of the nearly 700 bird species regularly living in North America each year either nest, winter, or migrate through the backyards, parks, and waterways in American cities. Some even spend all or most of their lives there. Peregrine Falcons on lofty railings or concrete balustrades scour skyscraper canyons for prey, flocks of starlings and grackles noisily roost at night above shoppers in our malls, pigeons squabble and defend home sites beneath busy freeway interchanges, swallows swing deftly over parking lots filled with rows of cars, and mockingbirds sing late into the night while defending nests in hedges and ornamental bushes.

A drive out from the center to the edge of any modern American city reveals a continuum of landscapes that are opportunities for birds. Only a few species select packed high rises, skyscrapers, parking lots, and the sparsely vegetated interstices of implosively developed downtowns, such as surround Philadelphia City Hall. A birder is hard pressed to find more than alien Rock Pigeons, House Sparrows, and European

Starlings in such locations, including the commercial area extending north along Broad Street. Even a mile away, after the intersection with Ridge Avenue, where smaller commercial buildings define the main thoroughfare and densely packed residential neighborhoods angle along side streets, pigeons, sparrows, and starlings are still the most conspicuous birds. Here and there in this desert of masonry, concrete, and asphalt, a few House Finches and Mourning Doves perch on overhead wires or call from the branches of maples and oaks planted to break the monotony of pavement and brick.

This urban homogeneity spreads out at least eight miles. It consists of shops, gas stations, and other commercial development, including the larger blocky buildings of Temple University. Then Broad Street (also known as Highway 611) dives into a new city scene and bird habitat—the old residential neighborhoods of Jenkintown, Abbingdon, and Willow Grove. Houses, lawns, and shade trees dominate these localities, although gas stations, chain restaurants, and other commercial facilities line the busy arterials—fingers of the densely developed asphalt savannah that stretches back into the urban core. Where lawns, mature oaks, maples, and other shade trees grace the neighborhood, there are American Robins, Blue Jays, and Carolina Chickadees. Many native woodland birds forage and nest in the manicured landscapes of these well established neighborhoods demarcating the beginnings of suburbia.

After crossing the Pennsylvania Turnpike fifteen miles from our starting point at City Hall, restaurants, hotels, gas stations, and shops still line the highway, as cross streets traverse residential neighborhoods. But here and there parks, undeveloped woodlots, creek beds, and the expansive woods and airfield of the Willow Grove military base provide large patches of new habitat between the residential subdivisions and

commercial shopping areas. There is even space for some water birds. Great Blue Herons hunt along the shores of lakes and ponds, while migratory shorebirds scurry along muddy reservoir margins as waterfowl float close by.

As I reach the edge of the metropolitan area, I am confronted with sparsely developed landscapes including subdivisions scattered within a matrix of fields and woodlots, as well as the Philadelphia's industrial fringe of airports, warehouses, refineries, factories, and sewage treatment plants. The industrial sector on the city edge includes the 6,000 acre GROWS/Tullytown Landfill complex along the Delaware River and new office parks with large mown expanses reclaimed from crop land. In winter, gulls loaf on the open grass after feeding at the landfill or scavenging nearby shopping centers. At night they sail off to roost on nearby lakes. Large flocks of Canada Goose graze these fields, and thousands of roving starlings and blackbirds swarm beside them.

A final division of the city that I notice consists of the many roads, railways, transmission lines, and communications towers that link together these urban, suburban, and exurban sectors. Turkey Vultures roost on transmission towers, and Red-tailed Hawks pounce on mice from the crossbeams of power poles. These corridors provide feeding areas for some birds, but also pose dangers too, as flight paths intersect speeding cars and a web of wires.

A drive through any one of America's 465 urbanized areas, identified by the U.S. Census Bureau as core cities and surrounding neighborhoods with a population above 50,000, reveals a similar setup. These urban areas share enough features that we can imagine them as representations of a typological city divided into five sectors of bird habitat used by both native and invasive birds.

The first sector I have described is an urban core dominated by buildings and pavement, including the city cliffs and canyons of high rise development (Zone 1A), and the asphalt savannahs of low-rise commercial and high-density residential development (Zone 1B). These zones, with 80 to 100 percent of their land covered by building and pavement, cover 5,621 square miles within American cities, an area just slightly larger than the state of Connecticut. In comparison with the other urban zones, these areas are comparatively small, covering only 3.2 percent of the total developed area, and .18 percent of the Lower 48 States (Homer *et al.* 2007).

Suburban garden neighborhoods (Zone 2) are mostly residential areas with yards covering 20 to 80 percent of the land. These medium to low intensity developed areas cover 58,548 square miles, an area larger than the state of Illinois, and make up 33 percent of all developed land, and cover almost 2 percent of the Lower 48 States (Homer *et al.* 2007).

Oases of parks and undeveloped open spaces (Zone 3) have less than 20 percent of their area paved or developed. This classification also applies to much of the urban frontier of scattered residential development and the industrial fringe (Zone 4). Whereas Zone 3 lies within the other urban zones, Zone 4 is located on the edge of the city. As mapped by the 2001 National Land Cover Database, the Developed Open Space of these two zones covers 112,302 square miles, an area larger than the state of Nevada (Homer *et al.* 2007). This area represents over 63 percent of the total developed land, and 3 percent of land area in the Lower 48 States (Homer *et al.* 2007).

Corridors of roadways and lattices of towers and wires (Zone 5) create a final urban habitat zone. More than 3 million miles of paved roads, 157,000 miles of

Table 1.1 Urban Bird Habitat Types



1A City Cliffs and Canyons

Dense high rise development with buildings taller than they are wide. Buildings and roads cover 80 to 100 percent of each lot.



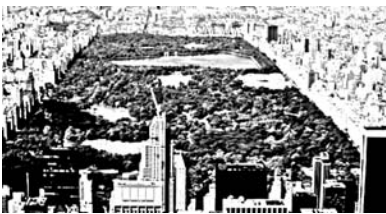
1B Asphalt Savannahs

Dense development with buildings shorter than their length or width. Buildings and paved parking areas cover more than 80 percent of each lot. May include commercial strip development, office parks, and high-density residential areas.



2 Suburban Gardens

Medium to low density development with homes and small buildings set in yards. Yards cover 20 to 80 percent of the area. Landscaping traditionally dominated by shade trees, ornamental bushes, and lawns.



3 Urban Oases

Large developed or undeveloped terrestrial or aquatic habitat patches within a developed matrix. Includes parks, riparian zones, golf courses, greenbelts, undeveloped lots, lakes, ponds, and rivers.



4 Urban Frontier

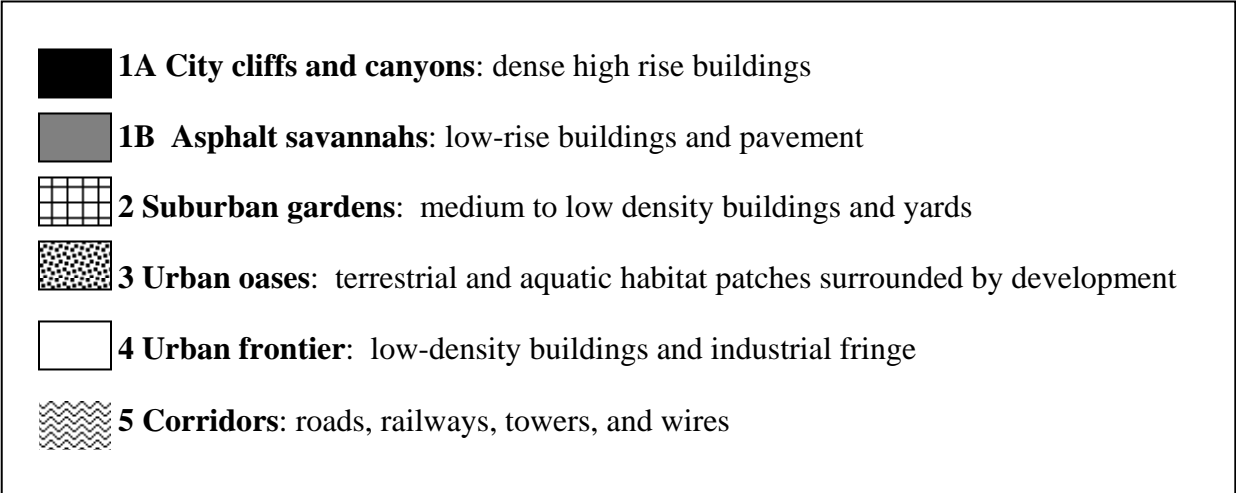
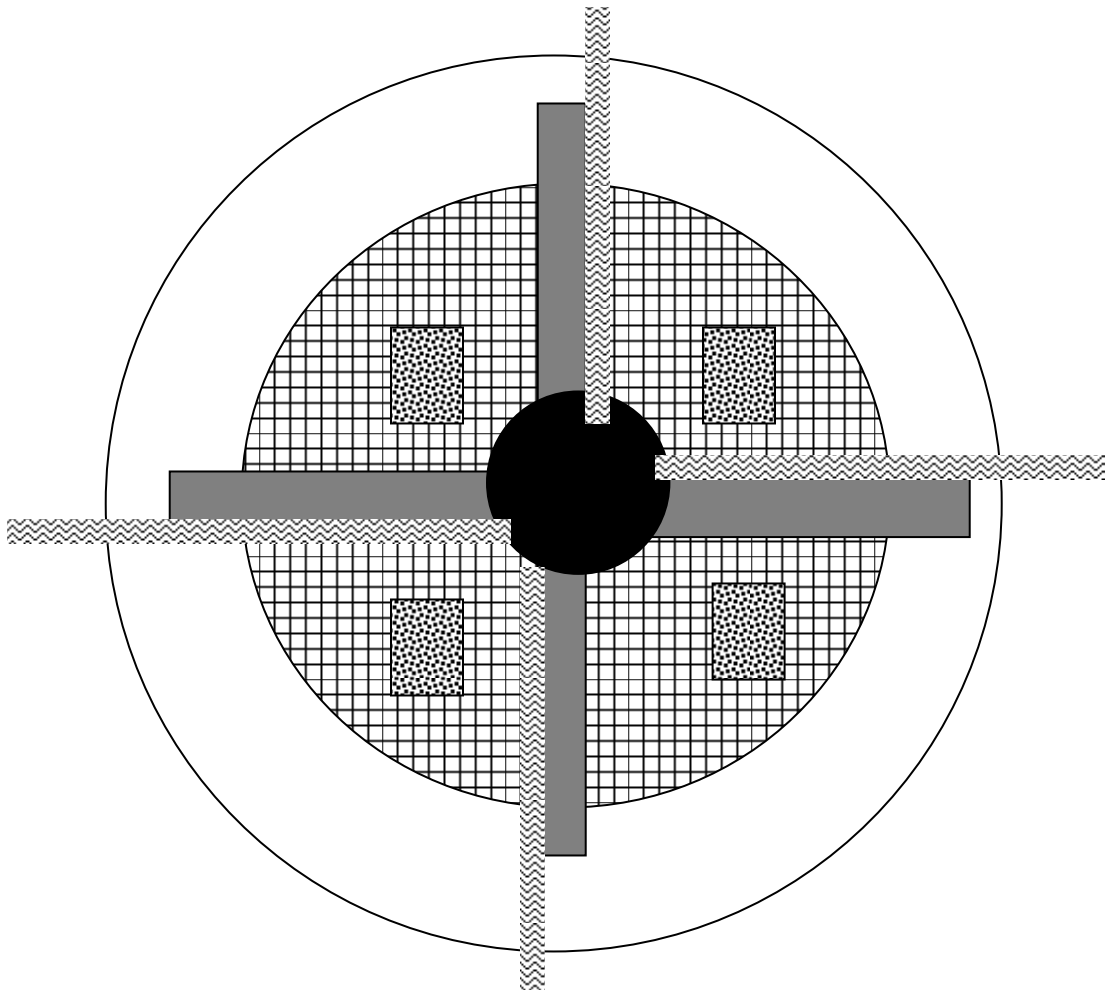
Scattered residential and industrial development in largely open agricultural or undeveloped landscapes.



5 Corridors

Network of transportation and communications structures, including roadways, bridges, railways, transmission lines, and communications towers.

Figure 1.1. Typological Urban Bird Habitat Map



transmission lines, and over 4 million miles of electric distribution lines bind the other sectors together, and extend out from the developed areas to link other cities and towns into a national urban network.

Each of these urban bird habitats (Table 1) as defined by their structures, location within the city, and layout, include a range of urban features well-known to most city dwellers. They are also spatially arranged in a familiar pattern (Fig. 1.1), with the most densely built sections in the city center that slide along major roadways, surrounded by suburban habitats and associated parks and other open space. Beyond the inner city and ring of residential neighborhoods, is the urban fringe of scattered track homes, commercial buildings, and industrial complexes. The corridors of roadways, railways, wires, and communications towers extend outward from the center of the city, and extend out beyond the urban fringe to link urban and rural areas, as well as distant cities into an urban system that spans the continent.

In 2000, the U.S. Census Bureau classified almost 95,000 square miles, an area larger than the states of Rhode Island, Delaware, Connecticut, New Jersey, New Hampshire, Vermont, Massachusetts, Maryland, and South Carolina combined, as urban land, defined as core areas with a population density of 1,000 people per square mile surrounded by neighborhoods of at least 500 people per square mile. These cities and towns cover 3.4 percent of the Lower Forty Eight States, and just over 80 percent of the U.S. population live in them (U.S. Census Bureau 2002). Many of these cities and towns are built near coastlines, waterways, or within other ecologically sensitive areas that provide habitat for at least 100 of the 178 North American bird species listed by the National Audubon Society and the American Bird Conservancy on their 2007 WatchList

as threatened or endangered (Butcher *et al.* 2007). Some of these rarer birds spend most of their time in cities, including flocks of Red-crowned Parrots roaming palm-planted neighborhoods of the Lower Rio Grande Valley in Texas. These social birds are now more common within the urbanized areas of McAllen, Brownsville, and Harlingen than in their traditional Mexican forest haunts. In addition to these rare birds, urbanized areas also support at least 110 of 121 species recently identified by the National Audubon Society as Vulnerable Common Birds—species such as Chimney Swifts and Common Nighthawks that are still widespread, but have plummeted numerically over the past 40 years.

The bad news, conservation biologists argue, is that city expansion poses the greatest threat to wildlife in the continental United States (Czech *et al.* 2000). Cities displace native forests, shrublands, and prairies, and many birds perish by colliding with buildings, windows, wires, and moving vehicles. By one estimate, collisions with windows and glass buildings kill one bird in twenty, up to a billion birds, in the United States each year (Klem 1990). Transmission and distribution lines weave a deadly cat's cradle or wirescape above city buildings and pavements and string into the countryside, raking down millions of additional birds as they hit them, often while migrating at night. Birds that survive this obstacle course face additional threats. As many cat owners know, these domestic animals are bird hunters. What the isolated pet lover may not know is that the 100 million tabbies and calicos roaming the landscape each kill an average of 10 birds a year—especially ground nesting species like Song Sparrows or the inexperienced fledglings of birds that are normally out of reach in trees or shrubs. When all the bird deaths attributable to buildings, wires, cars, cats, and other features of our cities are added

up, they reportedly account for 15 percent of all the birds, upwards of 3 billion individuals, killed in North America each year (United States Fish and Wildlife Service 2002).

Though fraught with potential perils, urban yards, parks, and waterways provide an embarrassment of riches for many more birds. Our common songbirds such as cardinals, wrens, swallows, orioles, and buntings attract the attention of urban park goers and suburban homeowners, who make special efforts to care for them. The 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation estimated that 56 million Americans set out food for birds and other wild animals, and 14.5 million people tend gardens and similar areas in order to provide food and shelter for birds. These enthusiasts spend \$3.5 billion on bird food, \$801 million on nest boxes, bird feeders, and bird baths, and \$1.6 billion on the plants and trees maintained to help birds around their homes (United States Fish and Wildlife Service 2007). City people enjoy the songs and antics of birds, and like to have them close by.

In addition to these individual homeowners and renters, 480 local Audubon societies, more than 1,600 land trusts, and other national and local environmental organizations such as the National Wildlife Federation and the Chesapeake Bay Foundation, are working to protect birds and their habitats in and around towns and cities across the nation. Counties and municipalities have set aside ponds, lakes, forests, and other habitats for native birds, and many communities have zoning to protect the places where birds live. Telecommunications companies and power utilities are modifying their utility structures in order to make them safer for avians. Federal and state agencies budget millions of dollars to fund programs protecting endangered and threatened birds,

many living within the limits of American cities. One group of ornithologists has gone so far as to characterize bird conservation as “the preeminent natural resource conservation effort in North America” (Ruth *et. al* 2003). With so many of these efforts to help city birds, urban bird conservation is a significant economic, social, and political phenomenon that merits attention.

PLAN OF WORK

This dissertation examines the set of habitats available to birds in American cities, and how individuals and groups are making these urban areas more bird friendly. I have described a typology of landscapes that models bird habitats in the more than 450 largest cities and surrounding suburbs identified as urbanized areas by the U.S. Census Bureau. I examine how birds have colonized and currently occupy these cities, and the habitat potential they provide. I also explore the ways that individuals, nonprofit organizations, and government agencies are creating additional nesting, feeding, and roosting opportunities for birds in these metropolitan habitats, and what the likely results will be in the opening decades of the 21st Century.

The American city is a mosaic of visual landscapes long recognized and described by urban geographers and ecologists. It includes the zones I described in Philadelphia and the features within them that add and detract opportunities for bird species. I identify the common species that take advantage of these modern urban forms, drawing upon examples from across the nation, based on published studies, media stories, and my own observations in the most populous metropolitan areas in the U.S.

In each of the five urban landscape types I also describe and evaluate the efforts of people and organizations making these landscapes safer and more inviting for birds. I draw upon published reports, government documents, news stories, and nine years of experience as the founding director of the Hornsby Bend Bird Observatory (1999-2004), executive director of the Travis Audubon Society (2001-2003), president of the Audubon Texas Assembly (2002-2004), and coordinator of community and backyard habitat programs for the National Audubon Society (2004-2008). These professional positions allowed me to work with local bird enthusiasts, public officials, government personnel, business leaders, developers, planners, biologists, and private citizens who are engaged in urban bird conservation across the United States and beyond.

I start with a history of the birds living in heavily developed downtown and commercial areas (Zones 1A and 1B), and recent efforts to keep birds from killing themselves in collisions with tall buildings and windows, as well as a new movement to transform buildings into habitat suited to birds by planting greenroofs and rooftop gardens. I then examine birds in residential areas (Zone 2), the delights they provide residents, as well as the challenges to maintaining bird gardens, evaluating for instance efforts to keep birds safe from roaming cats and traditions of feeding birds, providing nest boxes, and planting gardens for companionable species. Chapter 4 explores the various open patches found within cities (Zone 3), including planned parks, lakes, ponds, reservoirs, and other aquatic habitats, as well as unplanned and undeveloped lots, and additional riparian or unused corridor habitats. I then explore how birds have colonized industrial landscapes on the edge of cities, including landfills, airports, and wastewater facilities (Zone 4). I also discuss efforts to manage these areas as bird habitat, and review

of experiences and lessons learned from seven years of working to promote birds and bird habitat at Hornsby Bend, a wastewater facility in Austin, Texas. Chapter 6 details how birds interact with elements of urban transportation and communication networks, including roadways, power lines, and communications towers (Zone 5), and efforts to make these structures safer for birds.

After a detailed discussion of each of these urban bird zones, I describe how actual cities may vary from my model typological city in significant details on a case by case basis. Many cities are built in juxtaposition with coastlines, mountains, and other physiographic features. These unique habitats are interesting magnets for certain unusual birds not normally associated with metropolitan areas. I refer to examples that highlight the value of these urban habitats as conservation areas and how city or municipal officers have taken advantage of these peculiar conditions to celebrate the birds and other wildlife located within this mix of cultural and physical spaces. I also discuss how people and cities are using birds to help define and differentiate their communities, and investigate nonprofit and government efforts to promote bird conservation in American cities.

In conclusion, I evaluate the status of bird conservation efforts in American cities, outline the opportunities and potential pitfalls associated with developing a more comprehensive approach to helping birds in cities, and offer my thoughts on additional avenues for future research and the expansion of bird conservation efforts in cities across the United States, and around the world.

By documenting the rich birdlife found in cities and chronicling the efforts to make cities even safer and more inviting to birds, this study illuminates and charts new pathways through the wild heart of American cities. It highlights the close connections

between city and country, challenges false dichotomies of nature and culture, and opens up exciting new possibilities for the future of cities, the birds that come to inhabit them, and the people who love them. The robins and the hawk are not mere visitors to our cities, but neighborhood residents tied, as we are, to the fate of our urban future. While there may be ominous clouds on that horizon, there are also rays of light offering a glimmer of hope for all of us.

Chapter 2—Concrete Cliffs, Canyons, and Asphalt Savannahs (Zone 1)

At home in the hustle and bustle of America's largest city, few things surprise long-time residents of the Lincoln Towers apartment complex in New York City. But looking up one spring day, retired chemist Art Lindenauer was startled by an intruder on the balcony of his 28th floor apartment building on West 70th Street. The uninvited guest was leaning against his living room window, and only moved after he tapped on the glass. The trespasser—a hen Wild Turkey—posed on the balcony railing as Lindenauer snapped pictures for fifteen minutes before the bird flew off and disappeared into the concrete cliffs and canyons of Manhattan's Upper West Side. For several months, the female bird made appearances all across the borough, roosting on rooftops and in street trees from the West 60s, to Chelsea, and Greenwich Village (Lueck 2003). Wild Turkeys rarely visit the inner city, but other birds thrive in even the most heavily developed urban neighborhoods.

Dense urban neighborhoods dominated by buildings and roads, long present in Ancient and Medieval European cities, first appeared in Colonial American cities in the 17th Century, as rising land prices within the growing cities led owners to subdivide and maximize the built area on their lots. Rows of shops, with dwellings above, characterized the centers of Mercantile cities such as Colonial Boston and New York. Colonists built the first American row houses—Budd's Long Row—between Walnut and Dock Streets in Philadelphia in 1691 (Murtagh 1957). Row houses, built as block-long speculative enterprises, soon displaced William Penn's founding vision of a garden city of single family homes built on large lots (Ames 1968).

By 1800, New York City with a population of over 50,000, would have qualified as an urbanized area under current U.S. Census Bureau definitions. Philadelphia could boast a similar status within the decade. Early 1800s ornithologists Alexander Wilson and John James Audubon both commented on birds in these American cities. By this time, Chimney Swifts had already been nesting in unused chimneys in Boston and other cities for over 100 years (Josselyn 1674). Wilson, based in Philadelphia, noted Common Nighthawks “darting and squawking over the streets at a great height” and “sitting on chimney-tops in some of the most busy parts of the city” (Wilson 1970). Audubon wrote that during fall migration, Purple Martins “assemble in parties of from fifty to a hundred and fifty, about the spires of churches in the cities.” According to Audubon, even House Wrens ventured into the densely built up heart of early American cities (Audubon 1832).

In 1850, ten cities ranging in size from New York City (population 515,547) to Albany, New York (population 50,723) could qualify as urbanized areas (Gibson 1998). Narrow blocks of conjoined multistory residential and commercial buildings dominated the hearts of these cities. With the building of the first skyscraper in Chicago in 1885, the central business districts of American cities quickly took on a new monumental form of concrete cliffs and canyons. Native birds found few opportunities in these windswept blocks devoid of bushes and trees. Feral pigeons, present in American cities since Colonial times, nested on skyscraper ledges. They were soon joined by House Sparrows and European Starlings, additional species brought over from the continent by enterprising Americans.

After more than 200 years of city growth, highly developed city habitats with buildings and pavement covering more than 80 percent of their lots, can be characterized

by the height of their buildings. Concrete Cliffs and Canyons (Zone 1A) are central city neighborhoods dominated by buildings that are generally taller than their lengths or widths. Asphalt Savannahs (Zone 1B) include high density residential neighborhoods, shopping centers, malls, and strip commercial development characterized by shorter buildings and parking lots. Alien pigeons, starlings, and House Sparrows are the most characteristic birds in both of these zones, but these habitats also provide unique opportunities for additional urban exploiters, primarily those species that can nest on buildings or that do not depend on the presence of vegetation for nesting or feeding opportunities.

CONCRETE CLIFFS AND CANYONS (ZONE 1A)

On New York City's 9th Avenue, dozens of Rock Pigeons shuffle across the sidewalk, European Starlings squabble over discarded café fare, and House Sparrows create a chorus of chirps as unmelodic and ubiquitous as the traffic noise. These are clearly urban birds, content to spend the entirety of their lives in the concrete canyons of Manhattan's Upper West Side. One morning I counted 375 pigeons, 110 House Sparrows, and 60 starlings on a two mile walk between Penn Station and the American Museum of Natural History, an average of eight pigeons feeding on spilled food and human leftovers on each block. The only native birds I saw on my stroll were 2 Herring Gulls and 2 American Robins glimpsed as they flew overhead. While I found only five bird species here in the largest conglomeration of concrete cliffs and canyons in North America, the 549 individual birds I saw were more than I found later that day in Central Park, and confirm a surprising finding by urban ecologists; urban centers often harbor

more individual birds, though of fewer species, than more natural areas both within and outside of large cities (Marzluff *et al.* 2001)..

Skyscrapers, buildings of more than 12 stories, or higher than 115 feet, characterize the heart of the 70 largest urbanized areas—those with populations greater than half a million inhabitants. Skyscrapers are also found in all but 15 of the 80 urbanized areas with populations between 200,000 and 500,000, and in about 100 of the 300 smaller urbanized areas. Thousands of these enormous buildings are also scattered across the country in smaller cities and towns, as are tall buildings that are just shy of skyscraper status (Skyscraper Source Media 2008). The 2003 Commercial Buildings Energy Consumption Survey identified over 12,000 buildings with ten or more stories across the country (Energy Information Administration 2006), though at least 17,758 skyscrapers have been built or slated for construction in American cities (Skyscraper Source Media 2008).

As I found on my walk through New York City, only a few bird species actually thrive in the concrete cliffs and canyons of Zone 1A. Those that do generally do not depend upon vegetation for their nesting or foraging requirements. Introduced exotic species, especially the Rock Pigeons, European Starlings, and House Sparrows found along Manhattan's 9th Avenue, are the most successful urban exploiters residing in city centers across the continent. These birds thrive in cities by nesting on or in buildings, and by eating discarded human foods, life history traits developed over the course of several thousand years of living in Old World cities. These exotic birds are also extremely prolific. By raising multiple broods each year, they easily maintain their numbers in potentially hostile urban environs. Starlings and sparrows are also aggressive

competitors, putting them at advantage over native songbirds when contending for food or nesting sites in American cities.

The few native birds that nest in Zone 1A include species which are able to nest on buildings, and those such as aerial feeders that do not depend on vegetation to provide feeding areas. Chimney Swifts chase flying insects high over the downtowns of Eastern North American cities, where they nest in chimneys, flues, and smokestacks. In the southwestern United States, White-throated Swifts forage high over downtown Los Angeles and other cities, where they nest in the narrow nooks and crevasses on the face of skyscrapers. During migration, flocks of Chimney Swifts in the East, Vaux's Swifts in the West, and White-throated Swifts in the Southwest gather each night at communal roosts in the chimneys, smokestacks, and flues of downtown buildings.

Urban swift roosts occasionally draw crowds of curious onlookers. In the fall of 1994, up to 35,000 Vaux's Swifts began roosting in the chimney of the Chapman Elementary School in Portland, Oregon. Interested roost watchers helped solve an unusual urban bird conservation challenge when the birds were threatened by the school's desire to fire up the chimney with the onset of cooler weather. With support from the Audubon Society of Portland, the Portland Public Schools raised \$60,000 from several foundations to upgrade the school to a new gas heating system, enabling the swifts to use the chimney unmolested (Hollywood Pet Hospital 2008).

The most charismatic bird in Zone 1A is the Peregrine Falcon, a raptor capable of diving 200 mile per hour in pursuit of other birds. In the early 20th Century, peregrines apparently found urban pigeon populations a ready food source, and by 1938 they were nesting on the Sun Life building in Montreal (Fry 1952). In the early 1940s, Allan D.

Cruikshank noted that New York City was “as good a place as any” to look for these birds, which he noted on many bridges, churches and “the tallest hotels around Central Park.” He wrote that “it would not surprise me in the least if within a few decades the Duck Hawk were found nesting on the ledge of some tall building in Manhattan, since pairs have been found breeding in similar sites in other cities” (Cruikshank 1942:147). His prediction came true sooner, rather than later; in 1943 peregrines built a nest on New York City’s St. Regis hotel. By 1946 up to 16 individual falcons spent the winters in New York City, leaving their excrement whitewash stains “on the pinnacles of Riverside Church, on the statues of the Roman athletes atop the Whitehall Building in lower Manhattan, and on outcroppings of many older skyscrapers” (Herbert & Herbert 1965).

Peregrines soon colonized other city downtowns. In 1946, a pair nested on a ledge 361 feet up on the city hall tower in Philadelphia (Groskin 1952). Another pair nested on The Travellers’ Insurance Building in Hartford, Connecticut (Herbert & Herbert 1965). Unfortunately, during the 1950s the well-documented DDT induced decline of peregrines decimated the urban birds, and by 1961 they had disappeared from New York City.

In 1970, falcon biologist Tom Cade of Cornell University began a captive breeding program, and in 1975 The Peregrine Fund that he established began releasing young birds at hawk sites, including on tall buildings in urban areas where they would be safe from Great Horned Owls and other predators. In 1978, a wild peregrine nested on the U.S.F.&G. building in Baltimore. Five years later, nesting peregrines returned to New York City, and by 1988 there were 30 pairs of wild and captive born birds nesting in

24 urban areas across the country. After another five years that number had climbed to 88 falcon pairs in 61 urban areas (Cade *et al.* 1996).

By 1999, with more than 6,000 falcons released into the wild, and 1,650 breeding pairs across North America, the U.S. Fish and Wildlife Service removed from the official list of endangered species. Wintering and nesting falcons are now fairly common in most of the larger urbanized areas of the country. Owners of many tall buildings such as the Marriott Marquis Hotel in Atlanta, Georgia place gravel-covered trays on sheltered ledges as nesting scrapes to attract the birds. At least 16 pairs currently nest in New York City (New York City Department of Environmental Protection 2008). Thanks to the peregrine's ability to nest and thrive in the concrete cliffs and canyons of American cities, the banning of DDT, the concerted efforts of The Peregrine Fund and its partners, and the good will of skyscraper owners, the birds have staged a remarkable comeback from the brink of extinction.

ASPHALT SAVANNAHS (ZONE 1B)

Sitting in my car in a hospital parking lot in Austin, Texas, I'm entertained by the antics of two Great-tailed Grackles walking down a row of parked cars and hopping up to pick dead insects off the car grills. Another car pulls up, and before the driver can get out, the grackles have flown over to inspect the grill and windscreen of the car. While most birds eschew the parking lots and buildings lining the roadways of Zone 1B, these features offer unique opportunities for a range of species that are able to colonize these asphalt savannahs.

Sprawling strip development of low rise commercial buildings and parking lots are hallmarks of 20th Century automobile cities. Jesse Clyde Nichols built the first shopping center, Country Club Plaza, in Kansas City in 1925. By 1946, there were still only eight shopping centers in the U.S, a number which climbed to over 20,000 in 1984 (Jackson 1985), and surpassed 133,000 by 1999 (National Energy Information Center 2002). Including shopping centers, there are now over 4.8 million commercial buildings in the United States (Energy Information Administration 2006), surrounded by 3,035 square miles of parking lots. These hospitals, gas stations, office buildings, shopping areas, and other highly developed areas traditionally offer little by way of ornamental vegetations—perhaps a few street or parking lot trees, manicured hedges as foundation plantings, or small strips of mowed grass. The pigeons, starlings, and House Sparrows of Zone 1A also thrive in Zone 1B. They are joined by native urban exploiters able to nest on the rooftops of low buildings and scattered trees or bushes. Other urban exploiters, including grackles and blackbirds, may nest elsewhere, but fly into the area to loaf or forage on discarded human food.

Common Nighthawks began nesting on warehouse rooftops in Philadelphia in 1869. They nested on flat mansard roofs of Boston in 1870, flat roofs in Montreal in 1876, and in Cleveland, Ohio in 1879, with “innumerable records” of rooftop nesting reported in subsequent years (Bent 1940). Nighthawks prefer built up roofs of asphalt layered with gravel, where they scrape out a nesting site in a spot shaded from the most intense afternoon sun. At night, they fly over parking lots and buildings, where they chase moths and other insects attracted to street lights. Once common in cities from New York to Los Angeles, nighthawks have declined by 51 percent over the past 40 years

(Audubon unpublished data). Some of this decline is thought to correlate with a loss of gravel roof nesting habitat. The Commercial Buildings Energy Consumption survey has chronicled a 47 percent drop in built up gravel roofs from 1.6 million in 1992 to 1.0 million in 2003 (Energy Information Administration 2006).

Other species including Chimney Swifts, White-throated Swifts, Fish Crows, Barn Swallows, and Cliff Swallows may nest on the walls or other features of large buildings. House Sparrows and European Starlings often nest in ventilation shafts, air conditioning units, or drain spouts. In many American cities, gulls loaf on the flat roofs of shopping centers and other commercial buildings. Many other birds at least occasionally use these buildings as temporary perches or resting places, some of the more unusual species to do so include Great Blue Heron, Upland Sandpiper, Gyrfalcon, and Snowy Owl. In August 2006, a Northern Wheatear spent three days in a shopping center in New Hampshire, roosting and foraging on the gravel rooftops of a Toys-R-Us store and a Kmart. For this wanderer blown off its transatlantic migratory path, rooftops and parking lots may have been the closest approximation it could find to its arctic tundra nesting grounds.

Parking lots in Zone 1B provide foraging areas for many ground-feeding birds including grackles, blackbirds, starlings, and House Sparrows, especially those near restaurants or supermarkets where human food scraps abound. Brewers Blackbirds are common foragers in parking lots in urban areas in the Western states. Great-tailed Grackles are so accustomed to foraging in parking lots that the first birds to colonize northern Utah were found exclusively in the parking lots of south Provo office buildings and strip malls.

Several species of large gulls, including Herring Gulls (Ingolfsson & Estrella 1978), Western Gulls (Maron 1982), and Glaucous-winged Gulls (Barash *et al.* 1975), have learned to crack open clams by dropping them on the hard surface of parking lots. Younger birds apparently learn this behavior from older birds, and require up to a year of practice to become as proficient at cracking open the shells as the older birds (Maron 1982). American Crows and Northwestern Crow also drop hard objects onto roads or parking lots to break them open, though contrary to popular reports, they are not known to intentionally place them on roads in order for cars to break them open like a nutcracker (Cristol *et al.* 1997).

Grackles, blackbirds, crows, Purple Martins, and other species often form large nocturnal roosts in malls, shopping centers, and other areas of strip development. They are thought to choose these areas because the lights and urban location may make them unattractive to owls and other nocturnal marauders. Over 150 Green Parakeets roost each night alongside thousands of starlings, blackbirds, and grackles in a Hastings Bookstore parking lot in McAllen, Texas. Urban roosts may draw birds in from many miles of surrounding suburban or even rural foraging areas, to spend the night on buildings or in parking lot trees. Purple Martin roosts across the southeast are so large that rings of dispersing birds show up on Nexrad radar each morning during the fall migration. The Highland Mall in Austin, Texas regularly attracts over 200,000 Purple Martins during mid-summer as the birds congregate before departing to wintering areas in South America. At other times of the year, the same mall regularly hosts a nocturnal roost of over 50,000 blackbirds and Great-tailed Grackles.

While most birds in Zone 1B are drawn to opportunities afforded by buildings and parking areas, others are attracted to the zone's scant ornamental vegetation. From California to Arizona, male Anna's Hummingbirds sing with their grating metal songs and dive from great heights in sweeping displays to attract mates to their chosen nest sites in parking lot trees. Northern Mockingbirds sing from Bartlett pears and other parking lot trees, while nesting in foundation plantings in urbanized areas from California to New Jersey. Western Kingbirds colonized downtown Austin, Texas by nesting in street and parking lot trees in the 1950s (Webster & Webster 2002). Before colonizing asphalt savannahs, these species frequented natural savannahs and scrubland with similar scattered vegetation.

BUILDING LIGHT DANGERS

While asphalt savannahs and concrete cliffs and canyons provide nesting, foraging, and roosting opportunities for some birds, they also pose unique hazards to the many migratory species that have to pass through these areas each year. Skyscrapers are especially hazardous, as their many lighted windows serve as beacons attracting nocturnal migrants, which become disoriented in the lights and eventually collide with the building. Some skyscrapers are known to kill over 2,000 birds each year (Ridgley 2001). Mere months before terrorists brought down the World Trade Center towers, several articles in the national press identified the buildings as notorious bird killers (Kuntzman 2001).

In Toronto, concerned bird enthusiasts formed the Fatal Light Awareness Program in April 1993 to seek a solution to the skyscraper bird hazard. Each year,

volunteers patrol downtown skyscrapers in Toronto, collecting thousands of birds killed at the buildings, and lobby to get building managers to turn off external and internal lighting that attracts birds migrating past at night (Fatal Light Awareness Program 2004). Program founder Mike Measure reports that about 100 buildings in Toronto are voluntarily turning off lights at night to reduce the risk to birds. In 2006, the Toronto City Council directed its planning staff to draft green building guidelines aimed at keeping birds safe from night lights.

Following Toronto's lead, organizations in several U.S. Cities created similar Lights Out programs. New York City Audubon started a Safe Flight Program in 1997, and Audubon Chicago Region organized Lights Out Chicago in 1999. Milwaukee bird enthusiasts formed their own program, the Wisconsin Night Guardians for Songbirds (WINGS), in 2005 (Townsend 2005). Boston launched a similar program in 2008. These groups are starting to change the way buildings are lit in order to make urban buildings safer for birds. In response to requests from the New York Audubon Society, the Port Authority of New York (2000) announced efforts to reduce bird collisions, including turning off exterior flood lights and encouraging tenants to turn off nonessential lights after dark. During the summer of 2001, Chicago Mayor Daley's Wildlife and Nature Committee and the City of Chicago Department of the Environment sent flyers to the Building Owners and Managers Association, requesting that downtown buildings turn off exterior and window lights to reduce the hazard to migratory birds. More recently, Mayor Daley declared August 25-October 25 as Lights Out Chicago Days, and publicly recognized the 20 buildings participating in the program. Supporters claim that the

program makes these buildings safer for birds and saves 10,000 birds each year in Chicago (National Audubon Society 2003).

While organizers work with industry leaders and municipal authorities to institutionalize Lights Out practices, volunteers monitor buildings during migration to document bird kills and to rescue injured or disoriented birds. The Chicago Bird Collision Monitors, while documenting thousands of bird strikes, were able to rescue 173 birds of 42 species during Fall 2003, including 30 White-throated Sparrows and 20 Brown Creepers. Sometimes more than just birds are saved by these acts of compassion. In New York City, a volunteer was spared from the 9/11 terrorist attack when he left his workplace at the World Trade Center to take a stunned Ovenbird to a safe release location in Central Park.

By modifying building lighting practices, thousands of birds of hundreds of species are protected each year. While most cities do not have similar programs, newspapers around the country have reported on the problem, increasing awareness and promoting the possibility of “making city skylines more bird-friendly” (Leland 2002; Trinh 2004).

WINDOWS

Bright shining skyscrapers are not the only collision hazard that birds face in Zones 1A and 1B. In the early 1970s, William G. George, a professor of biology at Southern Illinois University and curator of the university’s bird collection, became concerned about the problem of birds being injured and killed by collisions with plate glass windows. He approached Dan Klem, a new PhD student at the university, with the

prospect of studying what he was beginning to call “window predation” of birds. The very next morning, Klem got up before dawn to pondering this as a possible dissertation topic. Shortly after dawn, while sitting on a bench next to a wall of glass covering the university’s chemistry building, he was surprised to see a Mourning Dove fly in through the trees, strike the glass wall, and fall to the ground dead. As he looked under windows on campus and in town, he found skeletons and dead birds everywhere. Traveling to St. Louis, he observed dead birds ranging in size from warblers to crows littering the stone window ledges at the arboretum research center, and was chagrined to see crows flying in to feed on the carcasses.

Convinced that he was witnessing an ecological catastrophe, Klem spent the next five years conducting surveys and field experiments for his doctoral research. While naturalists and ornithologists had observed birds striking glass windows since the early 1800s (Nuttall 1832; Lord 1950; Haines 1966), Klem’s research was the first major study of the problem, and he estimated that up to 1 billion birds were being killed by collisions with window glass in the United States each year (Klem 1979; Klem 1990). After completing his dissertation, Klem accepted a position at Muhlenberg College in Allentown, Pennsylvania, where he has continued to study collisions between birds and windows. If Klem’s estimates are correct, perhaps 30 billion birds have been killed by windows in North America since he first started researching this issue.

While Daniel Klem was researching window collisions during the mid-1970s, S. Dillon Ripley, an ornithologist and head of the Smithsonian Institute from 1964-1984, was creating a popular method to engage people in protecting birds from window strikes. Having read research suggesting that falcon silhouettes might alarm birds (Lorenz 1939;

Tinbergen 1948; Tinbergen 1951), Ripley developed a black paper falcon silhouette that could be taped onto a glass window in order to scare smaller birds away from the glass. The Smithsonian Institute offered these silhouettes for sale in their museum gift shop, and soon other conservation organizations began publicizing their use. Thirty years later, dark falcon silhouettes are popular fixtures on plate glass windows across the country. At the Cleveland Museum of Natural History, Director Harold D. Mahan created a similar silhouette that he called the “owl-outte” in the 1970s—a striking depiction of a Great Horned Owl in flight with talons exposed (Harrison 1979).

Since silhouettes are easy to buy or make and install, they are promoted by a wide range of organizations (Barnes and Constantin 1997; Lee and Henderson 1992). However, Klem’s research has shown that they do not effectively reduce window collisions (Klem 1990). One homeowner reportedly came home to find a dead Song Sparrow on the ground next to an owl silhouette; apparently the bird flew directly into the silhouette, knocking it from the window (Sharp 2001). Since the designs do not make the glass visible to birds, they still attempt to fly through what they perceived to be an unobstructed line of flight through a clear window or reflected landscape image.

Klem has found that the only way to stop window collisions is to make the glass surface visible to birds. This can be done by making the window opaque, or by covering the outside of the pane with dots or objects in a grid pattern no more than two to four inches apart (Klem 1990). If objects are placed on the inside of the window, reflected landscapes on the outer surface will still attract and kill birds. If design elements on the window are spaced wider than two inches horizontally and four inches vertically, some birds will still attempt to fly between the dots and be killed.

Initially, Klem's work gained only limited attention. At the 1998 Ornithological Congress in St. Louis, Klem found two window-killed birds—a Yellow-bellied Sapsucker and a Red-winged Blackbird—at the conference site, and brought them to his paper presentation, where he attempted to find out why his research on window collisions was failing to gain traction among professional researchers and bird conservationists.

According to Klem,

I went before the audience without slides, to lay out briefly my concerns to my colleagues - professional ornithologists who I admire. . . . I told them that I've spent my career on this; my doctoral work is on this. I told them this combines social, economic and biological issues. Then I asked them: Do you know something I don't know? Why aren't you concerned about this? (Yakutchik 2003).

During his talk, Klem begged his colleagues to critique his work or tell him if he was barking up the wrong tree. But nobody responded. While writers from the mainstream and bird watching media occasionally called, his work gained little attention until May 2003, when Maryalice Yakutchik, a freelance journalist and professor of journalism and creative writing at Loyola College wrote an article highlighting Klem's research on window strikes for the Sunday magazine section of the Philadelphia Inquirer (Yakutchik 2003).

That weekend, Bob Ridgley, an ornithologist on staff at the National Audubon Society Science Office in Ivyland, Pennsylvania, read the article and called up his friend and supervisor, Audubon Senior Ornithologist and Vice President of Science Frank Gill. The two had previously invited Klem to speak at the Academy of Natural Sciences in

Philadelphia when they had been on staff there in the late 1990s, but now Ridgley was convinced that they hadn't paid enough attention to Klem's work and the window strike issue. Gill read the story and convinced *Audubon* magazine to run an article on Klem's work the next year (Malakoff 2004), and dozens of additional news articles have since appeared in newspapers and magazines around the country (Trinh 2004; Duffy 2007; Butler 2007).

Klem gets several calls a year from people who want to help address the window strike issue, but after they hang up the phone, he usually doesn't hear from them again. People value unobstructed views through plate glass windows, making it difficult to employ techniques that make the glass opaque in an attempt to make it visible to birds. Besides the loss of unobstructed views, the monetary cost of covering windows may be perceived as prohibitive.

However, despite the obstacles, a few people and organizations around the country are working to reduce window collisions. In September 2004, the Evanston North Shore Bird Club in Illinois invited Klem to address them about bird collisions. Hearing of his visit, Randi Doeker, President of the Chicago Ornithological Society arranged to meet with Klem to discuss a project she was working on with Chicago city officials to attempting to halt window kills at McCormack Place—a glass-walled building that kills thousands of birds each year. Doeker then arranged for Chicago to host a Birds & Buildings Conference in March 2005, where city leaders, architects, owners of problem buildings, and bird conservationists met to discuss potential design solutions to address window collisions. The resulting Birds & Building Forum, headed by Doeker, has created a website with resources for others addressing the issue, and continues to

foster a collaborative network seeking solutions to the continuing challenge of window collisions. With encouragement from Doeker, the City of Chicago recently produced a brief design guide for bird-safe buildings (Bowen 2008).

In 1997, Rebekah Creshkoff of New York City Audubon started Project Safe Flight to address diurnal window strikes and nocturnal building strikes in Manhattan. Project leaders and volunteers monitoring various sites in downtown and midtown Manhattan have persuaded managers of problem buildings to replace dangerous windows. They are also working to compel government agencies to address collisions through the environmental assessment process, and seek to create innovative ways to reduce collisions by collaborating with architects and other design professionals (New York City Audubon 2008). In 2007, New York City Audubon published *Bird-Safe Building Guidelines*, a 55 page manual for architects, landscape designers, engineers, glass technicians, developers, building managers, city, state, and federal officials, and the general public.

In Philadelphia, collisions with glass windows extirpated the Ruby-throated Hummingbird population on the campus of Swarthmore College. Biology professor Timothy Williams invited Klem to speak on campus and his presentation convinced Carr Everback, an engineer and chair of the environmental studies program, to seek out a more bird-friendly design for a new glass-covered science center. Their solution was to install a series of glass panes with a fritted pattern of dots across the surface to break up the reflections and make the glass surface visible to birds (Yakutchik 2003, Malakoff 2004). Other building projects attempt to cut down on window strikes through innovative

window design, including striped patterns of fritted glass on windows at a new Niagara Falls observation tower in New York.

Several new commercial ventures are attempting to build a market for bird-safe window products. In addition to fritted or decorative glass, these include decorative leaf-shaped decals that reflect ultraviolet light visible to birds (WindowAlert 2008), loosely hanging window screens (The Bird Screen Company 2008), and a film—used for advertising on bus windows—with numerous small holes that can cover a window and make it opaque from the outside without obstructing the view from the inside (CollidEscape 2008).

Glaswerke Arnold, a German glass manufacturer, has created a new type of glass with ultraviolet coatings that both absorb and reflect ultraviolet light in a pattern that birds may be able to detect and avoid. Researchers at the Max Planck Institute for Ornithology tested this glass, Ornilux, and found it to be about 75 percent effective at deterring bird collisions in the lab. Since the glass is prohibitively expensive to ship to the United States, Guardian Global, an American glass manufacturer, announced that it would start manufacturing a similar glass in 2008. However, after additional marketing analysis, Guardian Global scrapped those plans. With an estimated startup cost of \$25 million, and profits of only about \$.25 for each square foot sold, Guardian Global would have to sell 100 million square feet (about 20 percent of their annual production) of the glass to recoup their costs. None of the major window manufacturers have expressed interest in the glass. As a sign that some architects may be interested in utilizing bird-safe glass in their projects, the Shelbourne Development Group, Inc. has announced that

it will use bird-safe glass in The Chicago Spire, a 2,000 foot tall Santiago Calatrava designed tower under construction in Chicago (Bowen 2008).

In order to create demand for new bird-safe glass products, New York City Audubon has joined with New Jersey Audubon, American Bird Conservancy, Wildlife Conservation Society, The Nature Conservancy, and Polshek Partnership Architects to form a Bird-Safe Glass Foundation. The group meets monthly, and is trying to get the U.S. Green Building Council to incorporate bird safety into the next LEED certification guidelines. The hope is that architects and developers may be induced to seek out bird-safe glass products by offering them LEED points for designing bird friendly buildings.

GREENROOFS

In addition to making buildings safer for birds, pioneering builders and designers are turning buildings into bird habitat by covering them with greenroofs and rooftop gardens. The first rooftop gardens in the United States graced late 19th Century theatres and hotels in New York City—including Madison Square Garden and the Waldorf Astoria Hotel. In 1880, New York conductor and musician Rudolph Aronson, inspired by French rooftop gardens, obtained funding from wealthy donors including the Vanderbuilts and Morgans, to build Casino Theater, the first roof garden theater in the United States. Other theater owners followed suit, obtaining funds from wealthy patrons to construct garden theaters for summer amusement in pre-air-conditioned Manhattan. Madison Square Garden, designed by celebrity architect Stanford White, opened its rooftop theater in 1888 (Osmundson 1999).

While the plantings on rooftop theaters were largely ornamental and provided limited habitat value for birds, they did inspire more luxurious plantings on residential rooftops of the well-to-do during the 1920s. The first large-scale rooftop gardens in the United States were five gardens designed from 1934-1936 for the Rockefeller Center by Ralph Hancock, the British creator of famous rooftop gardens in London (Osmundson 1999). One of these, the Garden of the Nations located on the 10th floor of the RCA Building, attracted birds almost immediately. These gardens provided a welcome opportunity for migratory birds otherwise relegated to flying “over miles of desolate roofs, as forbidding as mountain crags or a desert” (McKenny 1939:190). One observer noted that:

Hundreds of birds come to the Garden of Nations, both fall and spring. Often for days in April a hermit thrush picks his way fastidiously through the shrubs of the Japanese garden, while yellow-bellied sapsuckers play their familiar game of hide and seek behind the trunks of the trees which shade the paths. The tiny kinglet searches for insect eggs on the weeping willows and often a gusty spring storm brings in a rain of gaily-plumaged warblers, that flutter delightedly among the flowering crabs and cherries. Not long ago two screech owls stayed a number of days, while jays often streak stridently through the branches (McKenny 1939:190).

The success of the Rockefeller Center gardens sparked a desire for rooftop gardens in several other cities. In 1942, Timothy Pflueger designed the first rooftop garden to cover a subterranean parking garage in Union Square, San Francisco. Wealthy

industrialist Richard King Mellon admired the novel landscaping, and commissioned a similar garage for downtown Pittsburgh. In 1955, Workers finished construction on Mellon Square, featuring a central fountain surrounded by American sweetgums and black locust trees. Five years later, shipbuilding magnate and developer Edgar Kaiser, Sr. engaged landscape architect Theodore Osmundson to create the first large private rooftop garden, a three acre garden with 42 trees placed over the weight-bearing columns of a six-story shopping center at Kaiser Center in Oakland, California in 1960.

Osmundson designed 11 more rooftop garden projects in subsequent years, making the Bay Area a center for rooftop garden building and design. Landscape architect Lawrence Halprin created additional rooftop gardens in the area, including San Francisco's Ghiradelli Square, Fairmont Hotel, and Bunker Hill Steps (Osmundson 1999).

In recent years, civic leaders have made Portland, Oregon and Chicago, Illinois centers for rooftop garden promotion by providing incentives for constructing extensive greenroofs (lawnlike roofs of mostly of grass or groundcovers) and rooftop gardens (intensive greenroofs with trees and shrubs). Several rooftop gardens in downtown Portland provide habitat for Black-capped Chickadees and other native forest birds (Houck and Cody 2000). Birds also abound on the \$1.5 million 20,300 square foot greenroof planted on Chicago City Hall. North Park Village Nature Center Director Drew Hart and his team have recorded 57 species on this greenroof, including migratory Cape May Warblers and Olive-sided Flycatchers (Millett 2004; Tweit 2008). Other cities are following the lead of these pioneers and creating rooftop habitats. In Salt Lake City, the State Office Building installed a rooftop garden above their parking garage, and in 2000 the LDS Church created a four acre alpine meadow with conifers, 21 species of

native alpine grasses, and over 300 Utah wildflower species on the roof of a new 22,000 seat conference center (Moore 2001). On a recent birdwalk to the center organized by a local Wild Bird Center store, participants enjoyed a variety of birds on the roof:

American and Lesser Goldfinch, Pine Siskin, House Finch, Black-capped Chickadee, Mourning Dove, and two Peregrine Falcons, while overhead a Golden Eagle cruised the skies.

In the 1990s, a growing number of landscape architects began promoting green roofs as bird habitat. By 1997 at least one North American greenroof company listed the provision of wildlife corridors as a benefit of greenroofing (American Hydrotech 1997). In 2002, Gregory Wright in an article in the bird conservation magazine *Birdscapes*, announced the formation of a SUN Utility green roof team that will promote green roof construction for bird habitat in Los Angeles (Wright 2002). Green Roofs for Healthy Cities recently marketed a green roof conference in Manitoba to ornithologists as well as design professionals. In 2004, four Killdeer chicks became the first generation of birds to hatch on a 10.4 acre green roof above the Dearborn Truck Plant of Ford Motor Company's Rouge Center in Dearborn, Michigan. Designed to serve as a habitat acceptable to birds by architect William McDonough, the Ford Rouge Center boasts the largest green roof in North America (Johnson 2004). In 2006, the National Audubon Society promoted greenroofs as appropriate bird garden sites on apartments, schools, and corporate buildings (National Audubon Society 2006). Other organizations promoting greenroofs as potential bird habitat include the Lady Bird Johnson Wildflower Center, greenroofs.com, and Green Roofs for Healthy Cities.

Rooftop gardens can be constructed on both single family homes and larger commercial buildings, though they are more expensive than traditional roofs, and require specialized skills for installation—creating an obstacle to their availability and acceptance. In Europe, where many states and municipalities mandate green roofs as necessary mitigation for new building projects, firms specializing in green roofs and rooftop gardens are proficient in installing these structures and are leaders in rooftop garden design and technology.

Europeans are also more advanced in designing rooftop gardens as wildlife habitat. In England, bird conservationists are incorporating rubble from demolished buildings into rooftop gardens to encourage nesting of Black Redstarts—a bird which began nesting in bombed-out buildings after World War II, but declined as urban redevelopment eliminated its preferred nesting sites. While these birds can easily nest on unvegetated rooftops, greenroofs provide them with improved opportunities to find insect prey (Marren 2004). The Laban Dance Centre in London installed the first greenroof specifically designed for the Black Redstart in London. Local planning authorities now require greenroofs in sites important to the Black Redstart, including the Deptford Creek area. In the Greenwich Gateway, greenroofs are required on 50 percent of all buildings (Marren 2004).

British designers are beginning to create greenroofs for additional bird species. The Rolls Royce factory in Chichester, England installed a greenroof constructed to mimic a gravel pit, and has already attracted a pair of Little Ringed Plovers (Marren 2004). Researchers in Switzerland have noted that Northern Lapwings are starting to nest

on greenroofs, and are studying their nesting ecology to determine how to improve lapwing nesting success on these planted landscapes (Baumann 2006).

While greenroofs can provide many benefits, including wildlife habitat, there are several barriers to their more widespread adoption (Table 2.1). The increased weight of a greenroof requires additional engineering and supporting construction, which may add to the construction costs of the roof. Bidders who are unfamiliar with the greenroof materials or concerned about lack of local availability of materials may over-purchase,

Table 2.1 Benefits and obstacles to the widespread adoption of greenroofs.

Benefits	Obstacles
<ul style="list-style-type: none"> • Reduce temperature extremes • Increased energy efficiency • Reduce storm water runoff • Improved water and air quality • Increase lifespan of roof • Replace lost greenspace • Animal and insect habitat • Wildlife reintroduction • Vegetable production • Improved worker morale • Additional usable space • Increase property value • Higher lease rates for overlooking rooms • Improved view from higher offices • Community stewardship • Prestige 	<ul style="list-style-type: none"> • Higher initial cost than conventional roofing • No building standards—not mentioned in U.S. building codes. • No wind resistance ratings • No fire resistance test standards • Insurance risk tables not yet established • Increased insurance costs for landscapers • Builder and developer unfamiliarity with technology • Lack of local material availability • Perceived water needs of landscaping • Short-term ownership of commercial buildings due to tax benefits

again adding to construction costs. While greenroof infrastructure is currently more expensive than conventional roofing, prices are coming down as materials become more readily available and contractors gain experience with the technology. In Chicago, prices have dropped from \$20-25/square foot to \$12-15/square foot for extensive systems. An

extensive greenroof installed on the University of Texas Medical Center roof in Houston cost \$19/square foot, only \$4/square foot more than a conventional roof.

Lack of accepted building standards, wind resistance ratings, fire resistance standards, and insurance risk tables also make greenroofs more difficult to engineer and construct. Landscapers who normally work at ground level may face higher insurance premiums when they start working at heights. While greenroof advocates promote the cost effectiveness of greenroofs that last twice as long as conventional roofs, federal tax laws allowing owners of commercial property to depreciate their buildings over seven years, leading most owners of commercial buildings to sell them before they would see the benefits of a longer-lasting roof.

Despite these obstacles, the U.S. greenroof industry is growing. Though few builders are constructing greenroofs for the main purpose of attracting birds, a growing number of greenroof proponents see the technology as an unparalleled opportunity to create bird habitat over a significant portion of the urban fabric. If nothing else, greenroofs serve as a symbol of hope. For people living in heavily built up urban areas lacking attractive habitat features, it may be comforting to envision a reclamation of the built environment; to imagine converting the asphalt savannahs and concrete cliffs and canyons into a verdant bird paradise.

Chapter 3—Suburban Gardens (Zone 2)

While casing The Heights, an old established residential neighborhood in Houston, I smile and wave to local residents in their yards, and am careful not to stop my rental car and stare too long at anyone's home or yard with my binoculars. With windows rolled down, I hear the high-pitched staccato call of a Downy Woodpecker and the squeaks of Tufted Titmice. Several Mourning Doves sail over the road in front of me, and an American Robins calls from the next street over. Tall shade trees grace most of the small yards, and ornamental shrubs and bushes hug the foundations of early 20th century cottage style homes and bungalows.

Finally at the corner of East 5 ½ Street and Frasier, I spot my quarry—a gray bird sporting a black head, pointed crest, white rump, and a crimson patch under its tail. Eyeing me, it swallows a bayberry, then flies across the road and disappears into the lilacs of a neighboring yard. Nobody knows exactly how many bulbuls are flying around these neighborhoods, but over the past ten years birdwatchers have reported them from widely scattered locations over most of Greater Houston. Native to Southeast Asia, the Red-vented Bulbul is one of the most recent exotic bird species to colonize the lush yards and gardens of suburban America.

Neighborhoods of single family homes surrounded by well manicured lawns, hedges, and shade trees are perhaps the most characteristic landscape in American cities. The verdant lots of suburbia, the so-called Crabgrass Frontier (Jackson 1985), reflect an urban aesthetic that values privacy, independence, and the closeness of nature. While

hardly a wilderness, this well-watered, mowed, and pruned American Eden shelters and offers copious nesting and foraging opportunities for many native and exotic bird species.

Urban ecologists refer to birds that can thrive in suburbia as urban adapters (Blair 1996). Unlike the urban exploiters of Zone 1, which thrive among the buildings and pavement of city centers and commercial zones, urban adapters are those which take advantage of the trees, bushes, and lawns of suburbia. These are often native woodland species like chickadees, titmice, nuthatches, and woodpeckers that can find foraging and nesting sites in older neighborhoods with a canopy of shade trees. Where residents have planted bushes, hedges, and ornamental foundation plantings, Song Sparrows, Northern Mockingbirds, and Northern Cardinals find ample nesting sites, as well as plentiful berry crops to feed on during cold winter months. Ground-feeding birds such as American Robins and Mourning Doves also thrive where lawns and driveways provide foraging opportunities, and nesting sites are easy to find in nearby yard trees.

Garden birds have long attracted attention and favors from admiring human neighbors. European colonists were quite taken by hummingbirds, unknown in their native lands, which spent active summers buzzing about their gardens (Kalm 1773). Early Philadelphia naturalist William Bartram considered the Gray Catbird “a kind of domestic bird during their spring and summer residence in Pennsylvania” (Bartram 1791). 19th Century bird-student Alexander Wilson noted dozens of bird species in and around Philadelphia gardens, including House Wren, Winter Wren, Wood Thrush, American Goldfinch, Gray Catbird, Eastern Wood-Pewee (Wilson 1970). By Audubon’s day, Blue Jays, formerly confined to woodlands and forest, were nesting in yards with large trees (Audubon 1832).

Over the course of the next 150 years, naturalists and ornithologists observed many additional birds colonizing residential districts. Pioneering ornithologist Elliott Coues classified House Wrens as “semi-domesticated” and observing Rock Wrens haunting “the shrubbery of gardens in many of the western towns,” considered it “a very desirable addition to our ‘household birds.’” He also noted that it took time for many birds to become “civilized” and join the ranks of proper Victorian society. Of the Cliff Swallow, he declared that “it now nests habitually on buildings in the Eastern United States, though it still glues its curious mud fabrics to the faces of cliffs in the West” (Coues 1878).

Coues was witnessing more than just a shift in bird behavior, but the creation of whole new suburban habitats for birds. By the 1880s, horse-drawn trolleys, cable cars, and electric streetcars allowed developers to create outlying suburban housing developments where 19th Century workers could flee from the increasingly crowded and polluted conditions within American cities (Jackson 1985). Residents hoping to find more pastoral environs, were in actuality confronted with multi-story, detached, single-family homes constructed close together on narrow lots with only minimal side yards available for trees or landscaping. Few birds thrived in such heavily built environs, mostly exotic House Sparrows, starlings, pigeons, and other birds now found in the asphalt savannahs of Zone 1B.

For the affluent who could afford to purchase something more than the typical streetcar suburban house, planners and developers including Llewellyn Haskell and Frederick Law Olmstead created more verdant and pastoral neighborhoods with larger lots and curvilinear streets in suburbs including Llewellyn Park, New Jersey (1857) and

Riverside, Illinois (1868). These picturesque suburbs attracted many additional birds, including native forest birds not found in more developed suburbs, such as the Prothonotary Warbler that nested in a Chinese lantern hanging inside a Riverside, Illinois boathouse (Schantz 1912). By the end of the 19th Century, stylish suburbs flourished near all of the major cities. With lush lawns, abundant trees, and garden landscaping, these affluent suburbs provided ample opportunities for cardinals, mockingbirds, catbirds, robins, and other garden birds.

Garden suburbs served as a model for yard landscaping in automobile suburbs built after the turn of the 20th Century. Featuring lots averaging 2,000 square feet larger than those in earlier streetcar suburbs (Jackson 1985), the yards surrounding these small cottage-style homes allowed more space for lawns and gardens. As yard and street trees matured, these neighborhoods attracted canopy foraging species such as chickadees, titmice, jays, and even woodpeckers.

Other birds gradually adapted to new suburban lawns and gardens. American Robins, now a quintessential yard bird, was once a forest denizen, only arriving in Eastern backyards as lawns became fashionable at the end of the 19th Century. In 1868, they still hadn't settled the new towns in Iowa, where they were "seen chiefly along the skirts of the timber, in which it is forced to breed, the prairies being, of course, naturally treeless, and the country too recently settled to possess orchards" (Allen 1868). It took many decades before they acclimated to lawns from coast to coast—only appearing on lawns in southern California in the late 1920s (Stoner 1934). About the same time in suburban Seattle, Thomas Burleigh noted that "comparatively few show any preference yet for the vicinity of houses, old slashings, short stretches of woods, and fields

overgrown with scrubby underbrush being the spots where at present they can be found during the summer months” (Burleigh 1930).

After sixteen years of economic depression and warfare, housing markets boomed at the end of World War II, and developers built millions of small (usually about 700 square feet) homes on fairly large lots averaging 4000 to 8000 square feet (Jackson 1985). Homebuilding initially destroyed bird habitat, as builders cleared the lots of vegetation and bulldozed them level for construction. New residents planted lawns, fruit trees, and evergreens—which eventually attracted many birds as the trees matured over the succeeding decades. Tract home subdivisions such as the Levittowns in New York and Pennsylvania, once inhospitable expanses of closely packed cottages, now harbor dozens of common garden birds including doves, mockingbirds, chickadees, cardinals, and finches. In many areas, Eastern Screech-Owls are more common in mature suburban yards, where they hunt from the lower branches of shade trees, than they are in more rural areas, where thick brushy understories make the hunting more difficult and larger Great Horned Owls may pose a greater threat (Gehlbach 1996).

Average lot sizes and their associated yards climbed for several decades, but are now shrinking due to increased land prices and local zoning restrictions. Lots for new homes in 1976 averaged 10,125 square feet—almost double the size of lots in 1940s bungalow developments. By 2007 the average lot size for new homes was only 8,750 square feet—with a large home and additional driveway space leaving less than 3,500 square feet for landscaping. Average lot sizes, and their available garden bird habitats, are expected to shrink an additional 1,000 square feet within the next few years (Mason

2008). Newer subdivisions, with large homes on small lots planted with turf grass and ornamental nursery stock, are among the most impoverished bird habitats in Zone 2.

At the beginning of the 21st Century, the residential areas of Zone 2 covered 58,548 square miles, an area larger than the state of Illinois. Zone 2 makes up 33 percent of all developed land, and covers almost 2 percent of the Lower 48 States (Homer et al. 2007). As cities and yards spread across the country, many species expanded their range to take advantage of the new residential landscapes. Inca Doves began expanding their range to take advantage of urban and suburban foraging opportunities in the early 1800s. First found in Arizona in 1878, and in the San Antonio region in 1890 (Mueller 2004), these birds continue to expand their range northward, including colonization of southern Utah, where they became common in St. George and surrounding communities, in the early 1990s. These skillful seed foragers now thrive in urbanized areas in the Southwest, where they easily out-compete other ground feeding birds in developed neighborhoods (Shochat *et al.* 2004).

Since the 1930s, Northern Cardinals, Northern Mockingbirds, Red-bellied Woodpeckers, and Carolina Wrens—all formerly Southern birds—have ranged northward into suburban neighborhoods across New England and beyond over the past 100 years. Great-tailed Grackles, now an emblematic urban species across the Southwest, and considered a pest in many areas, only became common and widespread with the creation of suburban yards after World War II.

White-winged Doves are also expanding their range northward in Texas and California to take advantage of suburban open-ground feeding and shade-tree nesting opportunities. In Texas, the birds were formerly restricted to the Trans-Pecos and the Rio

Grande Valley, though winter freezes in the 1970s wiped out many of the valley citrus groves where they nested, and soon dispersing birds settled in San Antonio. These doves are currently more common in Austin and San Antonio neighborhoods than in their former south Texas strongholds. It continues to colonize new areas, and it now nests along the entire U.S. Gulf Coast and throughout most of Florida (Schwertner *et al.* 2002).

In colonizing new neighborhoods, all suburbs are not created equal. Birds may be present in some neighborhoods and absent in others depending on the amount and type of available vegetation. In one study of neighborhoods in Amherst, Massachusetts, 22 of 45 species preferred different types of suburbs. Old established neighborhoods with mature trees were more attractive to House Wrens, American Robins, Gray Catbirds, and Northern Cardinals, while more recently developed areas with mostly small trees and a few taller silver maples and Lombardy poplars attracted more Common Yellowthroats, Chipping Sparrows, Song Sparrows, and Common Grackles. A neighborhood of houses built within a second-growth oak-pine forest was preferred by native woodland birds including Tufted Titmouse, White-breasted Nuthatch, Wood Thrush, Red-eyed Vireo, Scarlet Tanager, and Baltimore Oriole (DeGraaf and Wentworth 1986).

AVIAN EXOTICA

Native species aren't the only birds taking advantage of lush suburban landscapes. Houston's bulbuls, and dozens of additional exotic species, find a haven in the surfeit of exotic trees and shrubbery plantings. As early as the 1840s, enthusiasts in the United States were importing and releasing birds in their neighborhoods, and by the 1870s, several groups had formed acclimation societies dedicated to acquiring and releasing

exotic bird species. By 1928, zoological gardens and private collections in North America were thought to hold at least 700 exotic species, and fanciers had released dozens of species in cities across the country. However, according to one early survey, only eleven species had become successfully established in North America by the 1920s (Phillips 1928)¹:

Over the years, hundreds of bird species have escaped to at least temporarily grace American cities with their presence. Escapees are usually game birds, exotic waterfowl, parrots, cage birds, or other zoo or animal collection specimens. Sometimes the more unusual escapees become local celebrities. In Salt Lake City, a pink Chilean Flamingo spent almost 20 winters foraging in the icy margins of the Great Salt Lake. The flamingo, celebrated in the local press as Pink Floyd, escaped from the nearby Tracy Aviary in 1988. Every summer, the bird disappeared—sometimes showing up as far away as Wyoming and Montana—only to return each fall to spend the winter feeding on brine shrimp near the Saltair Palace resort west of the Salt Lake City airport. Pink Floyd had many fans, and one local enthusiast even organized Friends for Floyd, a group that raised \$25,000 and requested state authorization to import and release additional flamingos to keep the bird company (Blake 2003, Speckman 2004; Westby 2004). Last seen in 2005, Pink Floyd no longer haunts Salt Lake City in the flesh, but his memory remains emblazoned in the local psyche (Roberts 2007).

With over 1,000 different species held in zoos and private collections in the United States, almost anything can appear in the wild as a free-flying escapee. Black

¹ Birds established in North America by the late 1920s (Phillips 1928): Gray Partridge, Ring-necked Pheasant, Spotted Dove (in Los Angeles, California), Australian Crested Dove (in Berkeley, California),

Swans, Egyptian Geese, Mandarin Ducks, and other exotic waterfowl occasionally breed in cities across the country. South Florida has become an exotic bird haven; some of the more unusual birds found there on occasion include Abdim's Stork, Sarus Crane, Wreathed Hornbill, African Gray Hornbill, and Pin-tailed Whydah (Environmental Wildlife Management Co. 2008). While most of these represent isolated individuals, other species are breeding in south Florida neighborhoods. Sacred Ibis, first found nesting in Miami-Dade and Palm Beach counties in the 1990s, have even expanded beyond the urban environs to colonize the Everglades (Herring & Gawlick 2008). Of the 196 free-flying exotic species reported from Florida, birdwatchers and researchers have found 48 species breeding in the wild in the last 10 years. Local authorities consider 11 species fully established, having bred for more than 10 years².

Southern California, with its temperate climate, also supports a large contingent of established exotic birds, including Common Peafowl, Black-hooded Parakeet, Blue-crowned Parakeet, Lilac-crowned Parrot, Yellow-chevroned Parakeet, Yellow-headed Parrot, and Red Bishop. Even as far north as San Francisco, urban parrot flocks have colonized the streetscape and draw the attention of city dwellers. Recently, a flock of parrots and their human devotees in San Francisco achieved national acclaim as the subjects of both a book and documentary motion picture, *The Wild Parrots of Telegraph Hill* (Bittner 2004; Irving 2004)

Rock Pigeon, Green Parakeet (Palm Beach, Florida), Skylark (British Columbia), European Starling, Crested Mynah (British Columbia), House Sparrow, and European Tree Sparrow (St. Louis, Missouri).

² Birds considered established in Florida are: Muscovy Duck, White-winged Dove, Eurasian Collared-Dove, Rock Dove, Black-hooded Parakeet, Budgerigar, Monk Parakeet, House Finch, Spot-breasted Oriole, House Sparrow, Red-whiskered Bulbul, and European Starling.

The Telegraph Hill flock of Red-masked Parakeet started with a pair of conures that first nested there in 1989. The two parakeets, named Victor and Inez by local parrot watchers, were wild-caught birds from South America, still sporting quarantine bands from the U.S. Department of Agriculture. By 1993, there were 26 birds in the flock, including at least five wild-caught birds and their young. Now numbering at least 160, the raucous birds have displaced a small flock of White-winged Parakeets that had lived in the area since the early 1970s (Bittner 2005).

Most suburban parrots are restricted to warmer Sunbelt cities, but at least one species thrives as far north as Vancouver, Washington, Chicago and New York, where they build large communal nests in trees or on utility structures and light poles. Urbanites enjoy watching these green and gray birds wing through local parks and yards, where they feed on acorns and sunflower seeds, providing a raucous and colorful tropical vision against a backdrop of winter grays and browns. Considered an agricultural pest in their native lands, officials in the United States closely watch Monk Parakeet populations, but so far they abound only in suburban areas where they pose little threat to commercial crops.

Monk Parakeets may not foray far beyond the borders of suburbia, but another exotic invader is spreading like wildfire across urban and rural America. Since the late 1990s, Eurasian Collared-Doves have exploded across the landscape. Originally colonizing Florida from the Bahamas in the late 1980s, they now nest in almost all of the Lower 48 states and several Canadian provinces. When colonizing a new area, these grain eating birds often set up residence near Wal-Mart garden centers and rural farms,

where they take advantage of spilled seed. Aggressive against other birds, in urban areas they hold their own and even out-compete native Mourning Doves.

Sometimes suburban exotics become established for decades, only to disappear later as the neighborhoods change. Crested Mynahs, established in Vancouver, British Columbia since 1897, started declining in numbers in the 1950s, and the last individuals disappeared in January 2003. Budgerigars, popular Australian cage birds, thrived for decades in the suburban communities built after World War II on reclaimed Gulf Coast salt marshes near St. Petersburg. Residents used to feed the parakeets, and provide nest boxes for them. As the first wave of retired Floridians aged, and new residents moved in, the budgies began to lose their nesting sites. In the 1980s, House Sparrows began to out-compete the budgies for the few boxes that remained, and the budgies are now hard to find. Where flocks of over 20,000 used to line the power lines, less than 50 individuals now persist in two small populations in Pinellas and De Soto counties.

The origins of many exotic bird populations in American cities remains shrouded in mystery, but some originate from deliberate releases by bird enthusiasts hoping to liven up their neighborhoods, like Eugene Schieffelin who first released European Starlings in New York City in 1890. Sometimes the birds are released by former residents of foreign lands attempting to make their new surroundings more familiar. The hundreds of European Goldfinches flying free and breeding across the Upper Midwest reportedly stem in part from multiple releases by an heiress from Eastern Europe willing to pay \$90 a pair to have her favorite birds from back home singing in her suburban Chicago garden.

HELPING GARDEN CITY BIRDS

While a small number of bird fanciers are enhancing their yards and neighborhoods with the sights and sounds of their favorite exotic birds, millions of suburbanites prefer to make these areas better habitat for native birds by providing food, nest boxes, and native tree and shrub plantings. Americans have a long history of gardening and landscaping to attract birds to their homes. In 1773, Peter Kalm recounted the delights of watching the antics of hummingbirds in his garden, and recommended planting flower gardens in order to attract these “beautiful and agreeable little birds” (Kalm 1773). Twenty years later, Thomas Jefferson wrote to his wife that he hoped new plantings of trees and shrubs around Monticello would attract mockingbirds, as “they like to be in the neighborhood of our habitations if they furnish cover” (Jefferson 1793). In the 1880s, Baron Hans von Berlepsch devised elaborate landscaping techniques to attract birds to his Prussian castle grounds near Stuttgart—making landscaping, along with feeding, nest box placement, and predator control, a pillar of his “bird protection” strategy (Berlepsch 1899; Lang 1899; Trafton 1910; Kennard 1912).

In the United States, Minnesota educator Dietrich Lange, himself a Prussian immigrant, popularized “the Berlepsch approach,” including how to attract birds through planting appropriate trees and shrubs. Gilbert Trafton described the rationale and strategies of this approach in 1910,

The chief problems in the bird’s life have to do with securing food and water, the rearing of young, and protection at all times from the dangers to which they are exposed. Effective means of attracting birds must take all these problems into account. The food-requirements may be partly met by

feeding birds in winter and planting shrubs and trees which provide fruit (Trafton 1910).

In selecting plants for a bird garden, Lange recommended fifty two different trees and shrubs, including those bearing fruit, and extolled the virtues of planting long tubular flowers attractive to hummingbirds (Lange 1899). For over 100 years, Audubon societies have promoted gardening for birds. Their official magazine *Bird-Lore* published frequent articles with tips for creating bird gardens, continuing after its name change to *Audubon* magazine in 1941. During the mid-20th Century, publishing houses offered a steady stream of books on the subject included Margaret McKenny's *Birds in the Garden and How to Attract Them* (1939), Audubon president John H. Baker's *Audubon Guide to Attracting Birds* (1941), *Audubon* magazine editor John K. Terres' *Songbirds in Your Garden* (1953), and Thomas P. McElroy, Jr.'s *The New Handbook of Attracting Birds* (1960).

Since the 1970s, gardening for birds has enjoyed a renaissance, with new bird gardening books published annually, and in recent years, even more frequently. In 1972 New England artist and author Ruth Sawyer Billard coined the term "birdscaping" to describe the practice of creating bird-friendly urban environments (Billard 1972), and birdscaping books have become a publishing staple, with several new titles appearing each year, and millions taking their advice and planting backyard habitats. The 2001 *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* found that perhaps one in ten of the nation's 82 million gardeners maintain gardens to help birds and other wildlife (U.S. Department of the Interior, Fish and Wildlife Service and U.S.

Department of Commerce, U.S. Census Bureau 2007). Many more may be interested, as indicated by a National Gardening Association survey finding that nearly 26% of gardeners take time to learn more about caring for wildlife at home (National Gardening Association 2005).

In addition to furnishing native plants for backyard birds, many suburbanites enjoy providing food for their favorite birds. By the end of the 19th Century, bird enthusiasts were encouraging wild birds to settle in their yards by providing food in addition to shelter. In 1845, Henry David Thoreau offered corn and bread crumbs to birds at his Walden cabin (Thoreau 1854). Since commercially available seed was unavailable, Dietrich Lange and other early bird feeders collected sunflower and other plant seeds for use at feeding stations. While Lange provided an illustration of a rudimentary bird feeder in his book, most of his feeding suggestions involved creating an elevated board or platform, or spreading food on the ground. He also recommended constructing bird baths and providing crushed egg shells for songbirds during egg laying. Lange explicitly derived many of his bird feeding techniques were from methods pioneered by Elizabeth B. Davenport's bird feeding program in Brattleboro, Vermont. During the 1890s, Davenport attracted flocks of finches and other passerines during the winter with suet, cracked corn, hemp, buckwheat, and other bird seed (Lange 1899).

Early bird feeding efforts were mostly noncommercial affairs, with enthusiasts collecting their own seeds, or perhaps purchasing 50 pound bags of wheat or sunflower seeds from feed mills (Henderson 1999). By 1923, Winthrop Packard of Canton, Massachusetts was advertising mail-order "special mixture bird food" and an "automatic food-house" bird feeder in *Bird-Lore*. Other than mail-orders, wild bird seed was not

easily available until Bill Engler of Chilton, Wisconsin began marketing small bags of seed in the late 1950s (Henderson 1999). By the 1940s, *Audubon* readers could purchase commercially produced bird feeders advertised in the magazine, including a line of official Audubon feeders featured in a full-page or half-page advertisement in every issue. The earliest seed feeders were usually either covered or uncovered platforms or gravity-fed hoppers or “house” feeders mounted on poles. While Berlepsch invented a gravity-fed hanging jar “bell feeder” in the late 1800s, commercially produced tubular seed feeders were not widely available until artist and engineer Peter Kilham formed Droll Yankees Inc. in 1969 to market and distribute his metal and plastic A-6F tubular feeder (Dennis 1999). While one authority listed twenty major bird feeder companies in the early 1950s (Terres 1953), hundreds of companies now market seeds and variations of the three feeder types to backyard bird enthusiasts, and bird feeding has become a popular past-time enjoyed by nearly half of all U.S. households (Cornell Laboratory of Ornithology 2006).

In addition to providing seeds for granivorous birds, early bird feeders learned that they could attract woodpeckers, nuthatches, and other insect eating birds by catering to their needs. Lange suggested attracting birds by nailing pieces of fat and suet to the boughs of trees, and creating an outdoor “Christmas tree” ornamented with “bits of raw, unsalted meat, suet, split walnuts, and other nuts” (Lange 1899:56). Bird feeding enthusiasts continued to promote suet feeders (Trafton 1910), and by the 1940s, the Hyde Bird Feeder Company was advertising the “chickadee diner,” a hanging feeder with three holes for suet and seed “chickadee treats” on each of its four sides. While suet feeders are less common than seed feeders, one survey of active bird feeding enthusiasts found

that 54 percent fed suet to birds (Dunn and Tessaglia-Hymes 1999). Suet is particularly attractive to woodpeckers, such as the Downy Woodpecker, which find suet a good substitute for beetle larvae, their favorite food. Other species, such as chickadees and titmice will regularly visit suet feeders, and the list of species observed at least occasionally taking suet includes most of North America's arboreal insect-eating birds.

In addition to providing seeds and suet for garden birds, turn-of-the-century bird lovers experimented with ways to attract hummingbirds. In 1900, Caroline B. Soule of Brookline, Massachusetts created perhaps the first artificial hummingbird feeder out of a small vial and paper flower (Soule 1900). In 1926, California banker B. F. Tucker began to make and sell small glass hummingbird feeders (Dennis 1999). When *National Geographic* featured these feeders in a 1928 *National Geographic* article, Laurence J. Webster of Boston was inspired to design his own blown-glass feeder. Two decades later, *National Geographic* illustrated Webster's feeders in a 1947 article, and the Audubon Novelty Company in Medina, New York began advertising the feeders in *Audubon* later that year (Chambers 2004). To promote his rival feeders, Tucker created a "hummingbird bar" installed along the side of a building "where 200 hummingbirds feed at one sitting" (Milne and Milne 1949).

During the early 1950s, hummingbird feeders advertised in *Audubon* magazine were mostly glass tubes with an artificial flower at the bottom, though as late as 1956, the Tucker Bird Sanctuary in Modjeska Canyon, California was still selling the older "Tiny Tucker" feeder, which consisted of a bottle with a single spout at the bottom. The next year, Dinah Dee of San Antonio, Texas began selling a new feeder with two feeding dispensers at the bottom, and two months later *Audubon* was advertising four different

styles of hummingbird feeder, including a hanging hook with two cups on the bottom to be filled with sugar water. In the mid 1960s, The Hari House in Philadelphia advertised ceramic hummingbird feeders fashioned in the shape of a bright yellow or persimmon hibiscus or a purple and pink or purple and blue fuchsia. In 1965, The Hummer Inn of Palo Alto, California first offered a “dripless” hummingbird feeder made of “unbreakable polyethylene.” Since the 1960s, hummingbird feeders have become mainstream, with a wide variety of feeders offered by specialty stores, as well as plastic models sold in home and garden centers nationwide.

While early bird feeding enthusiasts had noted that orioles would occasionally come to seed if bird feeding operations were continued throughout the summer, in 1958 Ruth Thomas wrote in *Audubon* that orioles were coming to her hummingbird feeder in Arkansas (Thomas 1958). In 1965, Hummingbird Heaven of Tujunga, California began marketing a new “oriole bar” designed by Erwin M. Brown. While hummingbird feeding benefited from twenty years of feeder advertising in *Audubon* magazine, the new oriole feeders didn’t get as much publicity. In 1966 Les Line took over editorship of *Audubon* magazine, eliminated the popular “Bird Attracting” column, and reduced the number and size of bird feeding advertisements. Only recently have a range of oriole feeders become more commonplace, benefiting from advertisements in the newer birdwatching magazines *WildBird*, *Birder’s World*, *Birdwatcher’s Digest*, and *Birds & Blooms*.

In spite of *Audubon*’s near abandonment of bird feeding as a regular magazine feature in the late 1960s, feeding birds has exploded as a pastime over the past 30 years. According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 55.5 million Americans feed wild birds or other wildlife in their backyards—

making bird feeding the most popular wildlife recreation activity in the United States. Backyard bird feeders spend \$3.5 billion on birdseed and wildlife food and \$800 million on birdfeeders, birdbaths, and nesting boxes (United States Fish and Wildlife Service 2007). According to an earlier 2001 survey, backyard bird feeding is comparatively more common in the Northeast and Mountain West, and less common in the South and West—with the highest participation rates in Montana (44 percent) and lowest rates in California and Texas (14 percent) (United States Fish and Wildlife Service 2002).

According to regular surveys conducted by the Wild Bird Feeding Industry, most backyard bird feeders are women who watch birds from their kitchen window. Most bird feeders do not target their efforts to attract particular birds, but they are interested in getting a wider variety of birds to attend their feeders (Wild Bird Feeding Industry 2006). Though the majority of birders cannot identify more than 20 bird species (United States Fish and Wildlife Service 2002), they often become attached to the birds that they see every day, and are motivated to “help” the birds that they often come to see as their “little friends.”

Those who really want to help birds in their yards often put up birdhouses or nest boxes. Providing housing for wild birds dates to early Native American as well as Medieval European traditions. In the late 17th Century, English clergyman and naturalist John Banister reported that Native Americans in Virginia hung gourds near their residences to attract nesting Purple Martins—reportedly for their value in driving crows and other “vermin” away from their corn and garden plots (Banister 1678-1692). Meanwhile, English colonists were also inviting birds to nest near their homes. Archaeologists at Colonial Williamsburg have unearthed ceramic bird pots mounted on

building exteriors to entice birds to nest near homes and gardens (Creel 1997; Ripley 2002). Colonists imported these pots from Europe, where a tradition of hanging bottles, also known as sparrow pots, starling pots, or nesting pots, first appear in England around 1500. In Medieval Europe, these pots attracted starlings and sparrows for the kitchen pot, and Dutch landscape painters frequently depicted them in their works (Cooper 2003). In America, where sparrows and starlings weren't introduced until the 19th Century, these pots attracted martins, wrens, and bluebirds.

In Colonial Jamestown, Virginia, the wealthy colonel and President of the King's Council, Nathaniel Bacon, Sr., "delighted much" in Purple Martins, and placed a large nesting box for them under the eaves of his house (Clayton 1693). The practice of erecting martin houses grew even more popular in the 1700s. While some enthusiasts, like Colonel Bacon, were clearly motivated by an affinity for the birds, others may have had more utilitarian motivations. In 1772, the Swedish traveler Peter Kalm remarked that "I have seen in several places little houses made of boards, and fixed on the outside of the walls, on purpose that these Martins may make their nests in them; for the people are very desirous of having them near their houses, because they both drive away hawks and crows as soon as they see them" (Kalm 1773).

Martins, which easily adapted to life with humans, may have attracted the most attention, but other species were also adapting to life in human settlements and using nest boxes provided by their human neighbors. In *Memoirs of an American Lady*, Anne Grant described a garden in 18th Century Albany, New York, where a small shelf was placed on the house as a nest platform for small birds, and garden fence-posts "are surmounted, every one, with an animal skull...a hospitable arrangement for the

accommodation of the small familiar birds” (Leighton 1986). In addition, Grant notes that the house slaves were allowed to make nesting sites for small birds by nailing old hats with holes in them to the side of the kitchen, while others might leave dead trees standing in the garden for the birds’ “emolument” (Leighton 1986).

While many of these early bird houses were home-made rustic affairs, well-to-do landowners could hire craftsmen to construct more substantial martin homes. In Boston, the firm of Rea and Johnston was servicing “wren houses” by 1780, and painted two “martin boxes” for a wealthy client in 1785 (Candee 1966). By the early 1800s, building houses for birds was widespread. Pioneering ornithologists Alexander Wilson and John James Audubon listed houses built for wrens, bluebirds, and martins (Wilson 1970; Ford 1957).

By the end of the 19th Century, bird enthusiasts were providing houses for additional species. In 1899, Dietrich Lange provided housing instructions for over a dozen species in *Our Native Birds: How to Protect them and Attract them to our Homes*. Lange offered appropriate dimensions and wooden house plans for a popular species including titmice, chickadees, wrens, nuthatches, creepers, woodpeckers, bluebirds, phoebes, swallows, martins, and Wood Ducks. He also suggested boxes for Barn Owls and other “useful” birds (Lange 1899).

The back to nature movement of the early 20th Century represented a watershed in research on nest box designs, with Lange encouraging experimentation so that additional native species might “learn to live in ‘white man’s houses’” (Lange 1899: 40). In 1904, The Audubon Society’s *Bird-Lore* magazine published an article on feeding and housing birds, and an entire issue of the magazine was dedicated to bird house design and

construction in 1905. After an additional decade of experimentation, the U.S. Department of Agriculture published nest box plans for additional species, including Great-Crested Flycatcher, American Dipper, and screech-owls (Dearborn 1914).

While most nest boxes were home-crafted affairs, commercially built boxes were readily available and advertised in magazines such as *Bird-Lore*. Prussian ornithologist and bird conservationist Baron von Berlepsch advertised a line of artificial woodpecker cavities carved out of logs. However, the rustic Germanic designs were not as attractive to Americans as those more closely resembling Lange's "white man's houses" (Lange 1899). Perhaps the most famous and extreme of these Americanized bird houses were enormous martin houses patterned after the U.S. Capitol Building. J. Warren Jacobs and his Jacobs Birdhouse Company in Waynesburg, Pennsylvania built these six feet tall bird extravaganzas until Jacob's death in 1947. Other firms promoted unique birdhouse designs. In 1923, John Lloyd Wright, Inc., "makers of the famous Lincoln Logs" toys, advertised wren houses made out of Lincoln Logs on the back cover of *Bird-Lore*.

While many people put up bird houses out of a vague desire to help birds and enjoy them in their yards, others have engaged in systematic efforts to provide housing for their favorite birds. In addition to nest boxes, turn-of-the-century bird enthusiasts such as Mable Osgood Wright were experimenting with installing platform shelves as nest sites for other species including American Robins and Eastern Phoebe (Trafton 1910). By the 1950s, some authorities even suggested mounting small roofed nesting platforms on small poles in garden shrubbery for Song Sparrows (Terres 1953; Schutz 1963). Others have experimented with installing wire mesh cones in trees to encourage nesting Mourning Doves, Great Horned Owls, and Long-eared Owls (Kress 2006), and

underground burrows made out of wood or PVC pipe for Burrowing Owls (Collins and Ross 1977; Texas Gulf Coast Field Research Station 2006).

Owls are increasingly popular with birdhouse enthusiasts, with efforts underway in many urbanizing areas to provide nest boxes for Barn Owls (Maryland Wildlife and Heritage Service 2004; Culbert 2005). These nocturnal hunters used to nest in open urban areas, including the Smithsonian tower in Washington, DC during the 19th Century (Maynard 1902), but have lost traditional nesting places and hunting areas to suburban sprawl. Meanwhile, suburbanites in many areas are carefully watching boxes designed to help Eastern Screech-Owls (Balinsky and Balinsky 2006; Johnson 2006; Shackelford 2006) and the larger Barred Owl (Owlcam.com 2006).

In the Eastern United States, large Purple Martin houses on poles are often the most visible sign of people trying to make their yards better for birds. Purple Martin enthusiasts have established martin colonies in millions of suburban backyards, rural properties, and exurban homesteads. Many of these martin “landlords” are dedicated to tinkering, experimenting, and constantly seeking ways to improve the nesting success of their birds. Tony Frederickson, a retired US Air Force Lt. Colonel from Seguin, Texas, has turned his small suburban backyard into a Purple Martin “super colony” that fledges over 1,000 baby martins each year. Frederickson started caring for martins in 1995 with two martin houses that attracted three pairs of birds. By 2004, his yard contained twenty nine multi-compartment martin houses, and fifty one hanging plastic martin gourds. He religiously checks each nesting compartment and nest gourd every five days to make sure the birds are healthy, and maintains a constant vigil to keep predators and competitors out of his colony by trapping House Sparrows, shooting European Starlings, and keeping

snakes at bay with metal predator guards mounted on the poles below each martin house (Chambers 2004).

Frederickson's efforts and record-keeping may be more akin to livestock management than typical bird feeding or housing practices, but they are encouraged by national organizations such as the Nature Society, the Purple Martin Conservation Association, and the Purple Martin Society, NA, which promote the active management of martin colonies (Doughty and Fergus 2002). New martin housing products appear for sale each year, and well-tended martin colonies with the latest innovations can produce phenomenal numbers of birds. In Frederickson's case, his first nine years of Purple Martin landlording resulted in 1079 total nesting attempts, with 5710 eggs laid, 4635 eggs hatched, and 4478 young fledged (Chambers 2004). While these results may dwarf those of most martin landlords, even the more passive "martineers" are united in their love for their preferred birds, and their determination to help them thrive.

Birdhouses range in price from cost free wren boxes made from scrap lumber, to aluminum Purple Martin house and steel pole assemblies costing over \$1,000. The largest, most elaborate, and perhaps most expensive bird houses are actually towers created to house Chimney Swifts. As early as 1910, Gilbert Trafton suggested that it might be "worth while to experiment with the Chimney Swifts, by making artificial chimneys of wood in imitation of the old-fashioned chimneys so commonly frequented by these birds," and without details he indicated that such "board chimneys" had been successfully employed (Trafton 1910). In 1915, Iowa bird researcher Althea Sherman took up the suggestion and built a large wooden tower specifically for Chimney Swifts. More recently, Paul and Georgean Kyle of Mansfield, Texas have promoted swift tower

construction through the formation of a swift research program, an annual newsletter, and two books published by Texas A & M press (Kyle and Kyle 2005a; Kyle and Kyle 2005b). So far the Kyles have documented 119 swift towers constructed by swift admirers in twenty one states, with numbers growing as other organizations, such as the National Audubon Society, promote tower construction (National Audubon Society 2006).

BACKYARD HABITAT PROGRAMS

In 1973, the National Wildlife Federation (NWF) created a backyard habitat program to encourage landowners to provide food, shelter, and water for wildlife. By 2008, the NWF program had certified just over 100,000 backyard habitats, a small fraction of nation's 55 million backyard bird feeders (United States Fish and Wildlife Service 2007) or 8.7 million backyard wildlife-viewers that maintain plantings for birds and wildlife (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2002). Run mostly as a membership development effort, the NWF Backyard Wildlife Habitat program requires homeowners to pay \$15 and provide a minimal wildlife habitat—three food sources, one source of water, two sources of cover, two nesting sites or wildlife nursery areas, and two sustainable gardening practices.

Hundreds of other organizations including state agencies and local nonprofits promote creating backyard habitats. The Humane Society of the United States offers an Urban Wildlife Sanctuary Program, and several state wildlife agencies sponsor similar

certification programs³, as do a handful of local environmental groups and watershed organizations,⁴ as well as Audubon chapters.⁵ Many others offer guidance on creating backyard habitats, including most state wildlife agencies, cooperative extension services, and Audubon chapters.

In 2000, the National Audubon Society began actively promoting backyard habitat creation for the first time in over thirty years. That spring it launched BirdCast, a partnership with EPA's Office of Pesticides Programs, the Cornell Lab of Ornithology, Clemson University's Radar Ornithology Program, the Academy of Natural Sciences in Philadelphia, and GeoMarine, Inc. to track songbird migration and encourage homeowners to manage their backyards as safe stopover habitat for migrants. Audubon developed Healthy Habitats to support BirdCast, and began promoting its five healthy yard principles: reduce pesticides, conserve water, protect water quality, remove invasive exotic plants, and plant native plants. By fall 2001, Audubon was supporting this program with a new vice president position, and had renamed the program Audubon At Home (Table 3.1).

³ State backyard wildlife programs include the Kentucky Department of Fish & Wildlife Resources Backyard Wildlife Habitat Program, Texas Parks and Wildlife Department Best of Texas Backyard Habitat program (offered jointly with the NWF program), and the West Virginia Department of Natural Resources WildYards program.

⁴ Local programs include the Three Rivers Land Conservancy's West Willamette Corridor Backyard Habitat Certification Program in Lake Oswego, Oregon, and the Maryland Master Gardener's Bay-Wise Landscape program.

⁵ Audubon Chapters with habitat certification programs include Atlanta Audubon Society (Georgia), Audubon Society of Portland (Oregon), and Valley Forge Audubon (Pennsylvania).

Table 3.1 Audubon At Home (AAH) Program Timeline.

Spring 2000	Public launch of BirdCast
May 2000	<i>10 Commandments for a Healthy Yard</i> in Audubon Magazine
July 2000	Healthy Habitats program launched, director hired
Feb 2001	<i>Audubon Guide for a Healthy Yard and Beyond</i> (250,000 copies)
Jun 2001	“Habitat Hero” awards in Tampa, Seattle, San Antonio Reprint <i>Audubon Guide for a Healthy Yard and Beyond</i> (250,000 copies)
July 2001	Second Healthy Yards director hired
Sep 2001	VP of Audubon At Home appointed to expand Healthy Habitats program
Oct 2001	Audubon At Home (AAH) announced to chapters and state offices
Dec 2001	Audubon board incorporates AAH into strategic plan
Jan 2002	EPA grant to Audubon for Seattle Audubon workbook
Mar 2002	Habitat Heroes featured in <i>Audubon</i> magazine <i>Lawn Pesticides: An Unacceptable Risk</i> (AAH and Audubon NY)
Jun 2002	Audubon joins NRCS Wildlife Habitat Management Institute Audubon receives \$75K grant from USFWS to support Urban Bird Treaty
July 2002	Reprint <i>Audubon Guide for a Healthy Yard and Beyond</i> (250,000 copies)
Sep 2002	Healthy Yard program becomes Audubon At Home (AAH)
Nov 2002	<i>Healthier Choices: The Audubon At Home Guide to Healthier Pest Control</i>
Jan 2003	AAH receives \$500K NRCS appropriation <i>Audubon At Home in Seattle: Gardening for Life</i> (10,000 copies)
Oct 2003	Audubon Ohio AAH program
Dec 2003	Audubon Pres. John Flicker spotlights AAH in <i>Audubon</i> magazine
April 2004	AAH receives second NRCS appropriation (\$500)
May 2004	Audubon Society of Northern Virginia AAH program
Jun 2004	AAH and NRCS planning meeting at Aullwood Nature Center in Ohio
Oct 2004	John Flicker establishes national AAH advisory group
Dec 2004	Audubon Science office hires AAH Science Coordinator
Feb 2005	AAH receives third NRCS appropriation (\$500)

Mar 2005	Publication of <i>Gardening for Life in Southeastern Pennsylvania</i> Spanish Healthy Yard and Beyond brochure (150,000 copies)
Jun 2005	AAH reprints NRCS <i>Backyard Conservation</i> booklet Colorado AAH book
Aug 2005	AAH ranchette programs in Arizona, Colorado, and Wyoming
Sep 2005	Audubon Society of Northern Virginia book published
Dec 2005	AAH program manager hired in Communications department
Jan 2006	Audubon At Home strategic planning begins, four major goals established
April 2006	Healthy Yard Pledge launched, mentioned in John Flicker's monthly column
April 2006	<i>Invite Birds, Bats, and Butterflies</i> poster series launched with printing of 750,000 posters AAH website with online materials to support poster series and pledge AAH featured in poster session at AMNH Conservation of Birds in Human-dominated Landscapes symposia.
May 2006	AAH presented to State Directors at annual meeting in Vail, CO
Jun 2006	AAH receives fourth NRCS appropriation
July 2006	AAH program manager position moved to Education department
Oct 2006	Audubon Pennsylvania and Audubon Maryland/DC AAH programs
Nov 2006	AAH featured in paper presentation at 4 th North American Ornithological Conference in Veracruz, Mexico.
Dec 2006	Audubon prints Spanish edition of NRCS <i>Backyard Conservation</i> booklet
Aug 2007	<i>Birds to Help</i> website launched
Feb 2008	Audubon Birdscapes blog
Nov 2008	My Yard eBird launch Online <i>Neighborhood and Community Bird Conservation Workbook</i>

At the national level, Audubon At Home initially focused on reducing residential pesticide use, and with funding from the National Resources Conservation Service, Environmental Protection Agency, Waste Management, and private donors, published outreach materials including books, posters, and brochures. A national team helps state

Audubon offices⁶ and local Audubon chapters⁷ develop their own Audubon At Home programs and materials. In 2006, Audubon launched an online Healthy Yard Pledge to enroll homeowners willing to support healthy yard principles,⁸ and also launched a *Birds to Help* website to encourage local chapters and other groups to create habitat for charismatic umbrella species in urban, suburban, and rural yards and properties. In 2008, Audubon Pennsylvania rolled out a new pilot Bird Habitat yard recognition program, focused specifically on what people can do to help birds on their property, with hopes that other Audubon state offices and chapters will eventually work together to take the program nationwide.

Audubon At Home has struggled over the years with competing organizational priorities, a decentralized organizational structure, and shifting leadership within Audubon. Audubon has spent most of its resources and energy into building quasi-independent state Audubon programs and constructing nature centers. The initiative started out with direct responsibility at the vice president level, but responsibility has slowly shifted down to a part-time program manager buried within the Education program—making it difficult to coordinate on a national level. Since Audubon state organizations operate independently and are free to develop whatever programs they can fund, and Audubon chapters are separate nonprofits affiliated with the national program, AAH only thrives at those levels when national staff can encourage states and chapters to

⁶ Audubon state offices with AAH programs include California, Mississippi, Maryland, Pennsylvania, and Ohio. Arizona, Colorado, and Wyoming have AAH programs directed towards ranchette owners.

⁷ Audubon Seattle created the first AAH chapter program around a gardening book funded by the EPA and National Audubon. Audubon Society of Northern Virginia created a program with funds from the national NRCS AAH appropriations. Other chapters support AAH principles without making it the focus of their own local program.

⁸ As of October 2008, with very little promotion, over 2,400 homeowners have taken the Healthy Yard pledge, representing over 6,900 acres on 656 urban, 1,073 suburban, and 676 rural properties.

support them. In this organizational environment, a small handful of national staff promote national AAH priorities and programs directly to the public through online and print media, as well as function as facilitators and consultants to local Audubon programs. Funding for AAH through the most recent of five USDA Natural Resources Conservation Service appropriations is dedicated to integrating the program throughout Audubon by improving communications with chapters and USDA field offices through an *Audubon Birdscapes* blog, regular conference calls, and an electronic newsletter. The goal is to get a majority of the 480 Audubon chapters involved in helping urban and suburban birds through a Healthy Yard program, local *Birds to Help*, or a national Bird Habitat program.

ROAMING CATS

With many people planting habitat, providing food, and offering housing for birds in suburban neighborhoods, birds there still face many perils. As noted in the discussion of Zone 1, windows take a tremendous toll on American birds, with each of the more than 76 million single family homes in the county (National Energy Information Center 2002) contributing to the carnage. But feral and free-ranging house cats roaming suburban yards and neighborhoods are an equally potent threat to birds. Activists routinely claim that birds kill over 100 million birds each year in the United States (American Bird Conservancy 2007), though other estimates based on the most recent research indicate that the number is potentially as high as 3 billion birds killed each year (Dauphiné 2008). Whatever the actual predation rates, cats pose a significant threat to birds across the urban to rural gradient. Early ornithologists Wilson and Audubon both noted that cats

were enemies of wrens, and by the late 1800s, bird lovers were considering ways to protect garden birds from predatory housecats. Audubon President William Dutcher wrote in *Bird-Lore* in 1909:

My neighbor's cats this past summer killed all of my lovely Warblers but one, eighteen in all, and two Wrens I know of, two Red-headed Woodpeckers, several other birds whose names I do not know; you will understand my feeling of antipathy for cats. Our Society will not be doing its full duty toward the defenseless birds until it in some manner curtails the liberty of those blood-thirsty creatures (Dutcher 1909).

Another reader, Martha Barrows of Chicago, suggested a tax on cats be levied, to discourage cat ownership. The next year, another Chicago reader urged the Audubon society to lobby for cat leash laws to keep cats from wandering free in the cities. Some enthusiasts even constructed cat fences to eliminate feline trespass. In 1917, Audubon society members unsuccessfully attempted to pass anti-roaming laws in the state legislatures of Massachusetts, New Hampshire, Connecticut, New York, New Jersey, and Wisconsin. While these efforts did see a few laws passed, the Audubon society as a whole did little beyond raising the issue to the consciousness of birdwatchers.

Roaming house cats are especially threatening to ground-nesting and shrub-nesting birds, many of which have disappeared from suburban areas and even otherwise healthy-looking urban natural areas and parks. They also take a heavy toll on recent fledglings and young inexperienced birds. Cats kill small and large birds alike. In South Texas, roaming cats decimated one neighborhood population of Plain Chachalacas, large

brown pheasant-like birds cared for by the local bird enthusiasts in Weslaco.

Homeowners who feed birds without controlling their local cat populations, may be doing more harm than good for the local birds by creating easier hunting opportunities for the cats.

The American Bird Conservancy (ABC) was the first major nongovernmental agency to mount a concerted effort to address the issue of cat predation. In 1997, the ABC board passed a resolution opposing outdoor cats, created a *Cats Indoors!* campaign, and hired a full-time coordinator to assist local groups in addressing cat problems in their communities. ABC supports local groups with information on their website and media materials, including flyers, brochures, and videos. To improve responsible ownership of cats, ABC recommends mandatory cat licensing and identification, as well as local legislation to restrain cats from roaming. Unfortunately, after ten years of campaign work, *Cats Indoors!* remains under-funded and is currently floundering after the resignation of its longtime coordinator.

While still a novelty, many communities including Aurora, Colorado and Montgomery County, Maryland have enacted ordinances requiring cats to be confined to their owner's property, or nuisance laws that allow owners of wandering cats to be issued citations and fines. In Tampa, Florida, the director of the Hillsborough County Animal Shelter worked with a city animal advisory commission for two and a half years to suggest and build public support for comprehensive cat legislation including anti-roaming provisions and mandatory cat registration and identification. Using online surveys and citizen working groups, the commission crafted a proposal with broad public support which passed in June 2000. While a strong step towards controlling feral and outdoor

cats, enforcement of the ordinance remains a problem. Only one third of all cats in Tampa are legally tagged, and it is difficult to gain compliance from the working poor who can't afford the license fees, and Hispanic residents with a more lenient culture of cat ownership and less trust of authorities.

A well organized lobby of feral cat advocates actively opposes adoption of anti-roaming ordinances, and many cities and conservation groups are hesitant to tackle the issue for fear of offending the cat-lovers. Alley Cat Allies, a vocal national nonprofit spends over \$4 million each year setting up feral or stray cat feeding stations, and vigorously opposing attempts to round up feral cats, or the creation of anti-roaming ordinances (Alley Cat Allies 2008).

While cat lovers are motivated to public action by a desire to save cats from being put down in animal shelters, bird enthusiasts are rarely motivated to take similar action on behalf of neighborhood birds. In Austin, only two members of the 2,300 Travis Audubon Society were willing to participate in a community working group convened by the municipal animal shelter to address the problems posed by free-ranging cats. After a lengthy and professionally facilitated community-building process, the Austin group was able to find consensus and recommend measures including an anti-roaming ordinance that the bird-lovers and cat fanciers were both happy with. While Austin has yet to enact an anti-roaming ordinance for cats, dozens of cities across the country have these ordinances, including Chicago, Houston, and Dallas. Many homeowners associations also include anti-roaming provisions written into their codes, covenants, and restrictions.

Despite a growing number of cities enacting anti-roaming ordinances for cats, efforts to protect birds from housecats, as with similar efforts to protect birds from

collisions, are still mostly voluntary individual efforts, with only a relatively small number of communities having taken official action to address the issues. The future of birds in the gardens of suburbia may well depend on a more vigorous approach to keeping them free from our feline companions, those cute murderous furballs, that kill up to five percent of all birds in the United States each year.

Chapter 4—Urban Oases (Zone 3)

Few sounds stir the heart with echoes of wild America as do the shrill guttural cries of Sandhill Cranes. As I watch, dozens of these tall grey birds soar overhead in wide circles. They slowly descend, calling incessantly with long legs dangling, before alighting in a small field. Behind them, Canvasbacks and other waterfowl mingle in a small pond, while a small group of Cackling Geese and a lone Snow Goose mix with a flock of over one hundred Canada Geese. Mountain Chickadees, Spotted Towhees, and Western Scrub-Jays call from nearby trees and bushes. Even in the depths of winter, in less than an hour I easily find nearly forty bird species here at the Rio Grande Nature Center, a 270 acre oasis of cottonwood forest, meadows, and ponds surrounded by suburban Albuquerque, New Mexico.

Similar oases are found in every urban area, including official open spaces such as parks, preserves, and golf courses as well as vacant lots, undeveloped parcels, creek flood plains, and steep hillsides. Lakes, reservoirs, and ponds are also important urban habitats. These oases (Zone 3) provide patches of habitat allowing hundreds of native bird species to thrive within the heart of American cities. As the public and local officials grow to appreciate the habitat value of these urban oases, they often take additional steps to protect and manage them to benefit birds. These areas are also favored birdwatching spots, where millions of urbanites develop environmental sensibilities by connecting with birds and other wild creatures.

PARKS AND OPEN SPACE

Parks and other official open spaces are prominent features of American cities. Colonial towns and cities featured commons, church greens and courthouse squares, and by the late 1700s, Philadelphia and New York had created ornamental urban squares as public amenities. By mid-19th Century, many city dwellers began to bemoan the loss of healthy open landscapes as infilling and rebuilding cycles created industrial urban centers dominated by buildings and roads. Inspired by the European Romantic movement and the fashionable principles of English landscape gardening, influential designers like Massachusetts Horticulture Society president Henry Dearborn and Bronx real estate promoters David Douglas and Henry Pierrepont sought to bring rural sights and sensibilities to urban centers by creating pastorally landscaped memorial gardens, such as Mount Auburn Cemetery, Boston (1831), Laurel Hill Cemetery, Philadelphia (1835), Green-Wood Cemetery, Brooklyn (1838) (Schuyler 1986). By 1849, cemetery promoter Alexander Jackson Downing claimed that “scarcely a city of note in the whole country has not its rural cemetery” (Schuyler 1986), and there currently over 80,000 cemeteries across the country.⁹ Early cemeteries, with their verdant lawns and groves of trees formed urban savannahs and woodlands that attracted Red-headed Woodpeckers, bluebirds, and ground-foraging American Robins and Chipping Sparrows (Maynard 1902). Victorian cemeteries often incorporated evergreen conifers as symbols of eternal life, attracting additional species, including kinglets, crossbills, siskins, and other winter visitors from boreal Canada.

⁹ Google Maps currently (Oct 2008) returns results for 80,700 cemeteries.

Inspired by the popularity of memorial garden cemeteries and the large landscaped urban parks appearing in Great Britain, developers began to create additional green open spaces in the heart of American cities (Whitehand 1992, Tuason 1997). Built as pleasure grounds for strolling and cultivation of refined landscape aesthetics, these pastoral scenes with large trees and open lawns were designed in the English landscape garden by pioneering landscape architects such as Central Park designers Frederick Law Olmstead and Calvert Vaux. After the New York legislature designated 700 acres for Central Park in 1853, other large cities began following suit. By 1870, nearly a dozen large landscape parks graced major American cities, including Golden Gate Park in San Francisco and Tower Grove Park in St. Louis, both established in 1868. Oakland, California created Lakeside Park at Merritt Lake, and the state legislature designated it a wildlife refuge in 1870—the first official wildlife refuge in the country. Chicago, Los Angeles, San Antonio, and over a hundred other cities established large landscape parks before the end of the 19th Century (Schuyler 1986; Tuason 1997). Bird counts in 19th Century parks often came up with only common woodland birds in small numbers. One observer, noting a meager seven species in Chicago’s Washington Park, admitted that it was “not much of a list, but we are thankful for small favors in the bird line in a city of this size” (Chase 1899).

Besides landscaped pleasure grounds, cities soon created additional types of parks including nature preserves, playgrounds, and athletic fields. In 1868, Philadelphia was perhaps the first city to create an intentional nature preserve when it acquired the lower Wissahickon Creek to protect it from development, incorporating it into Fairmount Park, previously established in 1854. Other cities soon followed: New Haven set aside Rock

Park in 1880, and Boston reclaimed the Muddy River as a park in the mid-1880s. With the creation of landscaped pleasure grounds as well as nature preserves, Boston and other cities began working to establish urban park networks to include a wide range of park types. In 1889, Boston created a children's playground at its Charlesbank Park. Other city park developers soon incorporated playgrounds and sports fields into the large landscaped parks across the country, and the early decades of the 1900s saw an explosion in playground and athletic field development in American cities. By 1930, there were 7,240 playgrounds in cities across the country (Tuason 1997).

At the opening of the 21st Century, American cities host a wide range of parks and preserves. A recent survey of the 55 largest U.S. cities found 642,871 acres of parkland covering from 2-20 percent of each city. This does not represent all parkland, only municipal parks within the city corporate boundaries. City parkland ranged from Jacksonville, Florida with 49,785 acres of parkland to Miami with a paltry 1,138 acres of city parks. Only Fresno, California reported a smaller percentage of its land designated to parks, with 1,323 acres covering only 1.98 percent of its incorporated area. Surprisingly, New York City at the heart of the quintessential megalopolis, has the highest percentage of its land designated as parkland, with 36,646 acres covering almost 19 percent of the city (Garvin 2004).

In addition to parks and preserves, urban oases include what might be termed "uncultivated habitats" (Spirn 1984) or "marginal nature" (Anderson 1999), less-managed or unofficial green spaces such as undeveloped parcels, vacant lots, steep hillsides, and creek bottoms. Sometimes these areas are remnants of larger native habitats, while others are new habitats support a mixture of native and invasive exotic

grasses, forbs, shrubs, and trees. A wide array of birds live in these spaces, and depending on the size and configuration of any given habitat patch, it may sustain native bird species not found elsewhere in the city. In 1916, a birdwatcher in Lynn, Massachusetts celebrated one such “neglected little nook,” a swampy spot “bordered by ragged backyards, city dumps, a small tannery, and a dismantled factory, formerly used by a company engaged in cleaning hair for plasterers’ use.” In this little wetland, Arthur P. Stubbs was able to find dozens of species, including wintering Wilson’s Snipe, Green-winged Teal, and Winter Wren. American Bitterns and Black-crowned Herons dropped in during migration. Stubbs marveled that “for so small a place, not over five acres, it surely is a bird haven” (Stubbs 1916).

Bird enthusiasts have a long history of urging that cemeteries and parks be managed as bird sanctuaries. The push to make cemeteries into bird havens took off just before the U.S. entered World War I. In 1916, Audubon secretary T. Gilbert Pearson, noting the lack of birds in a suburban cemetery otherwise beautified with landscape gardening and sculptural art, wrote an essay on making cemeteries into sanctuaries, and published it as an Audubon circular, *Cemeteries as Bird Sanctuaries*. Cemeteries around the country took up the call, including the Rosehill Cemetery in Chicago, Forest Lawn Cemetery in Omaha, and the Lake View Cemetery in Cleveland (Payne 1916). In Omaha, newspaper editor Miles Greenleaf was convinced that their Forest Lawn Cemetery had actually inspired the cemetery sanctuary movement when its superintendent had written to Audubon in New York asking what they needed to do in order to be considered a sanctuary (Greenleaf 1916). In 1922, H.S. Mann of the Forest Lawn Cemetery declared that,

We have been very successful in attracting birds to Forest Lawn cemetery. The cemetery contains 320 acres, all fenced, and is located north of the city limits of greater Omaha. It has an abundance of trees and shrubbery, about 250 acres of the half section being unimproved at this time. A creek runs through the southern portion of the cemetery, and east and north of it are great stretches of wild lands.

Bird houses, feeding stations, and baths have been erected in the cemetery. Quantities of tangled underbrush and small fruit-bearing bushes and vines have been set out and preserved for the birds. With these attractions, free from annoyance of cats, hunters and children at play, it is a paradise for birds (Greenleaf 1922).

The movement continued into the 1930s. While the country was gripped by the Great Depression, U.S. Biological Survey ornithologist Waldo Lee McAtee published a bulletin with recommendations for managing parks and cemeteries for birds. After suggesting winter feeding, provisioning of bird houses, and providing a source of water for drinking and bathing, he quotes with approval a park superintendent in Minneapolis, Minnesota who wrote that “for the past 5 or 6 years we have maintained a number of feeding stations in various parts of our park system, with very satisfactory results.” After listing a dozen species found in the parks, he concluded “it is safe to say that a large number of these species are staying in the parks on account of the food supplied them. The feeding of the wild birds in the parks is a great success and will be continued” (McAtee 1937).

In addition to advocating for bird-friendly park and cemetery management, Audubon activists also pushed for creating urban preserves just for birds. In 1910, pioneering bird protectionist Mabel Osgood Wright wrote in *Bird-Lore* that “Every day the cities and manufacturing towns are growing more solidly packed with human beings. The outlying brush lots and woodland [are] being stripped for fuel, and the many other uses of wood while the land itself is taking on a prohibitory value. Now is the time to secure these oases in what may be called the desert of civilization. In many places, it is now or never” (Wright 1910). As a model urban bird sanctuary, Harris M. Benedict, an associate professor of biology at the University of Cincinnati, established the Mary M. Emery Bird Reserve near the university. The sanctuary featured a cat fence, feeding stations, water, and nest boxes. According to Benedict, “The great object in view is to discover the most efficient and practical methods for restoring the birds to the cities. The motto in bronze on the entrance reads, ‘Bring Back the Birds to the Cities’” (Benedict 1910).

In 1914, Osgood was able to create her own urban bird sanctuary, the six acre Birdcraft Sanctuary in Fairfield, Connecticut, established on former pasture land donated to Connecticut Audubon by a wealthy donor hoping to establish a sanctuary where city residents could come and enjoy the company of birds. When first founded, Birdcraft was on the outskirts of town, but it was soon surrounded by residential and commercial development. More than 120 bird species have graced these woods, which form an oasis of trees in a maze of streets, houses, and stores.

The idea of creating private bird sanctuaries in American cities never got very far, but over the past century, hundreds of cities have deliberately protected millions of acres

as wildlife preserves. Most are created to protect unique or valued habitats, and some are created specifically birds, especially threatened or endangered species living within metropolitan areas. One of the largest urban preserves is the 5,300 acre Eagle Creek Park in Indianapolis, which includes 3,900 acres of forest, scrub, and restored prairie habitats and 1,400 acres of open water. Many Audubon WatchList species nest here, including Willow Flycatcher, Wood Thrush, Blue-winged Warbler, Prairie Warbler, Cerulean Warbler, Prothonotary Warbler, and Kentucky Warbler (National Audubon Society 2008).

Sometimes it takes municipalities decades to formally protect valued urban preserves. Before it was fully protected, Oaks Bottom in southeast Portland, Oregon was a neglected swampy area nestled between the Willamette River and residential neighborhoods on adjacent bluffs to the east. Northern Shovelers and other waterfowl spent the winter foraging on aquatic vegetation in the wetlands, sparrows wintered in adjacent meadows, and forest birds carved out territories in the woodlands and on the forested slopes above the ponds. In the 1960s, much of this area was used as a landfill, and debris from a local freeway project was dumped into the bottoms. To block the construction of an industrial park, the City of Portland acquired the site in 1969, and in 1972 the Sellwood-Moreland Improvement League and the Portland Audubon Society helped develop a plan to manage the 163 acre wetland area for wildlife.

City officials mostly ignored the swampy area, though by the mid-1980s, a rough trail wound between the marsh and the bluffs and local birdwatchers considered it one of the best birding spots in Portland. As birder interest in the area increased, Portland city officials began to take note, and in 1988, the city officially designated the area as the

Oaks Bottom Wildlife Refuge. As a municipal wildlife refuge, Oaks Bottom provides habitat for over 100 bird species each year, and recreational opportunities for thousands of birders, hikers, and joggers (Houck & Cody 2000).

Most urban preserves are established by the local municipal governments, but state and federal authorities have also helped create urban preserves and refuges. In 1955, Gulf Oil Corporation donated 145 acres of land near the airport to the City of Philadelphia as the Tinicum Wildlife Preserve. Then in 1972, this area received federal protection when the U.S. Congress created the John Heinz National Wildlife Refuge at Tinicum in order to protect the last 200 acres of freshwater tidal marsh in Pennsylvania. Now expanded to nearly 1200 acres, the refuge is home to over 280 bird species that nest, migrate through, or winter in the area, including locally rare Marsh Wren and Least Bittern. Other urban National Wildlife Refuges include the 23,000 acre Bayou Sauvage NWR which hosts Audubon WatchListed Mottled Duck and Swallow-tailed Kite within the city limits of New Orleans, and the 30,000 acre Don Edwards San Francisco Bay NWR, home to over 60 percent of the world's federally endangered California Clapper Rails. The 9,155 acre Jamaica Bay Wildlife Refuge, home to over 270 bird species in the shadow of New York City's JFK International Airport, is a unit of the Gateway National Recreation Area.

Since passage of the Endangered Species Act in 1973, federal authorities have worked more closely with municipalities to protect habitat for endangered and threatened species. In coastal California, the U.S. Fish & Wildlife Service and local city governments, neighborhood associations, corporations, and local energy utilities have created 34 Habitat Conservation Plans to protect the federally threatened California

Gnatcatcher, a small gray insect-eating bird that only lives in coastal sage scrub habitats favored as building sites by residential developers. In San Diego County alone, Federal, State, and local officials have purchased and protected over 112,000 acres as part of its Multiple Species Conservation Plan (DiGregoria *et al.* 2006).

In Austin, Texas, city and county governments working with the U.S. Fish & Wildlife Service established the Balcones Canyonland Preserve system in 1996 to protect federally endangered Black-capped Vireos and Golden-cheeked Warbler (Beatley 1994; Beatley & Manning 1997; Layzer 2008). As of 2008, the city, county, and other preserve partners had protected over 28,000 of the 30,428 acres required under the conservation agreement.¹⁰ Originally funded through a \$22 million city of Austin bond package approved in 1992, land acquisition and ongoing maintenance costs continue to skyrocket. In 2003, the U.S. Fish & Wildlife Service granted nearly \$5 million to purchase land, and lobbying efforts continue in order to garner additional scarce federal dollars for the preserve.

Even after preserves are established, land managers are frequently budget-strapped, making it difficult to maintain the habitat value of the preserves. To help protect the most valuable of these lands, the National Audubon Society designates them as Important Bird Areas (IBAs), and recruits local bird enthusiasts to monitor bird populations and help with habitat management. BirdLife International started the IBA

¹⁰ While an impressive achievement, according to the original plan, the protected acreage represents only about half of the initial Black-capped Vireo habitat and 29 percent of the potential Golden-cheeked Warbler habitat in the county—the rest being lost to surrounding residential and commercial development (Layzer 2008).

program in Europe in the mid-1980s, and has worked with partners to identify thousands of IBAs in Europe, Africa, the Middle East, Asia, and Latin America.¹¹

Audubon Pennsylvania launched the first statewide IBA in 1995, and Audubon currently has 48 state IBA programs engaged in identifying and protecting over 300 million acres of land at over 2,100 IBAs across the country. So far, just over 200 local volunteer groups, including 105 local Audubon chapters, have adopted nearby IBAs, where they monitor habitat conditions and bird populations at the site, and to work with land managers to ensure that the IBA is managed to protect its important bird populations. Audubon anticipates that upon completing its IBA identification process, roughly 15 percent of the United States will fall within designated IBAs.

Most IBAs are on public land in rural areas, though over 100 are in or adjacent to major urban areas. In addition to Eagle Creek Park in Indianapolis, Central Park in New York City is a designated IBA, since it is a significant stopover site for migratory songbirds moving through New York each Spring and Fall. The 9,200 acre Fairmount Park, which furnishes nesting habitat for Audubon WatchList Wood Thrush and nearly 100 other species, plays a similar role in Philadelphia, and became an IBA in 2004. In York, Pennsylvania, Kiwanis Lake Park became an IBA to recognize its importance as one of the state's few night heron colonies.

IBA designation can help sustain official protection when Audubon state and chapter organizations work with the local park service to ensure that management practices maintain bird populations. At the 83 acre Cove Island Park owned by the City

¹¹ There are 3,619 identified IBAs covering 7 percent of Europe. BirdLife partner organizations have completed IBA designation programs in Africa (1,230 sites covering 7 percent of the land area), the Middle

of Stamford, Connecticut, the Cove Island Wildlife Sanctuary Stewardship Committee organized restoration efforts with local volunteers, including teams of Master Gardeners who dedicated four hours every Monday to map the park onto a GIS, install a butterfly garden, and start invasive exotic plant control. After obtaining a \$400,000 grant from the State of Connecticut, they converted 10 acres of the park into a bird sanctuary with the help of 200 GE Elfun Volunteers who created nature trails, planted native vegetation, and installed nesting boxes for Purple Martins and Eastern Screech-Owls (National Audubon Society 2008).

Even parks that don't merit IBA status are still important local habitats, and many Audubon chapters and other groups work with city park departments to restore and improve their habitats. In 2007, the Arizona Water Protection Fund granted \$390,000 to the Tucson Audubon Society to restore and protect habitat along a wash in the 55-acre Atturbury Bird and Animal Sanctuary, part of the Tucson's Lincoln Regional Park (Beal 2007).

The 200 agencies and organizations of the Chicago Wilderness consortium are perhaps the largest partnership working to protect wildlife habitat in urban parks. Many of the sites in the 225,000 acre Chicago Wilderness reserve are Important Bird Areas, while others are smaller local habitat pockets surrounded by the development. Thousands of volunteers help restore habitat by removing invasive plants and planting natives, while others monitor bird and butterfly populations in the preserves (Chicago Wilderness 2008). The larger preserves in the network provide critical habitat for

East (391 areas covering 5 percent of the land), and Asia (2,293 IBAs covering 7.6 percent of the continent).

breeding and migratory birds in a state dominated by industrial agricultural landscapes (Brawn & Stotz 2001).

GOLF COURSES

Golf courses represent a unique subset of urban parks creating large patches of intensively managed open space within American cities. Charleston, South Carolina hosted the first golf club in the United States from 1789 to 1812, and by the mid 1800s there were dozens of golf clubs across the country, though their members usually played on makeshift courses. In 1886, Scottish immigrant John G. Reid, the “Father of American Golf,” established St. Andrews Golf Club in Yonkers, New York, the first permanent course in the U.S. The Newport (Rhode Island) Country Club constructed the nation’s first nine hole golf course in 1890, and by 1900 there were over a thousand of golf courses across the country (Dodson 2000).

By the 1920s, ornithologists began noting the various birds adapting to these new urban areas. Frank M. Chapman reported Killdeer, Northern Bobwhite, and Eastern Meadowlarks on one golf course in Ormond, Florida, writing that these birds “found new sources of food on the greens,” while “Sparrowhawks and Shrikes watched for grasshoppers from the flagstaffs and markers, Mockingbirds, Cardinals, and White-eyed Vireos cheered one from the bordering growth, and wintering Lesser Scaup Ducks gave impressive lessons in speedy adaptation to new surroundings by making their homes in the water hazards where they were soon on intimate terms with ball-hunting caddies” (Chapman 1933, 223-224). About the same time, another observer reported that the

Schenley Park golf course was the only place with breeding Horned Larks within the city limits of Pittsburgh (Burleigh 1923).

Nearly 17,000 golf courses now cover an area the size of Rhode Island and Delaware across the country (Cristol & Rodewald 2005).¹² While hardly “native” or “natural” habitats, these recreational lands harbor an incredible diversity and abundance of birds. One study found over 10,000 water birds of 42 species on 183 golf courses in Florida (White & Main 2005), while researchers found 82 species on 24 courses in South Carolina (Jones *et al.* 2005). In desert areas, irrigated golf courses attract birds typical of riparian areas, and may actually serve as a surrogate for those habitats (Merola-Zwartjes *et al.* 2005). Some species of conservation concern may actually do quite well on golf courses, such as Red-headed Woodpeckers in Ohio (Rodewald *et al.* 2005) and Burrowing Owls in south-central Washington (Smith *et al.* 2005). Extensive manicured greens and scattered trees that may be attractive to bluebirds (LeClerc & Cristol 2005), as well as other species such as Mourning Doves and grackles commonly found in suburban subdivisions (Blair 1996). However, if courses have native forest habitat nearby, they may harbor additional native woodland breeding birds (Jones *et al.* 2005). Well managed courses can attract a staggering diversity of species; birders have noted over 200 species at one Austin, Texas golf course, including Audubon WatchListed Short-eared Owl and Sprague’s Pipit.

With so many species attracted to golf courses, it was perhaps inevitable that conservationists would suggest managing links as wildlife habitat. Waldo Lee McAtee,

¹² There are currently over 17,000 golf courses in the United States, each an average size of 135 acres, for a total of 2.3 million acres (3,600 square miles) of golf courses.

indefatigable champion of landscaping for wildlife, began promoting management of golf courses for birds in 1921 with an article *Attracting Birds to Golf Courses* in the first volume of the United States Golf Association bulletin the *Green Sheet*. For the next ten years, McAtee contributed frequent articles in the bulletin, including information on *Shrubbery About Golf Courses*, *Golf Clubs Owning Lakes Can Aid Waterfowl*, and *Preventing Birds from Damaging Greens*. Other articles extolled the beauty and interest in individual bird species common on golf links, including Killdeer, American Robin, Northern Flicker, Chipping Sparrow, and Horned Lark. In 1930, the *Green Sheet* dedicated a whole issue to *Birds as an Adjunct to Golf Courses* (United States Golf Association 1930). In that same issue, Audubon ornithologist Arthur A. Allen announced that Audubon was forming a Golf Club Bird-Sanctuary Committee to work with golf courses in New York (Allen 1930). That year the National Association of Audubon Societies also published a 64 page booklet entitled *Golf Clubs as Bird Sanctuaries*, to press the concept—a suggestion that Witmer Stone, editor of the *Auk*, the official journal of the American Ornithological Union, considered “a very happy and practical idea” (Stone 1930).

Though the original Audubon effort seems to have been a casualty of the Great Depression, a few course owners continued to promote landscaping for birds, including John R. Williams, the chairman of the grounds committee of the Oak Hills Country Club in Rochester, New York, who extolled planting mulberries for birds and claimed that the \$25,000 spent in landscaping over the past 25 years had raised the property value of the course by over \$500,000 (Williams 1950). In the post-World War II years, course managers struggled with finding lawn pesticides that wouldn't kill birds, but few

considered managing golf courses as bird habitat until 1991, when disenchanted former National Audubon Society Regional Vice-President Ronald Dodson created a golf sanctuary program as part of his independently organized Audubon Society of New York (renamed Audubon International in 1996). By working closely with the United States Golf Association, the Golf Course Superintendents Association of America, the Professional Golfers Association, and the American Society of Golf Course Architects, Audubon International had enrolled 1,984 golf courses as wildlife habitat by July 2008, with 575 courses taking actions qualifying them to become Certified Audubon Cooperative Sanctuaries. These certified courses undertake environmental planning, wildlife and habitat management—including enhancements for birds, chemical use reduction, water conservation, water quality management, and outreach and education (Audubon International 2005). In 2008, the average certified course had replaced 22 acres of turf grass with native grasses or other habitats.

Audubon International also consults with developers of new golf courses to create customized habitat plans which allow consulted courses to enroll as Audubon Signature Courses. One of 66 current Signature Courses, the 244 acre ThunderHawk Golf Course in Beach Park, Illinois, restored 60 acres of native prairie, preserved 15 acres of wetland, created an additional 17 acres of wetland, and planted more than 900 oaks and maples to create additional woodland (Audubon International 2005). By planting native trees, shrubs, and grasses, creating wetlands and placing nest boxes, Audubon Signature Courses provide opportunities for additional species, though most of the courses retain their open, manicured appearance, and mostly provide habitat for relatively common suburban birds. The Dragon Golf Course at Gold Mountain in California partnered with

a local high school wood shop to build and place 45 bird houses on their Signature Sanctuary course—including boxes for Wood Ducks and American Kestrels (Dragon Golf Course 2005).

In addition to upland bird habitat, golf courses often provide significant wetland habitat. The Stevinson Ranch—Savannah Course Golf Club in the Central Valley of California, another Audubon Signature Course, restored 100 acres of wetland and created 120 acres of new wetland during construction. The course attracts thousands of individual birds each year, including geese, dabbling ducks, herons, and Sandhill Cranes. The Dave White Municipal Golf Course in Casa Grande, Arizona, hosts over a dozen species of waterfowl on its ponds. One winter arctic breeding Snow Geese and Long-tailed Duck shared the ponds with a Northern Jacana visiting from Mexico.

AQUATIC HABITATS

Rivers, lakes, ponds, reservoirs are important urban oases providing habitat for additional bird species. Most of America's earliest and largest cities were built on or near rivers, harbors, and other waterways in order to take advantage of water transport for import and export shipping. During the 1800s, cities began to construct reservoirs to store drinking water. Detroit built a 22,000 gallon structure in 1830 and a new 119,680 gallon reservoir the next year. Boston, previously served by a natural reservoir at Jamaica Pond, constructed the Chestnut Hill Reservoir in Boston in the 1860s, and since it remained partially ice free during the winter, it attracted mergansers, Black Ducks, Common Goldeneye, and Ruddy Duck—and occasional coastal species, such as a Red-throated Loon one lucky observer found there one February (Wright 1918). In 1923,

Tomas Burleigh detailed the birds observed on Pittsburgh's two drinking water reservoirs in Highland Park, including Common Loon, Herring Gull, and numerous other waterfowl (Burleigh 1923).

Power plant cooling ponds and storm water detention provide additional habitat for water birds in American cities. A study in Maryland found nine migratory and four breeding species in 34 storm water control facilities over the course of one spring and summer (Adams et al. 1985), and researchers in the Seattle area found 27 species at 30 detention basins over the course of 46 weeks—mostly dabbling and diving ducks (Blackwell *et al.* 2008).

In many parts of the country, city lakes and ponds create opportunities for water birds where none existed prior to urbanization. Waterfowl were once rare migrants in Central Texas (Simmons 1925), but large populations now winter on lakes, park ponds, and other waterways (Fergus 1999). In Phoenix, Arizona, where water was traditionally scarce, ponds at parks and golf courses now attract thousands of wintering ducks and geese. Each January, dozens of local birders conduct an aquatic bird survey of all the urban lakes and ponds, and in 2007 they found over 35,000 individuals of 55 waterbird species (Arizona Field Ornithologists 2008). Even in regions where water abounds, cities now occupy or surround the most productive wetlands and waterways. In Portland, Oregon, a series of natural springs are now Crystal Springs in Eastmoreland Park, where Bufflehead and Lesser Scaup forage on freshwater clams and shellfish. At nearby Westmoreland Park, a few Eurasian Wigeon usually join the wintering flock of American Wigeon, and hordes of domestic park ducks, making it one of the easiest places to find this bird the Lower 48 States.

Wild and domestic waterfowl are very popular with urban park goes. According to the 2006 National Survey of Fishing, Hunting and Wildlife Associated Recreation, more people travel away from home to watch waterfowl than any other type of birds. Of the 20 million Americans over the age of 16 who travel to see birds, 15.4 million travel to view waterfowl (United States Fish and Wildlife Service 2007). Much of this “wildlife” watching undoubtedly includes excursions to feed exotic and domestic park ducks.¹³

City residents have a long history of releasing domestic ducks and geese on urban ponds, lakes, and reservoirs. As early 1910, Horace Wright noted domestic “park ducks” on Jamaica Pond, Chestnut Hill, Franklin Park, and several other locations in Boston (Wright 1910), and New Yorkers had enjoyed watching wild and domestic ducks in their parks since well before J.D. Salinger’s Holden checked out Central Park ducks in *The Catcher in the Rye*. Though feeding feral ducks and geese is a favorite pastime, and encourages millions of urbanites, especially children, to care for birds, authorities warn that duck feeding may cause feral populations to climb, spread avian diseases and pollute waterways (Harris *et al.* 1981; Brand & Doucherty 1988; Campagnolo *et al.* 2001). Many cities, including Madison, Wisconsin have banned duck feeding in local parks (Madison Park News 2002), though such efforts are often unpopular and spawn protests. When the Pennsylvania Department of Conservation and Natural Resources proposed to ban feeding waterfowl at one popular park, over 300 local residents packed into a hearing at the local high school to complain (Hahn 2008). At Crystal Springs in Portland’s Eastmoreland Park, the Park Bureau tried to stop park goes from feeding ducks, but

¹³ Since more than 70 percent of the survey respondents classified as birders by this study are unable to identify more than 20 bird species (U.S. Fish & Wildlife Service 2007), it is unreasonable to suspect that most of them are aware of the difference between native and domestic or exotic waterfowl.

under duress they only managed to outlaw the tossing of stale bread, and now only people to feed the ducks a more nutritious cracked corn available for purchase at the park (Houck & Cody 2000).

Urban residents can become incredibly attached to park ducks. One Austin, Texas woman created a website to celebrate the myriad domestic ducks and geese on Town Lake. She named many of the ducks, and suggested feeding them flour tortillas and bird seed. Her website even chronicled the rescue of a female Khaki Campbell mallard, named Cheyenne, which had become ensnared with a fishing lure and monofilament fishing line (Human 2002).

Though popular with fans, feral waterfowl can cause significant ecological problems. American colonists kept Mute Swans on farm ponds, and in the late 1800s, ornamental waterfowl enthusiasts attempting to improve the beauty of urban parks began releasing the large European birds onto lakes and ponds in eastern cities. Currently, over 13,000 feral swans on the Eastern Seaboard are thought to descend from several hundred birds released on the lower Hudson River in 1910 and on Long Island in 1912 (Connecticut Department of Environmental Protection 2000, Atlantic Flyway Council 2003). These exotic invaders damage aquatic habitats and out-compete native waterfowl by overgrazing aquatic vegetation. Since exotic birds are not protected by federal law, supporters of the birds outraged by state-run culling programs, recently petitioned the courts for its protection and in 2001 the U.S. Court of Appeals ruled that Mute Swans merit Federal protection under the Migratory Bird Treaty Act of 1918. In order to control nuisance swan populations, individual states must now obtain depredation permits from the United States Fish and Wildlife Service (Atlantic Flyway Council 2003).

Away from their East Coast stronghold, fanciers have released swans on city lakes and ponds across the country. In 1988, an Austin, Texas socialite seeking to recreate her beloved Lake Geneva released four pairs of Mute Swans and eight exotic Australian Black Swans onto Town Lake in the presence of “paparazzi and television cameras, heart-shaped balloons, seven Austin ballerinas and about 200 people in dressy attire” celebrating Valentines Day at the downtown Four Seasons Hotel (Parker 1988). While the Black Swans persisted for a decade or more before succumbing to attacks by dogs and collisions with power lines, the Mute Swans remain and several pairs breed every year around the lake, fulfilling former mayor Frank Cooksey’s original wish that the birds enjoy “long life and many little swans” (Parker 1988). At times the swans attack pedestrians and canoeists that impose on their territories, leading a local journalist to nickname one particularly aggressive bird “Swan Quixote” (Szilagyi 1989). Swan attacks are common in cities across the country, with footage of attacks popular on video sharing web sites including YouTube.

Swans are not the only problematic waterfowl in urban parks and waterways. Over the past few decades, the nonmigratory Canada Goose population in the United States has increased to over 3.5 million birds (United States Fish and Wildlife Service 2002). Many of these resident birds spend most of their time in urban parks and waterways, where they have almost no predators and are increasing by 15 percent each year (GeesePeace 2008). Such large numbers of geese often become a nuisance by overgrazing the edges of ponds and polluting water and lawns with their large droppings.

Municipal attempts to cull excess goose populations have spawned opposition from local residents horrified by lethal means of goose population control, at times

leading to confrontations between citizens and animal control officers. In Seattle, protestors and city officials routinely clashed over the killing of 5,600 geese between 2000 and 2003 (Brasted 2008). In 1998, a similar conflict in Lake Barcroft, Virginia led local residents to create GeesePeace, an organization to promote non-lethal means of controlling resident geese.

GeesePeace works with local communities to create an integrated program to control goose populations levels. They train volunteers, and help them get the U.S. Fish and Wildlife permits needed to addle eggs and wary geese away from sensitive areas with Border collies, kites, or kayaks. They also offer advice on landscaping shorelines with cattails or aquatic grasses that geese will avoid. More than 20 GeesePeace demonstration programs operate in ten states, and other communities have adopted similar non-lethal methods (GeesePeace 2008), including Seattle, where several animal welfare groups created their own humane program which led to a moratorium on “lethal removal” of geese from city parks (Progressive Animal Welfare Society 2008).

Though considered an urban pest in many areas, not long ago people went out of their way to encourage goose nesting, even building special nesting structures to attract them. Three members of the Oroville Sportsmen’s Association in north-central Washington installed the first artificial goose nests in 1944. In imitation of the abandoned Osprey nests popular with local geese, the men constructed 18 basket-like nests out of twigs and straw and wired them onto willow and cottonwood trees along the nearby Okanogan River and Horseshoe Lake. A dozen pairs used the nests that first year, and the following year the men installed four more woven nests, and also wired two galvanized tubs high in the trees (Yocom 1952). Soon wildlife managers across the

country were experimenting with their own goose nest site designs, including floating platforms for ponds and lakes as well as pole-mounted fiberglass tubs appropriate for placement within marshland (Brakhage 1965; Craighead & Stockstad 1961; Dill & Lee 1970; Hanson & Browning 1959; Rienecker 1971; Will & Crawford 1970; Messmer 1986). Initially constructed to boost goose populations in rural settings, boy scout troops and park authorities soon installed them in urban lakes and ponds.

Urban geese do not need this extra help anymore, but bird enthusiasts continue to create artificial nesting sites for other water birds. The Merseyside Ringing Group in England created the first floating nesting rafts for Common Terns at a steel plant reservoir owned by the British Steel Corporation in 1970 (Birch 2004). Word of these efforts made their way to the states, and the Wisconsin Department of Natural Resources installed a series of small floating platforms for Forster's Terns in 1979. By 1987, 206 pairs of terns were nesting on five lakes where biologists strung one to two foot square platforms together on 30 to 35 foot sections of line attached to steel poles driven into the lake bottom (Techlow & Linde 1983; Fruth *et al.* 1987). Common Terns use floating nest platforms at the Crane Creek Wildlife Area east of Toledo along Lake Erie, and in nearby Canada where the Metropolitan Toronto and Region Conservation Authority installed four 15 x 15 foot rafts in the harbor (Dunlop *et al.* 1991).

Sometimes artificial nesting structures attract other species, giving rise to novel bird conservation efforts. In 1968, biologists in the Chippewa National Forest created floating sedge-mat islands as nesting sites for Ring-necked Ducks, but were surprised when they were taken over by nesting Common Loons. Lead biologist John E. Mathisen suggested that "the technique may provide a means of increasing nesting success of loons

throughout much of their range, should this ever become a matter of concern” (Mathisen 1969). Fortunately, further experimentation in Minnesota from 1970-1973 confirmed that loons would readily take to these “artificial islands” (McIntyre & Mathisen 1977), since water fluctuations, human disturbance, and chemical contamination of lakes soon made loon conservation “a matter of concern.” Since the 1980s, wildlife managers¹⁴ and neighborhood lake associations across the northern tier of U.S. states have installed floating islands or rafts throughout the loon’s breeding range, including urban lakes and hydroelectric reservoirs, though loon nesting success decreases as lakes become more developed (DeSorbo *et al.* 2007, DeSorbo *et al.* 2008).

URBAN BIRDING

With over 240 million Americans living in urban areas, patches of habitat within and adjacent to U.S. cities are the most convenient and likely places for urbanites to connect with nature. In the late 19th Century, birdwatchers in Boston, New York, Philadelphia, Washington, and other major cities formed Audubon societies and ornithological clubs to explore and enjoy local birds. In 1900, when *Bird-Lore* editor Frank M. Chapman called for his readers to go out and count birds on Christmas Day, the first 27 bird watchers to conduct Christmas Bird Counts reported mostly birds found in city parks and green spaces, including Central Park in New York, Fairmount Park in

¹⁴ Leading loon conservation agencies and organizations: Maine—FPL Energy Maine Hydro, BioDiversity Research Institute, Loon Preservation Committee; New Hampshire—Loon Preservation Committee, FPL Energy Maine Hydro; Massachusetts—Massachusetts Division of Recreation and Conservation; Vermont—Vermont Loon Recovery Project, Vermont Institute of Natural Science; New York—Wildlife Conservation Society; MI—Michigan Loon Preservation Association; Wisconsin—Wisconsin Department of Natural Resources, Sigurd Olson Institute; Minnesota—Minnesota Division of Ecological Services; and

Philadelphia, and Arnold Arboretum in Boston. Every year since then, Christmas Bird Count participants have scoured parks and other urban oases for birds during the annual count. In the 2007-2008 count season, over 35,000 birders surveyed 1,612 15 mile diameter count circles in the Lower 48 United States.

Urban birding has created traditions and cemented social ties among birdwatchers for over a hundred years, sometimes with long-lasting and far-reaching consequences. The competitive spirit of modern birding traces much of its roots back to the Bronx County Bird Club, which became famous for the exploits of its jocular young members, who competed fiercely with each other to find the most birds in borough cemeteries, parks, and open spaces. In 1924, the club started the Bronx-Westchester Christmas Bird Count, and pioneered a now popular multi-team approach to conducting the count, with each team surveying parks and habitat nooks in different portions of the count circle and competing with each other to find the highest number of species. Participants in these birdwatching contests include a veritable who's who of early 20th Century birdwatching, including Ludlow Griscom, considered the Dean of American Birdwatchers, bird artist and field guide author Roger Tory Peterson, and ornithologists Joseph Hickey and Allan D. Cruikshank. Peterson reported that Griscom and the urban bird clubs catalyzed much of what we consider modern birding. "Wherever one goes in all parts of our country one finds that the sharpest local field observers were trained either by Griscom, his protégés, or his protégés' protégés; or they can be traced indirectly to his influence through some eastern bird club in New York, Boston, Philadelphia, or Washington where his influence was felt most strongly" (Peterson 1965).

Modern bird clubs continue to promulgate these traditions, with urban parks and preserves providing fertile ground for growing each new generation of American birdwatchers. Most of Audubon's 480 local chapters conduct free or low-cost birding field trips to local parks and preserves throughout the year. In 2007, 352 chapters offered 7,165 field trips, with Golden Gate Audubon Society in San Francisco, Alameda, and Contra Costa counties conducting a whopping 300 field trips.¹⁵ Seattle Audubon leads walks in Seward Park, a 300 acre old-growth forest within the city that is home to Pileated Woodpeckers and Barred Owls. The Audubon Society of Portland leads excursions to Forest Park, Oaks Bottom, and dozens of other local birding spots. In Tucson, the local Audubon chapter hosts a bicycle jaunt around historic Reid Park to enjoy wintering herons, ducks, hawks, and hummingbirds. Great Salt Lake Audubon conducts birders up local canyons and schedules trips to

For serious birders striking out on their own, published bird-finding guides and signed birding trails provide detailed routes and avenues for exploring man urban parks and preserves. In 2001, the American Birding Association, recognizing the value of urban birding locations, published *A Birder's Guide to Metropolitan Areas of North America*, with detailed instructions on how to visit and observe birds in over 200 parks and preserves in 17 major cities in the U.S. and three in Canada (Lehman 2001). Dozens of local books and birding trail publications can offer even more detailed guidance. The Oregon Historical Society published *Wild in the City*, a guide to nearly 100 cemeteries, parks, preserves, and other greenspaces in the Portland Metropolitan area (Houck & Cody

(DeSorbo *et al.* 2008).

¹⁵ Based on Chapter Annual Reports submitted to the National Audubon Society. In 2007, 412 chapters submitted reports, and 365 chapters responded to questions about their field trip offerings.

2000). In Chicago, the local Bird Conservation Network and Chicago Department of the Environment created a *Chicago Region Birding Trail Guide* covering 57 birding sites in the area (City of Chicago 2005). For the more casual bird observer, signs in many city parks provide images and information about conspicuous local birds that may be seen by visitors.

Nearly 1,000 nature centers in the United States, most in urban parks, provide access to pockets of habitat and environmental programming for children and adults. Many teach bird identification classes, feature demonstration gardens, and offer instructions on how to create backyard wildlife habitats. Recognizing that ever growing numbers of urbanites, especially children, are not getting outdoor experiences, Audubon president John Flicker announced a new nature initiative that would effectively double the number of nature centers in the country. However, after a decade of struggle, the society found the endeavor to be too costly, and has only launched 40 new centers—including a 21,000 square foot Trinity River Audubon Center in Dallas, and a center in Deb's Park, serving inner city Hispanic population in Los Angeles. Even without a huge boom in nature center construction, existing nature centers provide the only avenue that many urbanites may have to experience the joys and wonders of birds and other wildlife. Just as parks and preserves provide an oasis of habitat “in what may be called the desert of civilization” (Wright 1910), nature center programming provides a respite from electronic gadgets, multimedia entertainment, and the clamors of modern city life.

Chapter 5— Urban Frontier (Zone 4)

On the last day of 2000, I spent the entire afternoon searching 1,200 acres of woods and ponds for birds. I had already found 240 species at my favorite birding spot that year, one more than a previous record set there in 1983. I spent hours traipsing through the woods, but couldn't find a woodcock. I looked through several large blackbird flocks, hoping for a rare Rusty Blackbird, but with no luck. I ended the day without adding another bird to my year list. As the sun went down on another year of birding, I sat on the hood of my beat up but trusty 1989 Chevy Celebrity birdingmobile and watched sparrows go to their roosts and ducks fly in to the ponds. On a back road at dusk, I finally met up with a bobcat. It was a great way to end a year of birding at Hornsby Bend, a municipal wastewater treatment plant nestled between gravel quarries and the airport, and easily the single most productive birding location in Austin, Texas.

Airports, landfills, and wastewater facilities are land-intensive industrial operations competing for space with low-density exurban residential development on the fringes of American cities.¹⁶ These industrial wilds offer unique habitat opportunities for birds, and often become important sites for bird habitat restoration and management. In the case of Hornsby Bend, a decade of work there has become a model for bird conservation and environmental activities at other industrial sites and beyond.

¹⁶ Situated mostly outside of officially described urban areas, I briefly discuss the large lot exurban residential developments of this Urban Zone 4 in Chapter 7.

FACTORIES AND OFFICE PARKS

Factories and other industrial facilities have been creating new habitats and impacting bird populations in America since the first colonists set up industries such as the Saugus, Massachusetts ironworks established in 1646 and the mills and forges established by Joseph Jenks, Jr. at Pawtucket, Rhode Island in 1671. Each colonial iron “plantation” deforested large areas, up to an acre a day, to supply charcoal for the furnaces, destroying forest habitats and creating open ground more favorable to ground-nesting Killdeer, nighthawks, and Spotted Sandpipers. Larger factories began shaping urban bird habitats after Francis Cabot Lowell built the first textile factory in Waltham, Massachusetts in 1813. As cities became industrialized, many ornithologists commented on the displacement of birds by factories in and around cities like Chicago (Eifrig 1919) and San Francisco (De Groot 1927).

The 2002 Economic Census provides details on the scale of industrial facilities in the United States, including 1,233 coal fire and other fossil fuel burning plants, 78 nuclear power plants, 199 petroleum refineries, and 416 hydroelectric plants in the United States (U. S. Census Bureau 2006). The country also has more than 226,737 industrial manufacturing facilities (Energy Information Administration 2001).

Industrial buildings and their associated parking areas and facility operations sometimes destroy native vegetation and bird habitats, but some birds are quick to colonize even these imposing structures. Peregrine Falcons, Chimney Swifts, and Killdeer have all nested on large factory buildings. In the Boston area, Herring Gulls have colonized factory rooftops in large numbers, sometimes causing heavy damage by clogging drainpipes and digging through the roofing material (Fisk 1978). American

Crows often use large industrial complexes as nocturnal roosts, causing factory owners to sometimes take drastic measures to disperse the birds. In 2006, civic authorities in Lancaster County, Pennsylvania obtained permits to poison 60,000 American Crows roosting on the roof of a local factory.

Warehouses and shipping facilities including wharves are additional components of urban industrial landscapes since constructed in the colonial port cities such as Boston, New York, Philadelphia, Baltimore, and Charleston. Modern warehouse facilities at inland cities are often located near airports or major roadways on the urban fringe where land is relatively cheap. There are currently over 603,000 warehouse and storage buildings in the United States (National Energy Information Center 2002). Near coastal or river sites, warehouse districts may offer loafing, roosting, or even nesting opportunities for gulls and other birds. Western Gulls have nested on Pier 26 at San Francisco since the 1920s, and Pigeon Guillemots have raised young under the rafters of Fisherman's Warf in Monterrey, California. One warehouse in North Miami has hosted a large Least Tern colony and at least five pairs of Black Skimmer (Fisk 1978).

After World War II, large corporations began to build new office buildings outside of traditional city centers, including General Motors near Detroit, Michigan and General Electric (GE) in White Plains, New York, creating new office parks on the edges of suburbia (Rowe 1991). With the growth of cities and the national economy, large corporate campuses have sprawled across former agricultural land on the urban fringe, and become a central component of new Edge Cities. While Edge City development includes high-rise office space and regional malls more characteristic of the asphalt savannah, much of it is characterized by large buildings on corporate estates surrounded

by acres of lawn and detention ponds or, increasingly, woodlands and other naturalized habitats (Garreau 1991; Scheer & Petkov 1998).

When building new facilities, companies often take advantage of low land prices and local subsidies to purchase more land than needed immediately in order to bank it for future expansion. If the land is already cleared as former cropland, building sites are often planted in lawn, providing foraging areas for Canada Geese as well as Killdeer and other upland shorebirds, loafing areas for gulls. On woodland sites, in order to save on building and landscaping costs, areas away from the construction zone are often left in place, providing habitat for many native species. When Schlumberger Limited was looking for a new office site in Austin, it only needed room for six buildings with 195,000 feet of floor space, but a conservation-minded vice president helped obtain a 438 site northwest of town where 195 acres of oak and mixed hardwoods could be reserved as habitat for endangered Golden-cheeked Warblers and other woodland birds (Houston Business Journal 2005).

In the 1980s, the National Wildlife Federation created a Corporate Habitat program to complement its Backyard Habitat program. However, they ceded the program to the Wildlife Habitat Council, a collaboration between businesses and nonprofits, in 1988. WHC helps corporate landowners manage their unused lands for the benefit of wildlife by encouraging employees of corporations to create wildlife management teams at their place of employment, and assisting them in creating management plans for corporate lands. Participating companies can have their lands certified as wildlife habitats.

WHC counts over 120 companies as partners, and claims to help protect and manage over 2 million acres in the lower 48 states, Puerto Rico, and fifteen foreign countries. 319 corporate sites are currently maintained as certified Corporate Wildlife Habitats in the United States. WHC has certified more habitats in the five states with WHC regional offices than elsewhere; states with regional offices average 17.4 habitats per state, while other states average only 5.6 certified sites per state. An additional 52 certified locations in Ohio, West Virginia, North Carolina, and Illinois are also directly served by regional office staff—making 43.6% of all habitats directly managed by local WHC staff, indicating that local staff limitations may be the greatest obstacle to expanding program participation in other states.

Certified sites include corporate offices that maintain native woodlands and grasslands, as well as industrial sites such as gravel pits, industrial wastewater ponds, and landfills. In 2003, WHC's Corporate Habitat of the Year was awarded to the Pfizer Kalamazoo manufacturing complex in Portage, Michigan. This 4,400 acre site is managed by employee volunteers working closely with the Kalamazoo Nature Center Community Wildlife Program and the WHC to develop and implement wildlife management programs, including next box monitoring, prairie and grassland maintenance, and restoration of woodlands and wetlands (Wildlife Habitat Council 2007).

AIRPORTS

Runways, mowed fields, and extensive grasslands associated with airports provide valuable habitat for many open-country birds. Municipalities constructed the

first airfields in the 1920s on open spaces near town, such as in city parks (Bednarek 2005). Larger commercial planes required longer runways, and cities built new airports with passenger terminals in major cities after Pan Am built the first modern airport and terminal in 1928 on land purchased from the Seminole Fruit and Land Company on 36th Street in Miami, Florida (Brown 1998; Federal Aviation Authority 2006). In 2006, there were 14,858 airports in the United States, including about 600 commercial airports.

While starlings, grackles, and House Sparrows are attracted to airport buildings, mowed runway margins often provide important habitat for grassland birds, especially in areas, such as the Northeastern states, where native grasslands are almost nonexistent. In Massachusetts, airports provide some of the only Grasshopper Sparrow habitat in the state (Vickery 1996), and Upland Sandpipers almost exclusively occupy airstrips there as well, even nesting at Boston's busy Logan Airport (Battenfeld 1999).

Though grassland birds may be attracted to breeding habitat at airports, runway grasslands may not be the most productive nesting habitat. One study of airfields in Illinois found 147 nests of six species, mostly Eastern Meadowlark, but also Grasshopper Sparrow, Savannah Sparrow, Song Sparrow, Horned Lark, and Red-winged Blackbird. However, only 14 percent of the airport nests were successful, indicating that Midwestern airports may serve as a population sink, especially for Eastern Meadowlarks (Kershner and Bollinger 1996).

Airports may provide more suitable habitat for other birds. Burrowing Owls have colonized airports in many areas, including Oakland, California (Thomsen 1971) and Miami, Florida, where they hunt in the short mowed grass by running and chasing down their insect prey. Arctic nesting birds may find airfields attractive on their wintering

grounds. Snowy Owls often winter on large airports, including Dulles Airport and Ronald Reagan National Airport in Washington, D.C., and short mowed airstrips provide important habitat for arctic nesting Smith's Longspurs wintering in Arkansas and Louisiana.

Airports attract so many birds that they can pose a significant hazard to airplanes (Doughty 1976; Henley 2004; Cleary & Dolbeer 2005). Airstrikes with large birds such as a 12 pound Canada Goose, which love to forage on short mowed runway grasses, are especially dangerous—with a collision at 150 miles per hour generating the same amount of force as a 1,000 pound object dropped from ten feet—and can easily decommission or bring down a plane. From 1960 to 2004, birdstrikes destroyed a reported 122 civilian aircraft and 333 military planes, and killed over 255 civilians and 150 military personnel, and damages from collisions with civil planes cost an estimated \$502.91 million each year (Cleary & Dolbeer 2005). In 2004, over 5,900 commercial airplanes struck birds, and over 7,600 bird strikes occurred in 2007 (Bird Strike Committee USA 2008). Most strikes take place on take off or approach to airports (Doughty 1976; Henley 2004). The most common birds struck by commercial planes are waterfowl (32 percent), gulls (28 percent), and raptors (17 percent) (Bird Strike Committee USA 2008).

Airport managers go to great length to discourage birds from using airports, including lethal controls, and the Federal Aviation Administration (FAA) publishes extensive guidelines for managing wildlife at airports (Cleary & Dolbeer 2005). The FAA advises recommends maintaining grasses at 6 to 12 inches, lining and overhead wiring of detention ponds, and wildlife dispersal using pyrotechnics and lethal control (DeFusco & Dogan 2006). Airport officials are most concerned about large gulls and

waterfowl that cause the most strikes. At the Detroit Metro Airport, wildlife control agents installed a grid of heavy-duty PowerPro® Fishing Line on 100 inch centers over three large ponds near the runways for less than \$10,000 in material costs. The large grid spacing effectively eliminated the larger and more problematic geese, gulls, and cormorants while still allowing herons, egrets, and grebes to use the ponds (Duffiney 2006).

Despite the overriding need to avoid birdstrikes, as urban development displaces open agricultural and other field habitats, airport runways are often the most attractive habitat for local grassland birds in many regions, creating conflict between aviation officials and the needs of wildlife. As two veteran researchers put it at a recent bird airstrike conference, “the airport is not a wildlife refuge!” (DeFusco & Dogan 2006). Relatively few airports actively improve their facilities as bird habitat, but wildlife advocates like Audubon do put pressure on airports to protect threatened, endangered, or locally rare birds inhabiting airport grasslands. Under pressure from New Jersey Audubon, the Atlantic City International Airport agreed to manages 290 acres for sensitive grassland bird species, and actually created 70 additional acres of open habitat at their facility. Audubon has designated the airport an Important Bird Area since it harbors regionally rare species including two pairs of nesting Upland Sandpipers, 40 pairs of Grasshopper Sparrows, and 15 pairs of Eastern Meadowlark (Barlas 2004; National Audubon Society 2008).

At the Stuttgart Municipal Airport in Arkansas, another IBA, planting of non-native grasses after runway construction wiped out the native *Aristida* grassland that traditionally harbored wintering Smith’s Longspurs, as well as additional wintering birds

including Sedge Wren, Short-eared Owl, and Rusty Blackbirds. In order to bring the birds back, the Arkansas Natural Heritage Commission, Arkansas Game & Fish Commission, U.S. Fish & Wildlife Service, and City of Stuttgart are working to restore 131 acres of *Aristida* prairie through prescribed burning, chemical herbicide application, rubble removal, mechanical removal of woody plants, and seed production and propagation of local genotype prairie plants (National Audubon Society 2008).

From 1997 to 2000, the Massachusetts Audubon Society conducted surveys of airstrips in New England and developed management recommendations for grassland birds. They instructed Airport managers to restrict mowing during the breeding season on areas not immediately adjacent to runways, maintain a 50-foot mowed strip adjacent to taxiways and runways to discourage nesting and reduce insect populations near aircraft operating areas, observe and mark nests and avoid mowing near nests until birds have fledged. Efforts were particularly effective in enhancing airstrips for Upland Sandpipers, which need grasslands larger than 100 acres for breeding, and areas with variable grass heights—short grass foraging areas, and taller grass for nesting sites (Massachusetts Audubon Society 2004).

Project researchers determined that New England airports can provide improved bird habitat by deferring mowing until the end of the breeding season, except for within 10 m of runways. In addition to providing nesting habitat, areas of taller unmowed grass benefit airport operations by discouraging the roosting gulls and crows which create a serious airstrike hazard. In managed airfields, Grasshopper Sparrows responded quickly to effective management. At Westover Air Reserve Base in Chicopee, Massachusetts, a

regime that deferred mowing until August increased Grasshopper Sparrow numbers from 55 to 168 pairs in six years (Melvin 1994, Vickery 1996).

LANDFILLS

Solid waste generated by cities creates disposal challenges for society (Melosi 2005), but opportunities for many birds (Belant *et al.* 1995). Americans historically burned, reused, or disposed of garbage on their own property or in communal open dumps. In the early 20th Century, cities were concerned about the human health impacts of open garbage pits, and waste engineers created the first small landfills in the Midwest—at Champaign, Illinois in 1904 and Dayton, Ohio in 1906. In the 1930s, a few cities across the country created larger landfills. In 1937, the Fresno Municipal Landfill, developed the technique of trenching, compacting, and burying the garbage each day rather than leaving it exposed in pits. Fresno commissioner for public works Jean Vincenz was the first to dub this system a “sanitary landfill” (Rathje and Murphy 1992). The Army Corps of Engineers promoted sanitary landfill construction during World War II, and about 100 cities in the United States established landfills by the end of the war. In 1988, there were about 8,000 landfills, though this number had eroded to 1,767 by 2002, and continues to decline each year with the closure of additional sites (Environmental Protection Agency 2006).

Gulls, starlings, blackbirds, and grackles are attracted to landfills (Belant 1997), where they scavenge the roughly 7 to 11 percent of landfill material that is food and yard waste (Rathje and Murphy 1992; Environmental Protection Agency 2006). As one sanitation worker at Fresh Kills Landfill in New York quipped, “for them, it’s one big

constant smorgasbord” (Firstman 1989). A study of three landfills in Ohio reported 42 bird species using the sites, mostly Ring-billed Gulls (70 percent), Herring Gulls (23 percent), European Starlings (5 percent), and Turkey Vultures (Belant *et al.* 1995). Large gull congregations often attract wandering birds, and birders regularly scope out landfills across the country in search of vagrant gulls. Asian Slaty-backed Gulls and Black-tailed Gulls, as well as European Yellow-legged Gulls have appeared at landfills from Texas to Maryland. Lesser Black-backed Gulls, regular winter residents in the Northeastern United States, have visited landfills in Utah, Colorado, Texas, and elsewhere. Birders in the Eastern U.S. scour landfills for California Gulls and Mew Gulls from the Pacific Coast.

With so many rare birds showing up at landfills, they often become popular birdwatching locations. For many years during the 1980s and early 1990s, the landfill in Brownsville, Texas was the only place in the United States where birders could reliably find Tamaulipas Crows. Reclaimed landfill sites provide habitat for additional birds, as well as recreational opportunities for birders. The capped landfill at Croton, New York hosts large wintering raptor populations, including Short-eared Owl, Long-eared Owl, and Rough-legged Hawk.

For landfill managers, large flocks of gulls, crows, and starlings are considered a nuisance. Facilities such as the aptly-named Crow Wing County landfill in Brainard, Minnesota are licensed to kill birds, use pyrotechnics to reinforce the fear of shooters, and make the garbage inedible by spraying it down each day with a mixture of methylantranilate and a slurry-based blend of polymers and fibers used as a landfill

cover. With this three-pronged approach, the landfill has reduced the gull population from over 10,000 to less than 200 (Knight 2005).

In addition to gull foraging areas, landfills often retain patches of natural vegetation or restored grasslands, and a growing number of landfills actively manage their facilities as bird habitat. The Wildlife Habitat Council has certified 11 landfills operated by Waste Management, Inc. and 8 landfills operated by Browning Ferris Industries (BFI). At their landfill in Imperial, Pennsylvania, hundreds of birds fledge in nest boxes set up for martins, bluebirds, screech owls, kestrels, Wood Ducks, and woodpeckers—and 52 acres of grassland on a closed portion of the landfill hosts one of only two breeding populations of Short-eared Owl in Pennsylvania (Wildlife Habitat Council 2007). Sometimes these landfills even harbor important populations of endangered and threatened species. El Sobrante Landfill in Riverside County, California protects 640 acres of open space as habitat for 26 pairs of the Audubon Watch Listed California Gnatcatcher (Waste Management 2007).

WASTEWATER TREATMENT FACILITIES

Wastewater facilities are usually located on the city outskirts, away from residential areas, and downhill from the city to reduce the need for pumping the effluent. The first municipal sewage works, including the first concrete pipe sewer system built in Mohawk, New York in 1842, consisted of underground sewage pipes that conveyed untreated wastes into local rivers or harbors. Concern about diseases prompted city sanitation engineers to seek healthier means of treating and disposing of municipal wastewater, and since the early 1870s, cities have developed several treatment

technologies that have created thousands of acres of rich aquatic habitats on the urban fringe.

Sewage farms, essentially fields irrigated with sewage, were developed in England and first constructed in the United States at the Women's Prison in Sherborn, Massachusetts in 1896 (Waring 1896). At Pullman, Illinois, officials decommissioned the first municipal sewage farm in the U.S. after only a few years of operation, but sewage farms in Danbury, Connecticut and San Antonio, Texas persisted for decades, as did California farms in Pasadena, Fresno, and Pomona (Metcalf and Eddy 1923).

Engineers designed more advanced sewage filter bed systems in the 1880s, which filtered sewage through natural sandy-loam soils, or contact beds constructed of porous gravel and sand. Wet sewage often hosted high invertebrate numbers, which in turn attracted migrating shorebirds. George B. Hendricks began finding locally rare shorebirds at the sewer beds at Pittsfield, Massachusetts in 1932, while two sewage beds constructed near Concord, Massachusetts regularly attracted Semipalmated Plover, Greater Yellowlegs, Pectoral Sandpiper, White-rumped Sandpiper, Long-billed Dowitcher, Stilt Sandpiper, Semipalmated Sandpiper, and Western Sandpiper (Griscom 1949). During the 1930s, the beds at Framingham even attracted such regionally rare species as Baird's Sandpiper, Dunlin, Buff-breasted Sandpiper, and Wilson's Phalarope (Griscom 1949).

Early in the 1900s, advances in sewage treatment processes led to the adoption of trickle filter systems, whereby sewage was broadcast through sprinklers over large filter beds of gravel and sand. During the winter of 1924, Rutgers College zoologist Leon Hausman noticed large flocks of birds foraging on the surface stones of a trickle system

sewage disposal plant in Bound Brook, New Jersey. Hausman identified the birds as Song Sparrow, American Tree Sparrow, Dark-eyed Junco, and American Goldfinch, and determined that they were feeding on larva, pupa, and adult moth flies living in the algae mat covering the stones of the filter bed (Hausman 1924). Filter beds in England, such as those at the Aylesbury Sewage Works, still attract numerous passerines such as Starlings, Pied Wagtails, Yellow Wagtails, Meadow Pipits, and Black-headed Gulls (Glue and Bodenham 1974; Bodenham and Glue 1997).

San Antonio created the first municipal wastewater lagoons or oxidation ponds in 1901 by building polders to hold raw sewage at Mitchell Lake, but engineers perfected and popularized lagoons as treatment plants during and after World War II. In 1945, fewer than 50 sewage ponds existed in the United States (Rohlich 1976), but during the next 15 years more than a thousand lagoons sprang up across the country. The high organic content of sewage lagoon water supports a rich bacterial, algae, and invertebrate ecosystem that attracts large numbers of waterfowl and shorebirds. As early as 1954, one observer counted more than a thousand birds at a ten acre oxidation pond at Maddock, North Dakota—more than the number of birds using all the nearby potholes and other natural wetlands (Van Heuvelen and Svore 1954).

Since the 1950s, municipalities across the United States have constructed thousands of sewage lagoons. In 1996 the congressionally mandated Clean Water Survey reported 9,252 sewage lagoons in the United States. These sites provide habitat for waterfowl and wading birds in many areas historically lacking aquatic habitats, creating thousands of new migratory stopover sites. Since their creation in 1958, the sewage ponds in Austin, Texas have attracted 19 species previously unrecorded in Travis County,

and at least 12 species considered rare in Texas (Fergus 1999)—including the first Spotted Redshank ever photographed in the state. Other sewage ponds in Texas have attracted such rare migrants as the state’s first Red-necked Stint, which stopped off at the Ft. Bliss sewage ponds in El Paso in 1996 (Lockwood 2008).

In Oregon, birders frequent about 90 of the state’s more than 120 sewage ponds in search of migratory waterfowl and shorebirds. Almost all of the waterfowl, wading birds, and shorebirds that migrate through the state are regularly observed on these ponds, and many regionally rare birds have appeared there as well (Tice 1999).¹⁷ In California sewage ponds have provided stopover sites for numerous vagrant birds from Asia and the Eastern United States.¹⁸ Birders across the country are keen to monitor bird migration at sewage facilities, since they often provide the best waterfowl, wading bird, and shorebird habitat in the state.

In recent decades, artificial wetlands created for sewage treatment have also become important bird habitat. First pioneered by Kathe Seidel at the Max Planck Institute in Germany during the 1950s, Robert Kadlec constructed a full-scale experimental wastewater treatment wetland in Michigan in 1973. Research continued widely during the 1970s and 1980s, leading to the construction of important wetlands at hundreds of sites including Arcata, California, Hillsboro, Oregon, and Beaumont, Texas (Campbell and Ogden 1999).

¹⁷ Rarities reported from Oregon sewage ponds include: Garganey, Tufted Duck, Hudsonian Godwit, Sharp-tailed Sandpiper, Ruff, Common Black-headed Gull, Little Gull, Eastern Phoebe, Clay-colored Sparrow, and Chestnut-collared Longspur (Tice 1999)

¹⁸ California vagrants found at sewage ponds: Tufted Duck, Long-toed Stint, White-rumped Sandpiper, Curlew Sandpiper, Buff-breasted Sandpiper, Scissor-tailed Flycatcher, and Red-throated Pipit.

Engineers in Arcata constructed the wetlands at the Arcata Marsh and Wildlife Sanctuary in 1981, and started treating sewage there in 1986. The 154 acres of marsh at the site regularly attract over 250 species of birds, and have hosted rare species including a Common Greenshank from Asia in 2002, only the second time birders had found the species in the California.

Jackson Bottom Wetland Preserve, 725 acres of wetland near Hillsboro, Oregon, regularly attracts hundreds of birds and increasing numbers of birdwatchers. A 12,000 square foot education center opened on the site in 2003, and over 25,000 people attend environmental programs or visit the center each year (Jackson Bottom Wetland Preserve 2008). Since 1983, birders have identified over 130 species of birds in the preserve (Cornell Lab of Ornithology & Audubon 2008), including a regionally rare Ruff—which dozens of birders observed there in October 2000. In Beaumont, Texas, thousands of visitors enjoy hiking, biking, and birding at the 900 acre Cattail Marsh at Tyrell Park, which began operation in 1993. Its eight cells planted with emergent marsh vegetation and adjacent riparian and woodland habitats have attracted over 350 species of birds including egrets, pelicans, Roseate Spoonbills, ibis, shorebirds, and ducks (Campbell and Ogden 1999).

Municipalities across the country are beginning to capitalize on the birding attraction and habitat value of wastewater lagoons and constructed wetlands. Beaumont publishes a bird checklist for Cattail Marsh, and the City of Henderson, just outside of Las Vegas, Nevada, has christened its facility the Henderson Birding Ponds. In Gilbert, Arizona, the city created a 110 acre recreational “water ranch” park out of its series of wastewater recharge basins and constructed wetlands. Desert Rivers Audubon Society

conducts monthly bird walks on site, and families stroll over miles of gravel trails where birdwatchers have found over 248 species there since the facility opened to the public in 1999.

HORNSBY BEND BIRD OBSERVATORY

The City of Austin's wastewater treatment facility at Hornsby Bend has been a favored birding location in Central Texas since teenage birders first discovered it in 1959 (Fergus 1999). While writing a master's thesis on the birds and birdwatchers there in 1998, I took over leading the Hornsby Bend area for the Austin Christmas Bird Count. While previous counters usually surveyed the 1,200 acre facility and surrounding trailer parks, agricultural fields, and exurban developments as a single group, I took up the old Bronx County Bird Club strategy and organized multiple teams to cover the area and we were able to find nearly 100 species—the first time the count area had even approached the century mark in over a decade. While comparing notes at lunchtime, Travis Audubon Society board members Stennie Meadours and Russ Nelson beamed about how much fun they were having and that they would enjoy doing a similar count more than just once a year.

After finishing my master's thesis, I held an evening meeting to organize a bird observatory to promote the study and understanding of birds at Hornsby Bend on June

16, 1999 (Table 5.1).¹⁹ Rather than formalize leadership of the organization, we decided to operate the Hornsby Bend Bird Observatory (HBBO) as an *ad hoc* partnership between

Table 5.1 Hornsby Bend Bird Observatory (HBBO) Timeline.

5 Mar 1961	First Travis Audubon field trip to “Austin Sewer Evaporation Ponds”
Jan 1996	Hornsby Bend Steering Committee formed
8 Feb 1996	Austin City Council directs plant managers to work with Travis Audubon
7 Nov 1997	New trails along river officially opened
9 Jul 1998	Hornsby Bend Bird Monitoring Project announced on TEXBIRDS
19 Aug 1998	Bird sightings checklist posted on kiosk at Hornsby Bend
19 Dec 1998	First discussion of monthly bird counts at Hornsby Bend during CBC

16 Feb 1999	HBBO website set up at www.angelfire.com/tx/hornsby/observatory.html
6 Apr 1999	HBBO announced on TEXBIRDS
16 Jun 1999	HBBO organizing meeting
10 Jul 1999	First monthly bird survey
16 Oct 1999	Birding shelter completed (EcoFair rainwater catchment workshop)
20 Oct 1999	First monthly meeting
20 Nov 1999	Hornsby Bend Birding Celebration, Hornsby Bend IBA designation
22 Nov 1999	First Hornsby Elementary Living Lab outdoor learning classes
1 Jan 2000	City of Austin hires Center for Environmental Research coordinator
20 Jun 2000	HBBO website moved to www.HornsbyBend.org
13 Jul 2000	Begin posting on daily bird sightings blog
19 Jul 2000	HBBO checklist online
21 Jul 2000	First Shorebird Survey workshop
7 Aug 2000	Online bird behavior notebook launched on HBBO website
16 Aug 2000	First hawkwatch begins (through Oct 15)
25 Aug 2000	First hawk migration workshop (Joel Simon)
3 Nov 2000	HBBO hosts Project Prairie Bird workshop
15 Jun 2001	HBBO becomes Travis Audubon Society program
15 Aug 2001	First paid hawkwatch
12 Aug 2002	Launch HBBO online bird sightings log
26 Sep 2002	HBBO hawk identification presentation posted online
1 Jul 2003	HBBO independent from Travis Audubon Society
23 Jan 2004	First HBBO owl workshop
20 Feb 2004	Purple Martin Landlord workshop

¹⁹ The early days of the Hornsby Bend Bird Observatory are perhaps best chronicled in numerous public emails available on the TEXBIRDS email list archives (<http://listserv.uh.edu/archives/texbirds.html>).

the Austin Water Utility Biosolids Management Plant and any interested individuals, companies, and nonprofits. In monthly meetings held on Wednesday evenings, HBBO partners met to plan and discuss ongoing bird research and educational programs at the ponds.

As the first Hornsby Bend Bird Observatory program, Stennie Meadours led the first bird survey on July 10, 1999. She put out an announcement on the TEXBIRDS email list, inviting any and all birders to participate in the monthly bird surveys which convened at 7am and 4pm on the second Saturday of each month. During the first count, four birders in the morning and six in the afternoon found 64 species in and around the ponds, including a locally unusual mid-summer Swainson's Hawk. For nine years, birders have continued these monthly counts and tallied over 250 species, providing a more complete and systematic record of the many birds using the ponds, riparian forest, and fields at this facility (Hornsby Bend Bird Observatory 2008).

In November 1999, we held a public event to celebrate the 40th anniversary of birding at Hornsby Bend. During the evening program, a panel of birders reminisced about the history of birding at the ponds, Texas Parks and Wildlife officials presented a plaque to the facilities manager, and Texas Audubon designated Hornsby Bend one of the first Important Bird Areas in the state because of its large congregations of migratory shorebirds and waterfowl. To support the IBA designation, the Hornsby Bend Bird Observatory became one of the first IBA support groups in the country, and a model for how a small group of enthusiasts on a shoestring budget can monitor bird populations and work with facilities managers to maintain bird habitat. When Stennie Meadours moved

to Houston, she started a similar monthly bird survey at Bolivar Flats, a globally important IBA on the Texas coast.

In order to collect bird sightings for my master's research, I had placed a bird sightings clipboard on an educational kiosk at the ponds in August 1998. We continued to collect these sightings, and I regularly posted them to the TEXBIRDS email list. I had set up an official HBBO website in early 1999, and in order to free TEXBIRDS from the barrage of daily Hornsby Bend bird sightings, I started a blog to post the daily sightings on the HBBO website.²⁰ In the days before blogging software, updating the pages with a web editor and coding all of the entries in HTML became tedious, so after two years we replaced the proto-blog with a system for birders to report their own sightings online using a free web guestbook program. The HBBO website also featured a bird checklist, birding guide, and calendar of workshops and regularly scheduled events, including the monthly bird survey (second Saturdays), monthly bird walk (third Saturdays), HBBO meeting (third Wednesdays), and habitat restoration workdays (fourth Saturdays).

With a presence on the relatively new world wide web, we began a series of bird monitoring programs at the ponds, as well as workshops to train birdwatchers as official bird monitors. In July, 16 birders attended the first HBBO Shorebird Monitoring Workshop—a Friday night bird shorebird identification lecture, followed by a Saturday morning field experience where attendees learned Manomet's International Shorebird Survey protocol and broke into four groups to do a practice count. Afterwards the volunteers signed up to count shorebirds throughout the rest of the fall migration. In

²⁰ Archives of the original HBBO website, including the bird sightings blog are available on the WayBackMachine internet archive: http://web.archive.org/web/*/http://hornsbybend.org.

2002, seven counts between July and September recorded 4,436 shorebirds of 23 species (Hornsby Bend Bird Observatory 2008).

In August, we started a volunteer hawkwatch at the ponds—the first regular hawkwatch in Central Texas—and Joel Simon from the Hazel Bazemore Hawkwatch in Corpus Christi taught a hawk migration workshop consisting of a Friday night hawk identification lecture, followed by a Saturday morning hawkwatch, which got all the new hawkwatchers excited when a kettle of 60 Mississippi Kites streamed overhead. That first year, a small team of volunteer counters spotted 370 migrating raptors during 45.75 hours over 18 days from mid-August to mid-September. The next year, we held another training workshop for volunteers, but also hired an official hawkwatcher, and the count soared to 4208 migrant raptors observed during 353 hours over 52 days from mid-August to mid-October. A paid hawkwatcher has conducted the count each subsequent year, resulting in a more consistent counting effort. In 2004, the hawkwatch reported a record 17,087 migrant raptors—including a surprising 10,000 Swainson’s Hawks passing over the count during three days in October. Most years the counters log about 7,000 migrant raptors (Hornsby Bend Bird Observatory 2008).

In addition to the annual shorebird and hawkwatch workshops, in the Fall of 2000 HBBO hosted a workshop for Project Prairie Bird, a citizen-science project to survey grasslands for wintering sparrows and other small birds.²¹ The Friday night lecture covered how to identify sparrows and other small grassland birds in flight, and the Saturday morning field session focused on how to walk the transects and record

²¹ Workshop instructors: Project Prairie Bird organizers Cliff Shackelford of Texas Parks and Wildlife and Cecilia Riley of the Gulf Coast Bird Observatory. Other project partners included the U.S. Forest Service and Raven Environmental Services.

vegetation data. After the workshop, the 51 participants divided into three-person teams and received assignments of public and private lands to survey throughout the winter months.

In 2002, we established a banding station at the ponds. Aspiring bird banding assistants attended a training workshop, after which they were able help band birds at a MAPS banding station.²² During the first season, the station banded 130 birds of 15 species, but due to an inability to get bands from the USGS Bird Banding Lab in Maryland, the banders had to close the station down early (Hornsby Bend Bird Observatory 2008).

In addition to bird monitoring workshops, HBBO has held three workshops on owl ecology and management, as well as a Purple Martin landlord workshop. The \$50 workshops begin with a Friday night lecture and end with a Saturday morning field component, capped off with a catered Texas-style barbeque. The first owl workshop with 60 participants had 40 more on a waiting list, and participants attended from as far away as the Rio Grande Valley and the East Texas Pineywoods.

HBBO activities take place at the Center for Environmental Research (CER), a large office, lab, and meeting space facility on site built by the City of Austin, University of Texas, and Texas A&M University. In early 2000, the Austin Water Utility hired Kevin Anderson as an environmental program coordinator for the center, providing an official city liaison with HBBO, and making it easier for HBBO to operate with direct support and in close cooperation with the center.

²² MAPS: Monitoring Avian Productivity and Survivorship, a bird banding program using a standardized protocol during the breeding season to measure bird population dynamics. The Institute for Bird

In addition to hosting and facilitating HBBO activities, the CER also conducts a wide range of environmental programs including training for City of Austin employees, restoration and ecological research onsite, as well as internships and programs for local schools and universities. HBBO partnered in many of these programs, including the creation of an Austin Biodiversity Group—a partnership of agency, nonprofit, corporate, and educational partners working together to promote and enhance local wildlife populations and habitats, and the Colorado River Corridor Project to protect river and its habitats east of Austin.

All of these activities require a range of trained volunteers and active participants, and HBBO has worked hard to recruit and train people at all skill levels. Beginning birders are invited to participate in the monthly bird counts, and are often paired with more experienced observers—providing personalized and fun bird identification and monitoring training and mentoring. Beginners are also invited to a monthly bird walk held on the Saturday following the monthly count. When I led these walks, I always promised that the group would find 50 species in a morning of walking the woods and scoping out the ponds—exposing hundreds of birdwatchers to dozens of species. Many times enthusiastic bird walk participants have returned later to help with a bird survey or join a monitoring workshop.

Birdwatchers have been slower to embrace the monthly work days, which we started advertising as Ecoliteracy Days—where participants can come help do trail work, invasive plant removal, or native tree planting and then enjoy an hour or two of exploring or birding the woods, fields, or ponds. However, these work days attract church, school,

Populations in Point Reyes, California started the program in 1989, and coordinates the banding at over 500

or nonprofit groups looking for service opportunities, creating a larger community of active supporters for the site and its birds.

As an IBA support group, HBBO serves as a test case for getting volunteers to help monitor and manage industrial sites or municipal facilities, and brings to light many available opportunities and challenges facing similar groups (Table 5.2). While the project has proven that a small group of dedicated volunteers can pull off miracles, they depend on motivated and dedicated leadership, which is often in short supply. After I left HBBO, monthly surveys, the hawkwatch, and monthly bird walks have continued with support from Travis Audubon Society and the CER, but other programs have dropped away and no new programs, or leaders to create them, have emerged.

My experiences at Hornsby Bend, as well as the other examples noted here, show that with the concerted effort of local bird enthusiasts and the managers of properties on the urban fringe, these areas can be serve the needs of modern industrial societies as well as the hundreds of bird species that nest, migrate through, or winter on the edge of American cities. These efforts require that groups of citizens learn to work effectively with these land managers, and build relationships of trust with them, but when this happens, together they can improve the habitat value of these industrial wilds, and the birds flourish.

Table 5.2 Challenges and Opportunities for IBA Support Groups

Challenges	Opportunities
<p>Leadership</p> <ul style="list-style-type: none"> • Difficult to coordinate major effort as a volunteer • Usually more “followers” than “leaders” available 	<p>Leadership</p> <ul style="list-style-type: none"> • Future leaders can be trained by giving them responsibility for small projects—such as coordinating the bird count.
<p>Funding</p> <ul style="list-style-type: none"> • Some projects need minimal funding (website hosting, etc.) • Difficult for volunteers to raise significant funds 	<p>Funding</p> <ul style="list-style-type: none"> • Workshop fees can raise funds for small projects • Volunteers may be able to obtain small grants or in-kind support from local organizations
<p>Property Management</p> <ul style="list-style-type: none"> • Site may be managed for purposes that put habitat at risk. • Management decisions require effective implementation by staff. 	<p>Property Management</p> <ul style="list-style-type: none"> • Groups that maintain close relationships with property or facility management will find many ways to help each other and avoid escalation of misunderstandings. • Volunteers can help property managers undertake projects they don’t have enough staff or funds to complete
<p>Volunteers</p> <ul style="list-style-type: none"> • Birders just want to bird—may be difficult to engage them in meeting with property managers, habitat work, or formal bird monitoring protocols. • May not be available during the day to meet with professionals from other organizations or property management. 	<p>Volunteers</p> <ul style="list-style-type: none"> • Birders enjoy a bird monitoring program that is most like regular birding, and includes social interactions like a countdown lunch or dinner to see what other teams have found. • Meetings need to take place during the evening or on weekends, preferably in conjunction with some other event.

Chapter 6—Corridors and Networks (Zone 5)

In 1876, U.S. Army surgeon and naturalist Elliot Coues was appalled at the number of dead Horned Larks and McCown's Longspurs he found dead under telegraph wires strung between Denver, Colorado and Cheyenne, Wyoming. On one three mile stretch he counted a hundred birds killed "quietly, insidiously, and uninterruptedly...by flying against these wires, which now form a murderous net-work over the greater part of the country." He saw three birds strike wires and fall stunned to the ground over the course of one hour, leading him to calculate that "many hundred thousand birds are yearly killed by the telegraph." Depressed by his observations, he concluded: "Usually, a remedy has been or may be provided for any unnecessary or undesirable destruction of birds; but there seems to be none in this instance. Since we cannot conveniently abolish the telegraph, we must be content with fewer birds" (Coues 1876).

Since Coues day, the "murderous network" of telecommunications wires has grown exponentially, as have the networks of roadways, railways, and other telecommunications structures of Zone 5 that weave together the other urban zones and link cities into an international urban system. Each of these networks poses hazards to birds, even while affording occasional opportunities. Fortunately, regulatory agencies and industry have not accepted Coues conclusion that there is no remedy for the birds killed by these networks, and efforts are underway to make them less hazardous to birdlife. Some are even modifying transportation and telecommunication structures to serve the nesting and roosting needs of wild birds.

ROADS

In the United States, 54,652 miles of freeway and 3,034,671 miles of paved roadways cover 11.1 million acres (17,375 square miles), an area about the size of Delaware, Connecticut, and New Jersey combined. However, habitat fragmentation, collisions, and traffic noise associated with roadways extend the impact of roadways for hundreds of meters beyond the edge of the paved surface (Forman & Alexander 1998; Trombulak and Frissell 2000). One researcher has estimated that 22 percent of the contiguous United States is directly impacted by the effects of roadways (Forman 2000).

As early as the 1920s, ornithologists were taking note of the many birds killed by collisions with automobiles (Gander 1927; Spiker 1927; Clabaugh 1928). One bird student recorded 277 birds of 28 species killed on Iowa roads (Spiker 1927), and another found 14 dead birds on one 239 mile trip, including one American Coot, two Red-winged Blackbirds, one Nuttall's Woodpecker, and one English Sparrow (Clabaugh 1928). After reviewing the causes of bird collisions with cars, Smithsonian ornithologist Alexander Wetmore lamented that "for all this destruction there is no apparent remedy, and the auto must be reckoned as another of the factors introduced by our civilization that is inimical to birds" (Wetmore 1934). Today collisions with automobiles kill an estimated 60 million birds each year (United States Fish and Wildlife Service 2002), and are a significant cause of death in many species including Burrowing Owls (Bird *et al.* 1996) and the threatened Florida Scrub Jay (Mumme *et al.* 2000).

Urban birds are also distressed by elevated roadway noise. Some songbirds, including Song Sparrows in Portland, Oregon, shift the frequency of their songs in urban

areas, in order emphasize higher pitched notes that carry farther over the lower frequency urban noise pollution (Wood and Yezerinac 2006). Other birds may not be as adaptable, and many studies have shown that birds may avoid areas with prolonged and elevated noise levels (Patricelli and Blickley 2006). Robert Dooling of the University of Maryland describes four effects of road noise: annoyance leading to abandonment of area, stress leading to reduced survivability, injury to auditory system, and interference with communication (Dooling 2006). These impacts extend across the country from city centers out to rural and otherwise wild lands (Forman & Alexander 1998; Trombulak and Frissell 2000).

While roadways are a source of mortality and disturbance for many birds, they also provide opportunities for other species. After reviewing the foraging, bathing, and nesting opportunities provided by birds, one early reviewer suggested that roadway benefits far outweighed their potential hazards (Linsdale 1929). Vultures, crows, ravens, magpies, and other birds commonly forage road killed birds and mammals. Black Vultures and Turkey Vultures are so adapted to foraging on roadkill, that they preferentially establish home ranges in areas with higher road densities (Coleman & Fraser 1989). Mallards in North Dakota prefer nesting on road rights-of-way, perhaps due to lower predation rates there (Cowardin *et al.* 1985). Snow plowing and the application of road salts may provide opportunities for birds during periods of heavy snowfall by opening up bare ground for foraging Horned Larks, meadowlarks, sparrows, and longspurs. In perhaps the most surprising use of roadways by birds, researchers found that urban pigeons use roadways as familiar flight paths, at times preferring to follow roadways than flying a more direct cross-country course (World Science 2004).

In the midst of the Great Depression, government biologist W. L. McAtee published recommendations “urging a treatment of these public and semipublic travel ways that will not only increase their bird population but make them more sightly.” He suggested less mowing, more tree plantings, and maintenance of shrubby fence lines (McAtee 1937). Unfortunately, planting trees and hedgerows along roadways often leads to increased collisions with vehicles (Orlowski 2008), suggesting that woody vegetation adjacent to roadways should be removed. Very little is usually done to enhance roadways for birds, but since roadside bird communities and populations are mostly determined by the habitat they pass through, roadsides can provide good habitat as long as they are similar to the dominant habitat within the landscape (Meunier *et al* 1999).

RAILS

First constructed in 1832 to portage canal boats traveling between Philadelphia and Columbia, railways enabled urban growth and the spread of cities while creating new opportunities for birds. Railroad companies experienced their heyday after the Civil War, tripling the number of railroad miles between 1860 and 1880. Track miles doubled again by the end of the 19th Century, when 193,000 miles of track linked urban centers and smaller communities across the country. In agricultural areas, unplanted railroad rights-of-way were often the only areas to retain native grassland or shrubby vegetation, providing foraging and nesting sites for field birds, and as the railroad expanded, birds learned to utilize the road beds and adjust to the noise of passing trains. One observer found an Eastern Meadowlark nest within nine feet of a Grand Trunk Western Railroad line. According to Bent, “Trains running at a high rate of speed, making much noise and

jarring the ground, apparently did not disturb the birds. The nest, in short grass, was completely covered over with dried grasses and the entrance was away from the tracks” (Bent 1958).

By the end of the 19th Century, ornithologists commonly noted that spilled grain along rail routes had been the chief means of facilitating the spread of House Sparrows across the nation (Anthony 1921). Spilled grain also attracted other species, including Horned Larks, which also sought shelter in the lee of the steel rails in windy open areas such as Nebraska. Unfortunately, this shelter at times turned deadly, as “crouching at night in the shelter of the rails, and stupefied by the noise and light of approaching trains they rise too late, are struck by the flying train, and thrown dead to either side of the track” (Barbour 1895: 187). Other birds have actually followed behind trains looking for food, including Common Ravens in the arid southwest, which one observer likened to seabirds following ships by calling them “goonies of the desert” (Grinnell 1908). Perhaps less surprisingly, gulls have followed trains looking for handouts just as they follow ships, including a flock that followed one train for several hours across the “Ogden cut-off” across a neck of the Great Salt Lake in Utah (Swarth 1920).

In addition to making recommendations for roadways, federal bird expert W. L. McAtee also suggested ways to improve railroad right-of-ways for birds. Noting that many railroads had already started beautifying these areas, he suggested that “if this planting could be directed in part, at least, toward attracting birds, it would be very effective and great good would be done. If the clumps of shrubs were formed of kinds furnishing the birds food and more of them were placed along the rights-of-way...thousands of birds could live where very few do now” (McAtee 1937).

Railway miles peaked at 254,000 miles in 1916 (Stover 1997), and declined to 220,000 miles in 2000. Since railroad right-of-ways often form linear wooded corridors, they may be too narrow to support interior-nesting woodland birds, but they can form dispersal routes linking patches of wooded habitat within the city. As railways are decommissioned, the rails are often pulled up and a hike and bike path installed in its place. Many of the nation's more than 1,500 "rails-to-trails" form urban greenbelt habitats that may be popular to both birds and birders, such as the 25 mile Schuylkill River Trail in Philadelphia. In Columbus, Ohio, the Olentangy River trail links 13 miles of parks and natural areas, including the Ohio State University wetland research center (Rails to Trails Conservancy 2008). In Lincoln, Nebraska, 77 bird species used one converted urban railway line, while 99 occupied a similar length of partially converted railway outside the city (Poague *et al.* 2000). Whether active, abandoned, or reclaimed, railway lines create valuable habitat corridors through large urban centers.

BRIDGES AND OVERPASSES

Bridges were among the first transportation structures built in America, and by the early 1800s, Eastern Phoebes were nesting under bridges near Philadelphia (Wilson 1970) and Audubon noted bridge-nesting Barn Swallows (Ford 1957). In the 1870s, even Rough-winged Swallows, which traditionally nested in holes excavated in steep riverbanks, were nesting in "nooks afforded by bridges, piers, and other contrivances of man" (Coues 1878:391). By the early 1940s, Cruickshank noted Peregrine Falcons roosting on New York City's George Washington Bridge (Cruickshank 1942). Rock

Pigeons commonly nest on ledges under bridges and highway overpasses, as do Cliff Swallows and, in the southwest, increasing numbers of Cave Swallows.

Bridges can provide shelter for a surprising number of species; a freeway bridge in Austin, Texas even hosted a nesting pair of Barred Owls. Bridges and overpasses may harbor some of the largest urban bird concentrations when martins, crows, and cormorants use them as roost sites. During migration, hundreds of thousands of Purple Martins roost under the causeway bridge over Lake Pontchartrain near New Orleans and the William B. Umstead Bridge between Manteo and Mann's Harbor in North Carolina (Riddle 2006). Peregrine Falcons have found new foraging opportunities at the Congress Avenue Bridge in Austin, Texas, where they have learned to pick off Mexican free-tailed bats at dusk as they depart from roosting sites in the expansion joints under the bridge.

Early attempts to improve bridges and overpasses for birds focused on protecting roosting sites and preserving known nesting sites for colonies of swallows and pairs of Peregrine Falcons. After falcons initially colonized bridges on their own, the Peregrine Fund and local wildlife officials deliberately hacked additional birds on bridges across the United States (Cade *et al.* 1996).

In the Metairie section of New Orleans, Purple Martin enthusiast Carlyle Rogillio instigated measures to protect martins roosting during fall migration under the causeway over Lake Pontchartrain. When observers noted that cars and trucks speeding over the bridge were killing an estimated 12,000 martins each year, Rogillio and members of his National WildBird Refuge organization pressed the causeway management to construct nearly a mile of protective wire fencing above the guardrails. The fencing keeps birds,

especially unwary juveniles, from swooping into the constant vehicle traffic above their roost (Doughty & Fergus 2002).

In San Francisco, the state transportation department is creating a cormorant colony on the new eastern span of the Bay Bridge. 1,600 cormorants already nested on the old western span, and Caltran has installed 7,200 square feet stainless steel mesh on the inside section of the new bridge as cormorant nesting platforms. The platforms are placed where the colonial nesting birds on one level can look down and see the other nesting birds (Russell 2006).

While traditional bridges attract a few roosting and nesting birds, new vegetated bridges and overpasses are starting to provide additional habitat along transportation corridors. Freeway Park in Seattle, one of the first of its kind in the U.S., is a lid over Interstate 5 to shield nearby offices from freeway traffic noise. Built in 1976, the five acre park designed by landscape architect and rooftop garden aficionado Lawrence Halprin is a pedestrian overpass featuring a series of plazas, lawns, bushes, trees, and artificial waterfalls. Though not designed specifically for birds, the \$24 million Freeway Park is an innovative, if expensive, reminder that even freeways and overpasses can be landscaped to provide shelter and pathways for urban wildlife.

In Europe, ecoducts or wildlife bridges are vegetated overpasses created to allow animals to cross safely over a freeway.²³ Usually 60 to 150 feet wide, these structures are corridors linking habitats on either side of the road (Badgerland 2004). These European innovations served as a model for the first ecoduct in the United States, the Cross Florida Greenway Land Bridge over Interstate 75 south of Ocala, Florida (McGinness 2000).

Finished in 2000, the 50.2 foot wide and 200 foot long overpass is narrower than European wildlife bridges, but deer and other wildlife accepted it readily as a vegetated pathway (Florida Department of Environmental Protection 2004). At a cost of \$3.1 million, the land bridge is an expensive way to maintain habitat connectivity. Florida has already built a second land bridge over Interstate 95 linking the Florida Agricultural Museum and the Princess Place Preserve (Flagler County 2002).

Wildlife overpasses designed to serve terrestrial animals also facilitate passage by small birds hesitant to cross multi-lane freeways. In conjunction with wildlife underpasses, these structures integrate human transportation systems into native birdscapes. Road engineers are now building complete wildlife highways, such as the Trans-Canada Highway through Banff National Park in Alberta, with 22 underpasses and two C\$1.5 million wildlife overpasses (Walker 2004). In the United States, Highway 93 under construction in Montana is the first wildlife highway in the United States, with three wildlife overpasses and wildlife bridges (NCHRP 2008). In Washington, the I-90 Wildlife Bridges Coalition of local four local Audubon groups and 28 other nonprofits, and 11 endorsing businesses are pushing for wildlife overpasses on a 15 mile freeway expansion through the Cascade Mountains 50 miles east of Seattle (I-90 Wildlife Bridges Coalition 2008).²⁴ Wildlife underpasses are less expensive than overpasses, making them the preferred option in rural as well as urban areas, but state and local highway departments across the country are increasingly building both when necessary, creating

²³ In the United States, the term “wildlife bridge” refers to underpasses allowing animals to cross under roadways.

²⁴ A tour of the proposed design rout showing a proposed wildlife bridge is available as a 2:44 minute video at <http://www.youtube.com/watch?v=0at17lokxZ4>.

many more bird-friendly urban and rural transportation corridors across the country (ICOET 2007).

BILLBOARDS AND SIGNS

Outdoor advertising in American cities began in 1835 with New York advertiser Jared Bell's large circus posters measuring more than fifty square feet. By 1900, billboard manufacturers had established a standardized billboard structure, and billboards were so common that the U.S. Congress passed the Bonus Act to encourage states to reduce billboards along interstate highways. The Highway Beautification Act of 1965 limited interstate highway billboards to commercial and industrial areas. Over 370,000 billboards currently serve as perching, roosting, and nesting structures for common urban birds, including Rock Pigeons, crows, grackles, blackbirds, starlings, and House Sparrows (Outdoor Advertising Association of America 2006).

Sign owners often view these congregating sign roosters as pests, fueling an industry marketing bird exclusion devices to billboard companies. A growing number of firms sell plastic owls, moving wires, and acoustic threats to those who tire of pigeon excrement soiling their advertisements. The most elaborate new bird deterrent is a \$4,200 robotic Peregrine Falcon that turns its head, flaps its wings, and utters piercing calls to scare away unwanted birds (Robop 2008). As less expensive deterrents are rarely effective for long, nuisance pigeons and starlings will be fixtures on billboards for the foreseeable future.

Occasionally billboards and road signs host more desirable species. Red-tailed Hawks have nested on billboards in Metropolitan Milwaukee, Wisconsin (Stout et al.

1996), and a pair of Barn Owls made the news in Austin, Texas when they nested on a 30 foot tall billboard, causing delays in construction of a major toll road (Wheeler 2003). In the Southeastern States, birders often find Common Nighthawks and Eastern Screech-Owls foraging near lighted billboards (Flynn 2004, Phillips 2004, Raney 2004)..

Some enthusiasts are even enhancing these billboards and road signs for wildlife. In 1983, the Iowa Department of Natural Resources started mounting nest boxes for American Kestrels on the backs of road signs on I-35. Eight pairs of kestrels used the first 20 boxes installed as an Eagle Scout project. Eventually, volunteers installed nest boxes on almost every mile of interstate highway from Missouri to Minnesota. Though the birds nest right next to the freeway, the young leave the roadsides as soon as they fledge and very few are actually killed by passing vehicles. Based on the success of this program, other states have created highway nest box programs, including Rhode Island, Nebraska, and Idaho (Varland et al. 1992).

WIRES

Telegraph wires were already common a generation before Coues lamented their impact on birds, but by 1880 the 21,147 miles of line in 1851 had grown into the “murderous net-work” of over 291,000 miles of line crisscrossing the country. Over the past century, the wirescape has expanded to include over 4 million miles of electric distribution lines and millions of additional miles of telephone and cable television wires. Over 150,000 miles of high voltage transmission lines supply power to urban areas and link American cities into a single power grid.

Relatively few birds regularly perch on high transmission power lines, though the largest Common Raven roost ever recorded involved over 2100 birds roosting on several miles of transmission lines and fifteen transmission towers in Southwestern Idaho (Engel *et al.* 1992). The more abundant and lower distribution lines provide better roosting, perching, and foraging opportunities for most birds. American Kestrels frequently hunt insects and rodents from perches on roadside power lines, as do larger Red-shouldered Hawks and Barred Owls on occasion. In early spring, Mourning Doves start to wail their plaintive *hoo-hoo-hoo-hooooo* calls from roadside and backyard utility lines, and across The hundreds of species observed perching on wires includes such oddities as Greater Prairie Chicken (Allen 1868), Spotted Sandpiper (Snyder 1924), Great Blue Heron, White Ibis, and Black-bellied Whistling Duck. Flocks of exotic parrots in California, Texas, and Florida gather on urban power lines at dusk before heading to nocturnal roosts. Where trees are scarce in the Intermountain West, Common Nighthawks roost lengthwise along lines during the day. Starlings, blackbirds, and grackles often form large nighttime roosts on power lines in well-lit commercial areas.

Pre-migratory flocks of swallows famously gather in late summer on wires before heading south. In 1908, in an essay describing the approach of Autumn in Omaha, Sandy Griswold noted that “the annual swallow parliament is being held:”

The swallows are gathering in whirling hosts. All day long they play about, swinging here and there in wide circles, now high in the air, now so low along the ground that the tips of green-black wings seem to snip the dusty grass blades, in and about the heedless stock, then again up into the cloudless blue. They gather, too, after each aerial sortie, in long rows along the telegraph and telephone wires

skirting our highways, and twitter and chatter to each other, until in little companies they volley off into the air again (Griswold 1908).

Despite the true wonder of such spectacles, urban wirescapes are hardly benign, since they are also significant collision hazard for many species. The U. S. Fish and Wildlife Service (2002) estimates that transmission and distribution lines kill 174 million birds each year in the United States, including the critically endangered California Condor (Singer 2002) and Whooping Crane (Doughty 1989). Lines pose perhaps the greatest danger to birds with high wing loading and low aspect, such as rails, cranes, pelicans, and herons, which may not be able to quickly adjust their flight path to avoid power lines (Bevanger 1998).

Efforts to make power lines safer for birds began in 1971 after researchers found more than 300 Golden Eagles dead near power lines in Wyoming. Several Federal agencies met in Washington DC in January 1972 to discuss a remedy to the problem. About the same time, Robert K. Turner of the National Audubon Society wrote to Pacific Gas and Electric Company officials drawing attention to the bird kills. When Richard Thorsell of Edison Electric Institute (EEI) in New York City learned of the deaths, he began coordinating efforts with other utilities to address the problem, and on 6 April 1972, EEI hosted a meeting in Denver, Colorado between industry, agency, and nonprofit wildlife interests. That year the Rural Electrification Administration (now Rural Utilities Service), a U.S. Department of Agriculture agency that lends money to rural electric cooperatives, set minimum standards for bird-safe power line design, and in 1973 the U.S. Fish and Wildlife Service established a raptor electrocution reporting system to monitor raptor deaths (Avian Power Line Interaction Committee 2006).

Industry, agency, and nonprofit groups have continued to cooperate in making power lines and utility structures safer for birds. In 1983, they formed an ad hoc group to address the problem of cranes colliding with power lines in Colorado, and in 1989 EEI formalized this group as an Avian Power Line Interaction Committee (APLIC) to continue dealing with bird and power line collisions and electrocutions. APLIC currently has 31 members including electric utilities, utility organizations, and federal agencies involved in bird and power line interaction issues. In 1994, APLIC published *Mitigating Bird Collisions with Power Lines* and in 1998, they issued an 18 minute companion video highlighting bird/power line interactions and mitigation techniques. Researchers are still trying to determine the best way to make wires less dangerous for birds (Janss & Ferrer 1998; Yee 2008), though industry has already designed dozens of options for making wires safer for birds. Commercially available bird flight diverters include large orange balls, wire spirals, hanging flags, and assorted dangling plastic shapes that look like oversized fishing lures (Yee 2008).

Unfortunately, recent research suggests that collision hazards are not the only threat posed by power lines. Though still poorly studied, electromagnetic radiation emitted from electrical transmission and distribution lines may impact the growth and development of birds nesting on or around transmission towers and power poles. One study of birds nesting under power lines found reduced nesting success in Tree Swallows, but not in House Wrens or Eastern Bluebirds (Doherty and Grubb 1996). Recent studies of American Kestrels conducted by McGill University researcher Kimberly Fernie, have found that electromagnetic fields alter melatonin levels (Fernie et al 1999) and growth of hatchlings (Fernie & Bird 2000). Electromagnetic field exposure also appears to affect

the reproductive success of kestrels by increasing fertility, egg size, and embryonic development, which improves fledging success but reduces hatching success (Ferne et al 2000). The most recent review found that electromagnetic field exposure often affects bird behavior, reproductive success, growth and development, physiology and endocrinology, and oxidative stress (Ferne & Reynolds 2005), but as of yet there are no estimates as to how significant this problem may be, or mitigation measures proposed for ameliorating this threat to birds or other wildlife.

POWER POLES AND TOWERS

Samuel F. B. Morse and Alfred Vail put up the first telegraph poles in 1837, sending their first telegram over 2 miles of wire at Speedwell Ironworks near Morristown, New Jersey on January 6, 1838. A hundred and seventy years later, over one million transmission towers and 116.5 million power poles support an extensive telecommunications wirescape servicing homes and businesses across the United States. Soon after the first telegraph poles were installed in the 19th Century, birds of prey found them to be convenient nesting sites and hunting roosts. Raptors frequently use the higher transmission towers as hunting perches, and both Black Vultures and Turkey Vultures perch on towers during the day or congregate in large numbers to roost on them at night. In Austin, vultures roosting on transmission towers caused power fluctuations that bedeviled high-tech companies reliant on stable power voltages (Quin 2001).

Some birds may occasionally build nests on transmission towers; a Red-tailed Hawk nested on one tower in metropolitan Milwaukee, Wisconsin (Stout *et al.* 1996) and Prairie Falcons have nested on a transmission tower near Lovelock, Nevada (Roppe *et al.*

1989). Monk Parakeets frequently build their bulky communal stick nests on power poles, and have nested on transmission towers and electric substations in Florida, New York, Oregon, and Texas. In Austin at least 34 Monk Parakeet nests were located on power poles, transmission towers, and cell phone towers in 2007 (Newgord 2007).

Early observers noted Western Kingbirds nesting on telegraph poles, and in Santa Monica, California, an Anna's Hummingbird chose a telegraph pole for a nest site (Chambers 1903). In many areas, especially in grasslands or shrublands, power poles are the tallest landscape feature and provide the preferred hunting perches and nesting sites for raptors. Ospreys frequently nest on power poles, or replacement poles installed by utility companies, as do at least eleven other raptor species (Blue 1996). Others, such as Scissor-tailed Flycatchers, may nest in the cross-beams of poles (Bent 1942), and early observers noted that woodpeckers readily excavated nest cavities in telegraph and later power poles—providing nesting sites for themselves, as well as for titmice and chickadees. Where trees were scarce, early telegraph poles provided ideal nesting sites for many species. One visitor to south Texas noted that “along the railroad tracks on the road from Brownsville to Point Isabel almost every telegraph pole had a hole in it” made by nesting Golden-fronted Woodpeckers (Friedmann 1925). Besides nesting opportunities, poles provided foraging opportunities for tree trunk foraging species like White-breasted Nuthatches. Bent even reported pine tree dependent Brown-headed Nuthatches foraging for insects and spiders on power poles (Bent 1948).

As with wires, utility poles and power towers pose an electrocution threat to birds. As early as the 1920s, utilities such as the Southern California Edison Company were placing structures on transmission towers to discourage birds from perching above

transformers, since their excreta caused electricity to bypass the transformers in a “flashout” that often killed or injured the bird, and caused costly power outages (Michener 1928). Recently, electrocuted hawks have been implicated as the source of wildfires in southern California (Marquez and Rowlands 2004).

On distribution poles, the close spacing of wires (phases) creates a shock hazard for birds of prey able to simultaneously touch two wires or a wire and pole. Nobody knows for sure how many birds are electrocuted on power poles each year. The U.S. Fish and Wildlife Service estimates some tens of thousand, and raptor biologists can only report from what they see, no matter what the total is, birds of prey are killed at “unacceptably high levels” (Williams 2000). Various products are available to retrofit poles to minimize their risk to raptors (Avian Power Line Interaction Committee 2006), including long plastic insulators slip over the tops of wires where they connect with poles, plastic insulator and transformer caps, and large triangles mounted on the pole crossarms to discourage raptors from landing there. New steel utility poles which conduct electricity are even more dangerous to raptors, but additional plastic retrofits are available to make these poles safe as well (Aichinger 2001).

In order to help utilities adopt these modifications, the Avian Power Line Interaction Committee worked with the U.S. Fish and Wildlife Service to develop voluntary Avian Protection Plans. These plans are utility-specific documents outlining how each utility will address bird electrocution hazards. The plans address corporate policies, training, permit compliance, construction design standards, nest management, avian mortality reporting, risk assessment, mortality reductions, avian enhancement options, quality control, public awareness, and identification of key resources (Avian

Power Line Interaction Committee and United States Fish and Wildlife Service 2005). Industries prefer to work with these voluntary and flexible guidelines and regulatory agencies prefer to avoid antagonistic relationships with powerful energy companies. Utilities that create Avian Protection Plans are granted some leeway with raptor electrocutions, while those that don't are more likely to face potential fines when their poles and lines kill birds.

All federal agencies are supposed to have bird-safe poles on their properties, and a growing number of utilities are starting to retrofit their poles (Blue 1996). In 2001, Hawk Watch International teamed up with Utah Power to identify dangerous poles and mitigate electrocutions on power poles. 46 volunteers, along with electric utility, state agency, and Hawkwatch staff monitored over 13,000 poles and identified those with the highest risk to raptors. Poles presenting the greatest threat have been modified to keep birds from landing where they may be electrocuted (Ligouri 2001).

In addition to making poles safer for birds, some are installing platforms on poles and towers to encourage ospreys and other raptors to use them as nesting sites. The Tampa Electric Company creates platforms to relocated Osprey nests away from dangerous power lines. Platforms are usually placed above the nest site on the original pole, or on a safer adjacent pole (Tampa Electric Company 2004). Most utilities prefer to remove nests from the distribution poles, and erect replacement poles and platforms nearby (Baldwin EMC 2004, Wisconsin Electric 2004). By installing additional poles and adding extension platforms, extra cross arms, or insulators to energized poles, Portland General Electric has created nesting sites that have brought the Willamette

Valley, Oregon population of Ospreys up from 13 pairs in 1978, to over 230 pairs in 2004 (Portland General Electric 1998, Portland General Electric 2004).

Power poles also make good superstructures for the placement of nest boxes. One bluebird fancier placed 109 utility pole-mounted boxes sites in three counties covering more than 248 square miles (95.7 km²) in north central Ohio (Sheldon 1995). The Prescott Birdhouse Company in Oregon obtained permission for customers to mount their Western Bluebird boxes on utility poles throughout the Willamette Valley. Sometimes power companies themselves encourage the placement of nest boxes on their poles. PNM, the power company in New Mexico has teamed up with six Albuquerque schools, Hawks Aloft, and B & D Industries to place kestrel boxes on their power poles. Students monitor the boxes with closed-circuit cameras to record chick survival rates (PNM 2004). Elsewhere, enthusiasts have used poles to support boxes for Barn Owls in Pennsylvania (Berg 2006) and California (UC Davis Sustainable Agriculture 1992).

COMMUNICATIONS TOWERS

Radio towers emerged as a new urban form at the turn of the 20th Century, when entrepreneurs started building towers, including Reginald Fessenden's 420 foot tower at Brant Rock, Massachusetts, which transmitted the first two-way transatlantic radiotelegraph message in January 1906, and became the first to transmit a voice radio program on Christmas Eve 1906. By 2002, there were over 100,000 communications towers and thousands of new towers are constructed each year. These towers range in size from cell phone towers, which are usually smaller than 200 feet high, to enormous new digital television towers that may be tower over 1,500 feet in the air.

As with power towers, many birds of prey nest on communication towers. Ospreys build their bulky nests on cell towers in Florida, Idaho, Massachusetts, Michigan, and North Carolina. In Florida, 35 to 45 percent of all cell towers host Osprey nests (Bechtel Telecommunications 2006). Bald Eagles are also starting to nest on cell towers in Florida (Hancock Wildlife Foundation 2008), and other raptors such as Red-tailed Hawks use cell towers for hunting perches.

Unfortunately, television, radio, microwave, and cell phone towers are not merely convenient raptor nesting sites, they are also a well known collision hazard for migratory songbirds (Avery *et al.* 1980; Hebert *et al.* 1995; Trapp 1998). Over 230 bird species have been killed in tower collisions (Shire *et al.* 2000), and the U.S. Fish and Wildlife Service (2002) estimates that communications towers kill 40 million birds in the United States each year. Many of these birds are killed at night, especially in foggy conditions, when they collide with towers or their supporting wires after becoming attracted to the aviation safety lights and circling around in the artificially lighted airspace.

In order to address this threat, Cornell Laboratory of Ornithology researcher Bill Evans created the Towerkill.com website with a bulletin board to host conversations about tower kills, a map of communications towers, and serves as an information portal for tower kill studies and information. Evans and others initiated conversations that led to institutional response (Evans 1998). Under pressure from the Towerkill advocates, in June 1999, the U.S. Fish and Wildlife Service established a Communication Tower Working Group (CTWG) composed of 42 government agencies, industry, academic researchers and nonprofit groups to address the problem. The CTWG encourages more research aimed at finding mitigation solutions, and in August 1999, the U.S. Fish and

Wildlife Service co-chaired a public workshop, Avian Mortality at Communications Towers, at Cornell University, where researchers and policy makers met to assess and discuss tower kills (Evans and Manville 1999). The next year, USFWS published a report summarizing tower kill research and recommending methods for studying the problem (Kerlinger 2000). They also issued voluntary guidelines for tower siting, construction, operation, and decommissioning (Table 6.1).

Table 6.1 U.S. Fish and Wildlife Service Interim Recommendations On Communications Tower Siting, Construction, Operation, and Decommissioning (Source: USFWS 2000)

1. Collocate new equipment on existing towers when feasible
2. Construct new towers less than 199 feet tall, without guy wires, and without lighting if not required by the Federal Aviation Administration.
3. Consider cumulative impacts of multiple towers.
4. If at all possible, new towers should be sited within existing “antenna farms” (clusters of towers) and sited away from important bird habitat and flyways.
5. If lights needed, minimum number of only white or red strobes should be used.
6. Place daytime visual markers on any needed guy wires.
7. Site and construct towers to minimize habitat fragmentation.
8. Do not build at locations or during periods of high bird use..
9. Build new towers to accommodate additional user antennas to reduce future tower needs.
10. Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the site.
11. Allow researchers to study impacts of towers on proposed site or at tower after construction.
12. Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use.

In recent years, the American Bird Conservancy (ABC), a participant at the first Towerkill workshop and member of the Communications Tower Working Group, has taken the lead in pressuring Federal agencies to address towerkills. In 2003, ABC and the working group pressed the Federal Communications Commission (FCC) to release a Notice of Inquiry to gather comment and information on the impact that communications towers may have on migratory birds (Federal Communications Commission 2003). In 2004, ABC pressed the Federal Aviation Administration (FAA) to issue a new directive recommending that Regional Air Traffic Division Managers use medium intensity white strobe lights rather than traditional red obstruction lighting on towers whenever feasible. Meanwhile, after collecting 265 comments and suggestions from researchers and industry interests, the FCC released the results of its Notice of Inquiry, compiled by Avatar Environmental Team (Avatar Environmental *et al.* 2004).

In late 2006, the FCC asked for public comments on the report and whether they should adopt recommended measures to reduce migratory bird collisions with towers. After almost a decade of pressure from towerkill activists, the FCC appeared poised to issue binding tower regulations limiting bird kills. However, the agency stalled and the American Bird Conservancy and Forest Conservation Council filed suit against the FCC and the Communications Tower Industry Association in the Court of Appeals for the District of Columbia Circuit. In February 2008 the court determined that the FCC had violated the National Environmental Policy Act (NEPA), which requires Federal agencies to prepare, at minimum, an Environmental Assessment (EA) of the impact of their decisions. The court ruled that the FCC must consult with the U.S. Fish and Wildlife Service and prepare an EA on the towerkills (Lasar 2008).

While there are still no binding Federal regulations addressing bird strikes at towers, at least one jurisdiction has already adopted the guidelines recommended by the USFWS (Board of County Commissioners of Brevard County, Florida 2002). Meanwhile, by using radar, global positioning systems, infrared, thermal imagery, and acoustical monitoring equipment, researchers are identifying the most important factors leading to collisions in order to design them to minimize future risks (Evans 1998, United States Fish and Wildlife Service 2000). The most recent review finds that the USFWS interim guidelines will minimize kills by restricting the height of towers, eliminating use of guy wires, replacing steady lights with white or red strobes, and avoiding siting towers on ridge tops (Longcore *et al.* 2008).

Meanwhile, state and local governments have sought ways to proceed with tower construction in a potentially unstable regulatory environment. Brevard County, Florida adopted the USFWS guidelines in 2001, and in 2003, the State of Michigan entered into a 2 ½ year study of tower threats to migratory birds developed and designed by private ornithologist Paul Kerlinger and USFWS biologist Al Manville. The state then signed a memorandum of understanding with the FCC to ensure that both parties can show good faith in complying with Federal wildlife regulations.

However, most communications companies are resisting regulations. Whereas power utilities are working cooperatively with the Fish and Wildlife Service to come up with voluntary Avian Protection Plans, communications companies are lobbying the FCC to limit any possible remediation or liability. It remains to be seen if the FCC will finally issue regulatory guidelines, work with communications companies to adopt voluntary APPS, or continue to stall, forcing the issue back into the courts. Meanwhile, the

American Bird Conservancy urges activists to take the issue to their local zoning boards and press for passage of the model tower ordinance passed in Brevard County, Florida.

If nothing else, this examination of transportation and telecommunications networks reveals that efforts to ameliorate their impacts on birds forces environmental activists into an even more complex network of federal, state and local agencies and commercial interests. The APPs are one example of how utilities can work with regulators voluntarily, and may form a model for how other industries can move forward in making sure that their activities minimize their damage to birds and their habitats, and possibly even turn their activities into a net positive for birds and other wildlife.

Chapter 7—Beyond Typology: Bird Cities in the Real World

Dozens of Brown Pelicans and Brandt's Cormorants huddle on a cliff overlooking the Pacific Ocean. In a full gale, Common Murres are tossed in the tumult and stiff-winged Black-vented Shearwaters shoot through wave troughs just offshore. Standing on the headland, watching Black Turnstones and Surfbirds on the rocks, one feels a connection to the great deep and the birds that traverse it. Wildlife abounds, but the cliffs at Ellen Browning Scripps Park are only a two acre wild spot in La Jolla, California, a tony suburb of San Diego. Across the street a fabulous breakfast awaits at the Brockton Villa Restaurant, famous for its Coast Toast, an orange-flavored-soufflé-like version of French toast. Human diners are welcome, but signs on the street warn passersby not to feed the seabirds.

Real cities are more than mere assemblages of the typological landscapes outlined so far. A few urban features, such as schools, do not fit easily within any one of these types, and many of the landscapes described so far also occur outside of the larger urban areas in small towns and even exurban developments. Topographic features such as coastlines and mountains harbor unique habitats in many large urban areas, providing additional opportunities for birds. Few ecologists would consider oceangoing shearwaters as urban birds, but how else are we to consider them when they are a mere hundred yards from a fashionable restaurant and hundreds of condominiums?

Just as real urban landscapes are more complex than described so far, urban bird conservation efforts transcends attempts to ameliorate hazards to birds or to make city features more bird-friendly. Hundreds of local governments, nonprofit organizations, and

bird enthusiasts are cooperating to ensure that urban growth protects habitat for birds in cities. Some cities recognize how birds and their habitats make their cities unique, and are incorporating them within their civic identity and promoting them in order to attract visitors and business within a competitive global economy.

ADDITIONAL URBAN LANDSCAPES

Schools, with their large public buildings and expansive schoolyards, stand out from the homes and smaller yards of their residential Zone 2 surroundings. In some ways, they are hybrid landscapes combining the large buildings of asphalt savannahs with the park-like oases of athletic fields. Or perhaps they are more like Edge City office parks dropped into the middle of the residential zone. As educational facilities, they also offer unique possibilities and challenges to those wishing to make them more attractive to birds.

In addition to promoting backyard wildlife habitats, the National Wildlife Foundation works with school officials, parent-teacher organizations, and students to create schoolyard habitats. Traditionally, these schoolyard habitats have consisted of a small corner of the schoolyard planted with trees and shrubs to attract butterflies and native birds, leaving most of the school grounds landscaped with traditional lawns and ornamental plantings that are of more limited value as bird habitat. Parents, teachers, and students often volunteer their time to create and maintain these projects, sometimes with unusual and questionable results. In Pleasanton, California, an Eagle Scout creating one schoolyard habitat mounted twelve bird boxes on three adjacent trees. In addition to being too close together, the bird houses were mounted upside-down. While these initial

efforts may be of questionable value to birds, they highlight a growing desire within society to create more space for birds, and to involve children in the creation and enjoyment of bird habitats.

More schools join the schoolyard habitat movement each year (National Wildlife Federation 2008), and a growing number of books provide guidance for school officials and parent-teacher groups desiring to create schoolyard habitats (Schiff & Smith-Walters 1993; Nuttall & Millington 2008). Dozens of organizations and agencies have joined NWF in promoting schoolyard habitat creation, including the U.S. Fish and Wildlife Service, Illinois Division of Natural Resources, and the Chesapeake Bay Foundation. In 2006, the National Audubon Society and the USDA Natural Resources Conservation Service published *An Invitation to a Healthy Schoolyard*, with tips on creating additional habitat for birds at schools, including installation of Chimney Swift towers and greenroofs.

While there are many informational resources available for school administrators and parent-teacher groups, they are usually on their own to find local community partners to help them build and maintain their schoolyard habitats. Local Audubon chapters, civic clubs, and nurseries or garden centers often volunteer time and materials to create these projects. As hard as it is to create a new schoolyard habitat, it may be even harder to maintain it—especially during the summer months when no sponsoring teacher, parent group, or administrator may be around to make sure that the custodial or grounds staff are able to water the new plantings until they are firmly established. Successful schoolyard gardens need to be large enough to provide real habitat value for birds, and contain naturalistic plantings of native plants that will require minimal upkeep as they mature.

Large lot urban development on the urban fringe also challenge the narrow typology of habitats previously outlined. While in some respects, these developments represent an expansion of the residential zone 2, scattered houses within acres of woods, forests, or rangeland represent an additional type of developed landscape—one which extends beyond the traditional bounds of urban areas which by U.S. Census Bureau definition are limited to those neighborhoods with a density of at least 1,000 people per square mile. They are also the most quickly growing residential sector in America, and are swallowing up millions of acres of bird habitat each year. A recent report indicates that land dedicated to exurban residential development expanded 30 percent during the 1990s, and now covers more than 94 million acres (Lubowski *et al.* 2006). One study found that these “peri-urban” areas with an average of 256 people per square mile, cover as much as 15 percent of the lower 48 states (Imhoff *et al.* 2000). Depending on how it is measured, the roads, houses, and large lots of this exurban growth may cover up to 25 percent of the conterminous United States, and represent 39 percent of all houses (44.8 million homes) (Radeloff *et al.* 2005).²⁵

Decried by some as unsightly sprawl, the large multi-acre lots created by subdividing larger tracts of forest or range land have the potential to both fragment

²⁵ The exact amount of land classified as exurban depends on how it is measured. The United States Department of Agriculture Major Land Uses study identifies 300,060 square miles, or 8.3 percent of total U.S. land as developed. This figure includes 93,720 square miles of urban development, 146,828 square miles of rural housing lots, 42,642 square miles of intense nonagricultural rural development including roadways, and 16,870 square miles of farm roads and farm yards (Lubowski *et al.* 2006). If measured by census block densities, 25 percent (536,679 square miles) of the conterminous United States is developed at “exurban” housing densities of at least 1 house per 40 acres (Brown *et al.* 2005). 277,666 square miles of this exurban development is a wildland-urban interface, where houses at a density greater than 1 per 40 acres meet or intermingle with otherwise undeveloped wildland vegetation. This wildland-urban interface covers 9 percent of the land in the contiguous 48 states, and contains over 44.8 million houses (39 percent of all houses) (Radeloff *et al.* 2005).

previously occupied native bird habitats, or if native vegetation is retained, to continue to harbor most of the native species that previously occupied the undeveloped property. Some exurban developments, such as the 8,600 acre Cordillera Ranch near Boerne, Texas, limit clearing of vegetation on each large (average 5.4 acre) lot to a small area beyond the actual house footprint, and manage the whole development for wildlife, including Northern Bobwhite, Wild Turkeys, and Eastern Bluebirds—with annual homeowner fees used to hire environmental consultants to create and oversee the implementation of the wildlife management plan.

However, many exurban developments feature landscaping that more closely approximate traditional suburbs, with large lawns and scattered trees replacing the native habitats. These exurban yards may still attract large numbers of birds, though most will be typical suburban species such as Mourning Doves, Downy Woodpeckers, orioles, phoebes, American Goldfinches, and House Finches, rather than the other owls, woodpeckers, warblers, sparrows and other birds that may have formerly bred or wintered in the more specialized native local habitats. Just as with other forms of development, some birds seem to prefer nesting near human structures in exurban neighborhoods, while others avoid even the lowest levels of development. One study in Colorado found that exurban development attracted Black-billed Magpie, Brewer's Blackbird, and Mountain Bluebird, as well as typical urban adapters like American Robin, Brown-headed Cowbird, and House Wren. However, Black-capped Chickadee, Black-headed Grosbeak, Orange-crowned Warbler, Blue-gray Gnatcatcher, Dusky Flycatcher, and Spotted Towhees avoided nesting close to homes and yards (Odell and Knight 2001).

The Natural Resources Conservation Service has become interested in helping landowners protect the wildlife habitat in exurban developments, but it struggles to reach these new exurban homeowners. Unlike the previous landowners, the occupants of these subdivided properties are usually transplanted city dwellers without a tradition of working with federal agencies like this branch of the U.S. Department of Agriculture. In 2006 the agency joined with the National Audubon Society to publish *An Invitation to a Healthy Country Home*, a poster and associated web pages with details on how to manage fencelines, wetlands, woodlands, and riparian areas for birds and other wildlife. The following year, they published *Preserving the Natural Resources of Your Country Home or Ranchette*, a workbook and additional web pages with instructions on how to choose bird species to help on exurban properties, as well as how to start managing habitat and deal with nuisance wildlife (National Audubon Society 2007). In 2005, Audubon organized programs in Arizona, Colorado, and Wyoming to reach out to exurban property owners, but recently scaled back these programs due to budget shortfalls. With an increasingly large portion of the country being divided into 30 to 60 acre ranchettes or country estates, the future of American wildlife depends more and more on the actions of urbanites managing these not-quite-rural-and-not-quite-urban properties.

While this examination of urban habitats has focused on the large urban areas with a population of greater than 50,000 residents, the 3,173 smaller towns and cities, identified as urban clusters by the U.S. Census Bureau contain many of the same landscape zones, though often in closer proximity to agricultural or wild lands—creating additional opportunities and challenges for those wishing to manage commercial areas,

yards, or industrial lands as bird habitat.²⁶ In Hyrum, Utah, a small town of 7,551 outside of the Logan, Utah urbanized area, Western Meadowlarks fly from agricultural fields on one side of the road to forage on the lawns of a residential neighborhood lining the other side. Several miles away, in the smaller town of Paradise (population 759), the 28 square blocks of yards, school, and a cemetery are the same as those in any urban area in Utah, but since they are close to mountain foothills, flocks of Sharp-tailed Grouse descend from the hillsides each day during winter to forage on the lawns and roost in ornamental yard trees. These non-traditional backyard wildlife habitats challenge our definitions of urban by providing opportunities for additional birds. They also pose challenges for those seeking to protect these otherwise rural birds, as well as opportunities for engaging additional residents in making their yards more attractive to birds.

NONTRADITIONAL URBAN BIRDS AND HABITATS

Urban areas are more than just roads, yards, buildings, and generic parks. Depending on their location, topography, and ecological setting, cities often provide a wide range of habitats not usually considered within a framework of urban ecology—including coastlines, mountains, deserts, and grasslands. Each of these habitats brings new birds within the city, and challenges for bird conservationists seeking to protect them.

Coastal waterbirds, and even pelagic species, are not typically considered urban birds, but 22 of the 100 largest urban areas including New York City, Los Angeles, Miami, and San Diego are built along coastal harbors, beaches, and headlands, where

²⁶ The U.S. Census Bureau defines an urban cluster as a population area with an urban density of at least

these birds forage, roost, loaf, or even nest. It is difficult to track figures on developed coastlines, but many coastlines including southern California, Florida, the DelMarVa Peninsula, and Long Island Sound are heavily developed, with beach houses, condos, and factories abutting within coastal habitats. Audubon Watch Listed Wilson's Plover nest on sandy beaches in the shadows of condos and casinos along the Gulf Coast, while American Oystercatchers and Least Terns forage along the condos and apartment-lined beaches of New York City's Coney Island.

Audubon chapters and other local groups in California, Texas, Florida, and Massachusetts often struggle to protect beach nesting birds in urban areas. This usually involves marking and patrolling nesting areas to keep out dog-walking and off-road-driving beach lovers, but sometimes the threats come from surprising sources. In southern California, conflict arose between the Pacific Jewish Center in Venice Beach and the local Marina Peninsula Neighborhood Association and Los Angeles Audubon when the orthodox community wanted to string a 200 lb. test fishing line from poles around Santa Monica and Marina del Rey to serve as an *eruv*—a ceremonial fence that creates an extension of the home and marks out an area where worshipers can travel and engage in activities otherwise prohibited during Shabbat. The group wanted the poles and monofilament line to extend out onto the beach near a nesting colony of endangered California Least Terns, but bird lovers feared that the line would snag the terns as they entered and left their nesting area. The California Coastal Commission originally sided with the *eruv* builders (California Coastal Commission 2007), but Audubon and the neighborhood association finally stopped the project at the city and county level. Similar

1,000 people per square mile, and a population between 2,500 and 50,000. Smaller towns, though they also

confrontations between *eruv* supporters and bird protectionists have sprung up in coastal communities from San Diego to Westhampton Beach, Connecticut.

In addition to coastal habitats and birds, many cities including Denver, Salt Lake City, Albuquerque and seven more of the largest 100 urban areas, are built in or within close proximity to mountainous habitats that bring montane species into their cities. During winter months, many of altitudinal migrants including Dusky Grouse, Townsend's Solitaire, Red-breasted Nuthatch, and Mountain Chickadee descend from high elevation forests to seek refuge in well-landscaped yards, parks, and cemeteries. At 10,650 feet high in the Cibola National Forest, flocks of Brown-capped, Black, and Gray-crowned Rosy Finches swirl around the jagged slopes of the Sandia Crest in clear sight of suburban Albuquerque only two miles to the west and 4,000 feet lower in elevation. During especially harsh winters, even these alpine birds may descend to take advantage of bird feeders in the city, as rosy finches do throughout the Intermountain West. Mountain cities can improve their habitat value to birds by protecting habitats on their borders and encouraging residents to landscape for wildlife and provide winter bird feeders.

In desert locations where cities often displace native shrubland habitats, well-watered yards, parks, and golf courses create new bird habitats similar to traditional desert riparian areas (Emlen 1974; Rosenberg *et al.* 1987; Mills *et al.* 1989; Germaine *et al.* 1998; Beal 2007). Cities such as Phoenix and Tucson, Arizona, and Las Vegas, Nevada need to balance the requirements of native desert shrubland birds such as Gambel's Quail and Audubon WatchListed Rufous-winged Sparrow, which abandon

contain the same types of urban landscapes, are not classified as urban.

developed areas, with the needs of riparian species including Gila Woodpeckers and Crissal Thrashers, which may even prefer urban parks and yards. Tucson Audubon is starting an urban wildlife landscape design course for professional landscapers, and joining with other Audubon chapters in Arizona to promote landscaping with native plants to save water and attract native birds.

In grassland regions, street trees, residential yards, and urban parks in cities including Houston, Denver, and Omaha create urban forests that provide new habitats for woodland species while displacing native grassland nesting birds. Even small prairie towns create shelterbelts which attract Eastern forest birds including Baltimore Orioles and Indigo Buntings westward into new areas. Mississippi Kites are expanding westward to nest in city groves (Parker 1996), while grassland birds in the United States continue to decline in most areas. According to the Audubon WatchList published in 2004, of the 27 grassland species with good trend data from the Breeding Bird Survey and Christmas Bird Count, 23 are declining (National Audubon Society 2004).

Grassland cities need to do more to protect the open areas that harbor these declining birds. Boulder, Colorado has been the poster-city for protecting urban grassland habitats (Beatley & Manning 1997), but a recent study has found that only 76 percent of the 29 native grassland species found there a hundred years ago are still present. Species that have disappeared or declined are mostly shortgrass prairie birds including Burrowing Owl, Common Nighthawk, Loggerhead Shrike, and Lark Bunting. Species like Vesper Sparrow and Savannah Sparrow, which prefer mixed or tallgrass prairies are faring better, indicating that urban grassland preserves can support native

species, but may need extra management attention to retain shortgrass prairies preferred by some birds (Jones & Bock 2002).

NEIGHBORHOOD AND COMMUNITY BIRD CONSERVATION

As these few examples highlight, urban bird conservation requires more than volunteer efforts to protect birds from hazards or create backyard habitats. Effective urban bird and habitat protection, conservation, and restoration depend on the concerted efforts of local governments, businesses, nonprofits, and other partners. In *Nature-Friendly Communities*, Duerksen and Snyder (2005) examine 20 case studies and review habitat protection and land use planning strategies used by cities and other local governments across the country (Table 7.1). While most of these strategies are becoming more common, no city has yet to incorporate them all, and in most cases city efforts are directed towards protecting “open space,” and less frequently “habitat,” let alone habitat for specific priority bird species. The exception usually being, as discussed previously, efforts to protect habitats for federally or state listed threatened and endangered birds.

All cities can improve their regulations and conservation practices, but most do have staff and regulations in place that can be employed to help birds in cities. Some even have specific urban wildlife management plans (Seattle Department of Parks and Recreation 2000). In the complex bureaucratic and competitive economic and political arena of urban development (Elkins 1985; Elkins 1987; Lewis 1996; Warner & Molotch 2000; Rybczynski 2007), local bird enthusiasts need to work closely with city officials to

Table 7.1. Habitat Protection and Land Use Planning Strategies Employed by American Cities and Other Local Governments (Duerksen & Snyder 2005).

<p>Program Structure and Administration</p> <ul style="list-style-type: none"> • Staffing • Departments work together • Partnerships/Intergovernmental cooperation <p>Planning</p> <ul style="list-style-type: none"> • Mapping and Environmental Studies • Comprehensive Plans/Habitat Plans • Prioritizing acquisitions <p>Acquisition/Funding</p> <ul style="list-style-type: none"> • Long-term/reliable funding <ul style="list-style-type: none"> ▪ State/Federal funding ▪ Bond initiatives ▪ Utility revenues • Land dedication • Mitigation • Impact Fees • Purchase of development rites • Public-private partnerships <p>Social Indicators</p> <ul style="list-style-type: none"> • Affordable housing • SMART growth <p>Measure and Publicize Results</p> <ul style="list-style-type: none"> • Land protection • Environmental Quality • Landowner Outreach 	<p>Regulations</p> <ul style="list-style-type: none"> • Zoning and Subdivision Controls <ul style="list-style-type: none"> ▪ Large-lot and conservation district zoning ▪ Conservation overlay zoning ▪ Conservation/cluster subdivision ▪ Transferable development rights • Development Standards <ul style="list-style-type: none"> ▪ Targeted protection standards <ul style="list-style-type: none"> • Stream, wetland, and lake buffers • Tree and vegetation protection • Hazard area protection (slopes, flood plains, etc.) • Site features ▪ Wildlife-specific regulations ▪ Infill development incentives and standards • Fiscal impact assessment <p>Restoration</p> <ul style="list-style-type: none"> • Habitat Restoration • Exotic species removal • Mitigation programs <p>Leading by Example</p> <ul style="list-style-type: none"> • Implement preferred practices on public properties <p>Education</p> <ul style="list-style-type: none"> • Engage landowners in private habitat protection, conservation, and restoration
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make sure they adopt and enforce best conservation practices. Even when planners are using the very latest GIS mapping techniques to define areas for protection, they often lack the most basic information about what bird species are present, in what numbers, and in which remotely sensed and computer mapped habitats. During a recent Envision Central Texas regional planning process, organizers invited Austin area environmental advocates to a meeting to identify areas for protection. There they were expected on the fly to delineate important habitat areas on a large scale map with marking pens. Sadly, the effort seemed to be focused more on protecting favored open spaces rather than on seriously examining or protecting the matrix of habitats involved in the landscape ecology of local bird and other wildlife populations.

In working with their local governments, bird advocates find allies among a growing number of publicly employed biologists and ecologically trained landscape architects and community and regional planners. As early as the 1960s, Ian McHarg called for the inclusion of wildlife in urban plans (McHarg 1969, McHarg 1996, McHarg and Steiner 1998). In 1973, Gill and Bonnett reviewed the growing literature in urban ecology and proposed that land use initiatives incorporate native plants and animals in suburban communities, industrial estates, public grounds, and parks (Gill and Bonnett 1973). At a 1976 conference of the American Institute of Planners, Royce LaNier responded to the increased emphasis on ecological planning by making a plea for wildlife biologists to instruct city planners and managers as to where and how wildlife habitats could be created within cities. Bemoaning a lack of information, he called for instructions that would guide planners in laying out open space as special habitat, and designing environments for specific animals (LaNier 1976).

Three decades later, landscape professionals usually recognize the importance of maintaining wildlife habitat. The American Society of Landscape Architects “urges the identification and application of planning and design principles that promote the enhancement, protection and management of landscapes that support wildlife...in wild, rural, suburban and urban settings” (American Society of Landscape Architects 2007). The American Planning Association has published two guides to planning for wildlife in urban, suburban, and rural settings (Leedy *et al.* 1978; Duerksen *et al.* 1997; Elliott 1998). Unfortunately, while the professional associations support wildlife habitat protection in principle, even sympathetic and well-trained planners often lack the detailed ecological understanding needed to design urban landscapes for local species (Sukopp *et al.* 1995), and one review of urban ecology as the basis for urban planning admitted that planning efforts to address urban wildlife “have been sadly neglected” (VanDruff *et al.* 1996).

Fortunately, in the past decade a growing number of landscape architects and planners are designing and managing urban and suburban settings for birds and other wildlife. Grant Jones, Founder and Senior Principal of Jones & Jones, Architects and Landscape Architects, in Seattle, Washington, lectures on designing for birds and wildlife and incorporate animals into his designs for settings including the Seattle waterfront (Jones 2004). Even larger firms such as Barr tout their attempts to design landscapes that sustain wildlife (Barr 2007). In order to create a sustainable wildlife plan, planning professionals need to incorporate preferred conservation strategies with the results of academic research on local urban ecologies and the species and habitat distribution data generated by local birders and other wildlife enthusiasts.

Though urban ecology is still a small but rapidly growing subdiscipline within academia (Vandruff *et al.* 1995; McDonnell *et al.* 1997; Pickett *et al.* 1997; Dow 2000; Pickett *et al.* 2001; Alberti *et al.* 2003; Luck & Wu 2004; Shochat *et al.* 2006), hundreds of researchers have studied the ecology of birds in cities across the country and around the world (reviewed in Marzluff *et al.* 2001 and Lepczyk *et al.* 2006), and a recent bibliography of urban bird studies lists over 1100 references (Rocky Mountain Bird Observatory 2003). Urban bird ecologists have offered suggested guidelines for protecting city birds and their habitats (Savard *et al.* 2000; Marzluff & Ewing 2001), but are still searching for “effective means of encouraging citizens to conserve birds and their habitats and reduce their impacts” (Marzluff & Ewing 2001). Initial surveys of Audubon volunteers and ongoing work with Audubon chapters across the country suggest that citizens are most likely to engage in urban bird conservation efforts that are easy, fun, and don’t take much time, and are less likely to get involved with city planning efforts including attending planning meetings and consulting with planning professionals.

Many nonprofit and agency programs are trying to engage the public in habitat protection, creation, and restoration programs. In 1998, Alpine, California, a small town of 10,000 about 20 miles east of San Diego approached the National Wildlife Federation about certifying their whole community as a wildlife habitat. They created a “Sage & Songbirds” program to promote birds and butterflies in backyard gardens, and became the first city to be recognized by NWF as an official Community Wildlife Habitat. In order to qualify as a certified habitat, community residents first form a Habitat Team to “organize and mobilize the community, create goals for the community with the assistance of the Habitat Team, work with a wide variety of resources within the

community from government agencies to local non-profits, work with local agencies and businesses to obtain funding for the community's project, and educate the community on the principles of the Certified Wildlife Habitat program” (National Wildlife Federation 2008). To certify their community, the team has to certify a given number of backyard habitats based on their community size. A city of 50,000 residents would have to register at least 200 backyard habitats, while at least 800 habitats would be needed to certify a city of more than a million people. In addition, teams have to conduct a number of education and community-wide conservation programs. After a city is certified, the team has to conduct additional activities each year to maintain its certification.

As of October 2008, there were 29 certified wildlife communities in 14 states, and an additional 34 communities in 14 states registered and working towards certification. Attempts to certify a community can generate creativity and high civic spirits. After forming a Habitat Team in 2001, Arlington, Virginia struggled to obtain certification until the city hosted a contest between its neighborhoods to see which could certify the most backyard habitats. As a result, in 2005 the city finally obtained its certification after 63 civic associations registered anywhere from one to 36 backyard habitats in order to win refreshments from three local sponsoring restaurants (National Wildlife Federation 2008).

Other organizations have tried to create additional community-wide bird conservation programs. In 2004, the staff from the Wisconsin Department of Natural Resources sought national support for a national Bird City USA program similar to the Tree City USA certification program run by The Arbor Day Foundation. Though unable to obtain funding or support from other organizations, including the National Audubon

Society, they listed it as a strategy they would pursue as part of their official Wisconsin Fish, Wildlife, and Habitat Management Plan.

In 2007, Audubon International founder and president Ron Dodson latched onto this idea and ran with it when he formed Audubon Lifestyles, Ltd. as a for-profit company to promote green products and sustainable home building, development, and landscaping. As an initial fee-based project, he rolled out a Bird City USA program to “provide direction, technical assistance, public attention, and national recognition” for cities engaged in bird conservation (Audubon Lifestyles 2008). To obtain the award, a group has to form a natural resource advisory group to recommend environmental improvements to their municipality, recognize International Migratory Bird Day, and send in a \$250 application fee. While the Bird City USA program remains the most popular page on the Audubon Lifestyles website, so far no one has applied to receive the designation; perhaps because it is unclear what benefit such a designation would really confer on the community, or accrue to local birds. Unless Audubon Lifestyles enhances the program requirements, every city in the country could enroll without it going very far towards helping urban birds.

In an attempt to engage more citizens in community-wide urban bird conservation efforts, in 2006 the National Audubon Society and USDA Natural Resources Conservation Service published *An Invitation to a Healthy Neighborhood*, a poster and series of web pages encouraging people to work together to create and protect bird habitats in their community. These resources address how to create a neighborhood habitat group, choose charismatic local birds to promote in the community, undertake a local Lights Out campaign to protect migratory birds from collisions with buildings or

other large structures, conduct a Cats Indoors! program, promote greenroofs, and work with schools, commercial properties, and homeowners to plant and manage these urban landscapes for birds. As with many other urban bird conservation programs, the materials are in place, but they additional program staff to promote and market the materials and to assist local groups that form to take on the suggested activities.

In 1999, the U. S. Fish and Wildlife Service created an avenue for promoting urban bird conservation when it launched the Urban Conservation Treaty for Migratory Birds program to “help municipal governments conserve migratory birds that nest or fly through their cities” (United States Fish and Wildlife Service 2003). The treaty program provides \$10,000 to \$150,000 challenge grants to cities, which work with local business and nonprofit partners to create projects addressing four main bird conservation issues: habitat creation, protection, and restoration; education and outreach; hazards reduction; and non-native, invasive, or nuisance animal and plant species management. The USFWS requires cities and their partners to match the granted funds and encourage them to incorporate existing bird conservation programs into their plans.²⁷ So far, nine cities have enrolled in the treaty program.²⁸ New York City, the most recent to sign the treaty, expects to spend \$450,000 in total funds and matching contributions. So far, most cities signatories have used the funds to adopt and promote a few specific conservation

²⁷ The USFWS suggested incorporating the following programs into urban bird treaty plans (United States Fish and Wildlife Service 2003): Audubon At Home, NWF Backyard Wildlife Habitat, Cats Indoors!, Audubon and Cornell Lab of Ornithology citizen science projects (including Great Backyard Bird Count, Birdhouse Network, and Project Feeder Watch), Earth Force, Earth Stewards, Fatal Light Awareness Program (FLAP), 4-H, Important Bird Areas program, International Migratory Bird Day, National Park Service Land and Water Conservation Fund, National Fish and Wildlife Foundation Migratory Bird Conservancy, Partners in Flight, Plant Conservation Initiative, Shorebird Sister Schools Program, Shorebird Sister Cities Program, and the USDA Forest Service Urban and Community Forestry program.

programs. Chicago worked with 26 partners to create its own Lights Out program, promote bird conservation through *A Bird's Eye View* website, a two-page *Design Guide for Bird-safe Building*, and promotion of rooftop gardens. The treaty program is supposed to provide funds to kick-start bird conservation in each city, though it is unclear how many cities will continue to fund local projects beyond the initial treaty grant. In Chicago, the Lights Out program continues with support from the Chicago Audubon, and the website is still hosted on the city server, but there isn't much by way of official programming to promote the materials.

Only a small handful of cities have participated in this federal program, but on a statewide level most state wildlife agencies have created their own plans to protect birds and other wildlife in urban areas through official state wildlife action plans. In 2000, the U.S. Congress required that each state and territory create these plans in order to qualify for federal funds awarded through the Wildlife Conservation and Restoration Program and State Wildlife Grants Program. By 2005, all 56 states and territories had finished compiling their plans, which were required to address eight principle elements (Table 7.2), and as of 2008 these federal programs have provided the states over \$485.6 million in new funds for wildlife protection.²⁹

²⁸ Cities enrolled in the USFWS Urban Conservation Treaty for Migratory Birds program: New Orleans (1999), Chicago (2000), Philadelphia (2002), Houston (2003), Portland (2003), St. Louis (2004), Nashville (2004), Anchorage (2008), New York City (2008).

²⁹ Funds derived from Outer Continental Shelf Oil & Gas royalties.

Table 7.2. State Wildlife Action Plan Required Elements (Association of Fish and Wildlife Agencies 2005).

1. Information on the distribution and abundance of wildlife, including low and declining populations, that describes the diversity and health of the state's wildlife.
2. Locations and relative conditions of habitats essential to species in need of conservation.
3. Problems that may adversely affect species or their habitats, and priority research and survey efforts.
4. Conservation actions proposed to conserve the identified species and habitats.
5. Plans for monitoring species and habitats, and plans for monitoring the effectiveness of the conservation actions and for adapting these conservation actions to respond to new information.
6. Procedures to review the plan at intervals not to exceed 10 years.
7. Coordination with federal, state, and local agencies and Indian tribes in developing and implementing the wildlife action plan.
8. Broad public participation in developing and implementing the wildlife action plan.

Many of these plans identified urbanization as a threat to wildlife, or urban species and habitats as conservation priorities. Some plans provide mostly generic analysis and suggestions. The Oregon plan calls for protecting large habitat areas in cities, building relationships with urban ecologists, engaging urban residents in conservation planning and on the ground projects, technical and financial support for local projects, and education materials to prevent and resolve human-wildlife conflicts (Oregon Department of Fish and Wildlife 2006). Other plans are more specific. Pennsylvania identified sprawl as leading to the extirpation of several species, and listed cityscapes as important habitat for Peregrine Falcons, as well as declining Chimney Swifts, and Common Nighthawks. The Pennsylvania plan calls for monitoring of urban and suburban Northern Bobwhite, Long-eared Owls, Wilson's Snipe, and Common

Nighthawks, and for working with private landowners to help priority species within the city.³⁰

Several states are already using State Wildlife Grants to help urban birds and other wildlife. In 2005, the North Carolina Wildlife Resources Commission used State Wildlife Grants to create an Urban Wildlife Project and hire a biologist to review existing town and county Land Use Plans, Land Use Ordinances, Park & Greenway Plans, and Subdivision Proposals, and to give planners technical guidance in steering growth away from sensitive wildlife habitats in favor of infill and conservation-based development elsewhere. In Kansas and Missouri, State Wildlife Grants fund the Kansas City Wildlands program, a partnership of more than two dozen local groups cooperating to restore habitat in ten local parks and preserves, including the 1,000 acre Burr Oak Woods Conservation Area in Blue Springs, Missouri, where over 130 bird species regularly occur, including Red-headed Woodpecker and grassland sparrows (Cornell Laboratory of Ornithology & Audubon 2008), and a wildlands program bioblitz in 2004 found 11 mammals, 70 birds, 23 reptiles and amphibians, 53 fungi, 200 plants, and hundreds of insects and other invertebrates (Kansas City Wildlands 2008).

In spite of the considerable expenditure represented by these programs, most efforts to help birds in cities proceed in an almost haphazard fashion. Except when

³⁰ Prioritized actions include: Encourage landowners to consider enhancing existing sites or creating artificial structures if conditions warrant. Recommend to owners of historic structures to keep chimneys open, avoid covering them or screening them so swift nest and roost sites remain available. Encourage redevelopment or renovation planners in historic districts to include the use of open chimneys. Foster long-term commitments to maintaining artificial nest structures will be necessary. Test the effectiveness of various artificial gravel nesting pads placed on non-gravel roofs for suitability for common nighthawks (Pennsylvania Game Commission 2001).

dictated by the requirements of federal or state laws, projects usually advance as staff or volunteer interests and city or nonprofit budgets allow. Meanwhile, outside of cities hundreds of agencies and bird conservation organizations are working together under the umbrella of a North American All Bird Conservation Initiative (NABCI) dedicated to addressing the conservation needs of all bird species. With its roots in the federal 1986 North American Waterfowl Management Plan, and subsequent plans for other groups of birds,³¹ the NABCI partnership emphasizes “integrated” or “all-bird” conservation, a new proactive approach designed to supersede the *ad hoc* and mostly opportunistic activities of traditional bird conservation programs. Instead of conducting projects based on funding or political opportunities, “all-bird” conservation applies an adaptive planning and management approach to address the most significant conservation priorities at the species, habitat, and landscape level.

The goal of integrated bird conservation is to establish “regionally-based, biologically-driven, landscape-oriented partnerships delivering the full spectrum of bird conservation across the entirety of North America” (U.S. NABCI Committee 2000). This approach involves a dynamic process of strategic planning, implementation, and evaluation (Table 7.3). The goal is to identify and prioritize species of concern, set population objectives for those species, set goals to provide enough habitat to sustain desired bird populations, and create a strategy for acquiring, restoring, or managing

³¹ Other plans include the U.S. Shorebird Conservation Plan (2000), North American Waterbird Conservation Plan (2002), and Partners in Flight (2004).

needed habitat. Partners set population goals and create and implement conservation plans at a national level and regional level.³²

Table 7.3. North American Bird Conservation “All Bird” or “Integrated” Bird Conservation Strategy.

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| <ol style="list-style-type: none">1) Identify and prioritize species of conservation concern2) Set bird population objectives3) Set habitat objectives to sustain desired bird populations4) Plan to acquire, restore, or manage habitat to meet population and habitat objectives5) Implement plan through regional and local partnerships6) Monitor bird populations and habitat to determine if meeting goals7) If needed, adapt management based on monitoring results |
|--|

Since 1986, government agencies and partners have invested over \$4 billion in these bird conservation efforts, widely acclaimed for stabilizing waterfowl populations, and protecting, restoring or enhancing over 15 million acres of waterfowl habitat (United States Fish and Wildlife Service 2006). The plans are driven by professional biologists utilizing sophisticated GIS habitat models and population viability models. Plan partners depend on federal and state funding to protect habitat patches through purchase or conservation easements. While these expensive and cutting-edge plans increasingly set the agenda and guide bird conservation across the country, so far they have failed to deliver “the full spectrum of bird conservation across the entirety of North America” because the plans do not address urban areas.

³² At the regional level, plans may be created by states or physiographical regions (known as Bird Conservation Regions) harboring similar habitats and bird populations. Many of the priorities of these plans, if not the full habitat and population goals, have been incorporated into the State Wildlife Action Plans.

BIRDS AND PLACE

As cities become more involved in protecting local birds and habitats, some are starting to celebrate the contributions these birds make to the city identity and sense of place. Since the 1980s, a growing number are even designating official birds. In 1986, urban naturalist Mike Houck approached iconoclastic mayor Bud “Expose Yourself to Art” Clark about naming the Great Blue Heron as the official city bird of Portland, Oregon. According to then city commissioner Mike Lindberg, the motion was adopted quickly, without much debate because "it was the right thing to do...the heron tells us who we are as a city and what we want to be" (Houck & Cody 2000; Hill 2008). Since then over two dozen other U.S. cities have designated official city birds, including Chicago (1999), San Francisco (2000), and Seattle (2003). Urban cliff-nesting Peregrine Falcons are an apt symbol of Chicago as the windy city, home of the first skyscraper, and bustling built up City of the Big Shoulders. San Francisco’s California Quail memorialize a mostly bygone pastoral era while inspiring local officials to preserve patches of shrubland within the city, and the Great Blue Heron links Seattle to the waterways of Puget Sound and Portland to the Willamette River. In Madison, WI, local humor columnist Doug Moe launched a whimsical effort to nominate the plastic pink flamingoes as the official city bird in memory of a 1979 prank when students placed over a thousand plastic flamingoes on a Bascom Hill, the symbolic heart of the University of Wisconsin-Madison campus (Moe 2008).

Sometimes birds even turn up on official city seals. In the 1800s, many cities included the “American” Eagle in their seals to affirm their identity as American cities.³³ The seal of Baton Rouge, the Louisiana state capitol, features a pelican, though ironically a White Pelican rather than the Brown Pelican which is the official state bird. More recently, some newer communities are expressing their identity through locally important birds chosen to grace their city seals. At La Quinta, California, a rapidly growing city of nearly 40,000 in the Coachella Valley near Palm Springs, the city seal includes the Gambel’s Quail, a desert bird common in local parks and backyards. In Arcadia, California, city founder Elias J. Baldwin imported peacocks from India in the early 20th Century. Dozens of birds now roam the city, making short work of any planted petunias, pansies, and nasturtiums. Though some residents complain that the birds are a nuisance, the city celebrates the birds as official city symbols on the city seal, city logo, and street signs.

In Albuquerque, the New Mexico Department of Transportation adopted a stylized roadrunner, the state bird, as the branding image for a new “rail runner express” commuter train. The popular trains feature a red and yellow roadrunner face on the engine, tail feathers on the coaches, and a “Beep-Beep” door closing tone brings to mind the classic call of the Warner Bros. cartoon roadrunner. As a very visible, attractive, and popular symbol, the rail runner is helping to cement Albuquerque’s reputation as a hip modern city rooted in its desert surroundings.

In 1991, local artist Lynn Kitagawa painted a huge Great Blue Heron on the side of the Portland Memorial building dominating the river bluff overlooking the Oaks

³³ City official seals depicting American Eagles include New York City, Hartford, Denver, San Francisco,

Bottom preserve in Portland, Oregon. In the fall of 2008, a team of artists expanded the mural, covering 50,000 square feet of the building exterior with wetland images including nearly a dozen local birds,³⁴ celebrating the natural heritage of the area and the identity of Portland as a quintessential river city.

Other cities promote their city through birding festivals that celebrate regional birds and natural history spectacles. This reflects both a growing recognition of the value of local birds, as well as a trend (since the 1980s) of cities creating cultural, historical, or other festivals to boost tourism and enhance community image (Rowe 1999). The “Fiesta de las Golondrinas” in San Juan Capistrano, California is perhaps the oldest bird-related festival in the country, originating as an annual school festival in the 1930s. It was later taken over by the San Juan Capistrano Business Council, and since 1987 has been a month-long series of activities to celebrate the return of the legendary swallows to the fabled mission.

Some of the first birding festivals started in smaller towns and rural areas with spectacular concentrations of birds. In 1984, the Montezuma Vista National Wildlife Refuge near Monte Vista, Colorado began a Whooping Crane Festival to celebrate the introduced flock of Whooping Cranes that traveled with a large flock of Sandhill Cranes. The last of the Whooping Cranes in this flock died in 2002, but the festival continues as the Monte Vista Crane Festival. Sauk City and Prairie du Sac, small communities outside of Madison, Wisconsin, started promoting Eagle Days in 1988, and derives over \$1 million in tourist revenues each January when thousands come to see the Bald Eagle

and Los Angeles.

congregations on the Wisconsin River. That same year, Phil Norton, refuge manager at Bosque del Apache, worked with the Socorro County Chamber of Commerce and the City of Socorro to host its first Festival of the Cranes near Socorro, New Mexico. The Kirtland Community College in Mio, Michigan held its first Kirtland's Warbler festival in 1993.

These first popular festivals were used to promote endangered species in rural areas, but soon urban chambers of commerce were following suit and creating festivals to bring tourists and acclaim to their cities. In 1994, Fr. Tom Pincelli started the Rio Grande Valley Birding Festival in Harlingen, Texas, to promote birding in South Texas. The festival brings a thousand birders to the area each November to enjoy morning field trips, afternoon talks, dinner programs, vendor displays, and the local sights and spectacle of Green Jays, Great Kiskadees, and other Mexican birds in their only haunts north of the border.

San Diego and other large cities now host their own birding festivals. One study found nearly 50 birding festivals in the mid-1990s (Howe *et al.* 1997), and there are now over 100 festivals in cities across the country (American Birding Association 2008). In addition to bringing in birders and tourist dollars, these festivals showcase the beauty and natural treasures of the hosting city—boosting civic support and attention for local birds, as well as raising the green image of the city and its profile as a bird-friendly and hospitable place to live and conduct business. Birds are no longer just accidental or

³⁴ The mural features a Red-tailed Hawk, Osprey, Turkey Vulture, Belted Kingfisher, Hooded Mergansers, Common Mergansers, American Widgeon, Wilson's Snipe, Western Sandpiper, American Coots, and Wood Ducks

opportunistic urban neighbors, they are increasingly valued as community assets to promote and celebrate.

Chapter 8—Conclusion: Bird Cities of Tomorrow

Dried leaves rustle as a Carolina Wren pursues a large brown spider across the dry creek bed. The spider, seeking an escape, darts out of the leaves. Half way across the stream channel, exposed, out in the open, the spider freezes momentarily. The wren is on it immediately, grabbing the spider in its beak and shaking it repeatedly until all of its legs have fallen off. Without legs, the spider lays helpless on the ground, as the wren rises up above the arachnid and, using its dagger-like bill as a pile-driver, repeatedly pummels the spider's head and thorax. After pulverizing the spider's head, the wren picks up its prey, which is almost as large as the bird itself, and quickly swallows it abdomen first. Afterwards, the bird flies into a greenbrier tangle above the creek bed. For thousands of years, wrens have stalked spiders across Central Texas creek beds. Thanks to mature shade trees and protected streamside vegetation, this ancient drama commonly occurs in the residential neighborhoods of Austin, Texas.

In *Garden Cities of To-morrow*, early 20th Century British urban planner Ebenezer Howard advocated bringing the beauty of nature and fresh air of the country into the heart of industrial cities. Over the past hundred years, urban growth in the United States has trended towards this ideal. Verdant suburbs and parks as well as protected open space make American cities veritable gardens, and birds like the spider-stalking Carolina Wren abound. This dissertation has examined how birds have come to occupy various landscape zones within American cities, and how people are making those zones safer and more hospitable for birds. This research has also revealed areas where additional research can help further bird conservation in cities, and documented a

trajectory that provides possible hints as to the future prospects of urban birds and bird conservation.

SUMMARY OF FINDINGS

This dissertation has shown that technological solutions and strategies exist to address most major threats to birds in cities, and to improve bird habitat in all of the landscape zones of the city. In some cases, such as provisioning nestboxes and excluding or removing free-ranging cats, the strategies date back more than a hundred years. Other solutions, such as window films or utility line flight diverters, represent new responses to long-known problems. However, no city employs all of these strategies, and the technical or political solutions are scattered among the hundreds of urbanized areas and thousands of smaller urban clusters across the country.

This study has elucidated the many types of individuals and organizations marshalling resources to mitigate bird deaths caused by urban hazards. Individuals keep their cats indoors and place obstructions on their windows to limit bird-window collisions. Others work together to oppose construction of bird hazards, or to redesign towers, wires, and wind turbines that are safer for birds. Corporations create and market new technologies such as white-strobe aviation hazard lights to keep birds safe while fulfilling their desired social function. Other people and organizations are reshaping the layout of urban areas by seeking to protect bird habitat from development. Governments create endangered species preserves in and around major cities, and buy land for parks and preserves in order to protect other birds and their habitat while providing recreational opportunities for urban residents. Individuals, nonprofit groups, and business interests

work to set aside undeveloped land, and to manage it to meet conservation and recreational needs. Millions of people and billions of dollars are dedicated to making cities better for birds, and yet for all of the habitat created or protected and birds fed and sheltered, there is often little coordination between public efforts, nonprofit programs, and the actions of private homeowners.

Bird conservation efforts undertaken by local governments are often directed towards public lands and involve professional biologists or planners using computer technology to model and map habitat and other land features. The increasing sophistication of these professional techniques may help create better growth or conservation plans, a division often occurs between highly-trained and specialized professionals meeting during business hours to evaluate the latest maps and plans, and the private citizens or nonprofit volunteers who may not have the time or training to participate in the public planning process. Local agency initiatives, such as backyard habitat programs, can help bridge the divide between professional conservation planning and private efforts, but they require agency commitments in staff and other resources that may be difficult to sustain over time.

Nonprofits also struggle to maintain urban conservation programs. Smaller Audubon chapters and other volunteer groups often lack the financial or volunteer resources to undertake major projects. Their volunteers may not have the time or training to participate in meetings with planning or conservation professionals during the day. Larger nonprofits spend a lot of time seeking funds to maintain programs, and may not have enough staff or financial resources to operate effectively. Urban wildlife programs may face competition from other programs within the organization. Local Audubon

chapters often split between those interested in conservation, and birders who just want to go on field trips. Within the National Audubon Society, urban programs compete for funds and attention dozens of other programs including the Important Bird Area program and a new global warming initiative. National programs at Audubon are difficult to implement at the local level due to a decentralized organizational structure of functionally independent state offices and fully independent local chapters. Even the National Wildlife Federation's backyard habitat program, the most well-known urban habitat program in the country, is run by a small staff within the membership and education departments, and has to compete with a host of public policy programs for institutional support. Without local chapters, NWF depends on direct mail and a handful of staff in regional offices to promote its backyard programs.

Private bird-helping efforts are widespread in urban areas, but individual actions are usually uncoordinated and unconnected to regional conservation priorities. Guided by how-to books and brochures distributed by local agencies or nonprofits, gardeners create and manage millions of acres of backyard habitats. Millions maintain bird feeders, and though they desire to help birds, usually do not consider themselves as birdwatchers or join bird-related organizations and affinity groups. They represent a vast untapped resource of people who care enough to feed birds, but perhaps need encouragement and training to make their activities beneficial for more than just the common feeder birds.

OPPORTUNITIES FOR FUTURE RESEARCH

This dissertation has identified the principal ways that people are helping birds in urban environments, but we still lack a comprehensive study of how widely many of

these conservation practices are employed. A thorough survey is needed to document how many of these strategies are being implemented in each urbanized area. Since each urban area often consists of multiple municipalities,³⁵ surveying the many municipal departments and local nonprofit programs will be a challenge.

Since local bird clubs and Audubon chapters are often the primary bird conservation organization in each urban area, a more detailed study of local Audubon chapter activities would be useful. The National Audubon Society currently requires each chapter to provide a summary of activities in order to qualify for supplemental funding, but these summaries provide only general statements about chapter activities. Initial polling of chapter leaders indicates that most chapters promote bird feeding, sheltering, or other bird conservation activities, but usually on an *ad hoc* or limited basis. A more detailed survey would provide a sharper picture of exactly how much urban bird conservation is happening within Audubon chapters. Since chapters vary widely in size, funding, and interests, a closer look at the different types of chapter organizations, and their limitations, can identify additional opportunities, as well as challenges to be addressed, if they are to become more effective at protecting their local birds.

Preliminary research has shown that people are most likely to engage in bird conservation activities that are easy, give them direct contact with birds, and are enjoyable. However, in order to promote urban bird conservation, we need a better understanding of the values and other motivations driving individual conservation actions and involvement with birds. Researchers have identified ten universal human values (Schwartz 1994), as well as other personal factors such as personality and social factors

³⁵ The Portland, Oregon urbanized area is made up of more than 40 separate municipalities,

including age, sex, and gender, that motivate various types of environmental behavior. Research to determine how these various factors correlate with different types of bird conservation activities can help us devise strategies to involve people with different types of personality and values.

Birders have conducted Christmas Bird Counts in urban areas for over 100 years, but the results of these surveys have not been correlated with landcover change to help us better understand how bird populations track urbanization within these 15 mile diameter count circles. Similar studies using the results of the Breeding Bird Survey could provide additional data on resident birds, as well as information on migratory breeding birds. Both of these data sets need to be correlated with land cover data and analyzed to explore the relationship between urbanization and bird populations on a local as well as regional and national level.

As more and more people landscape their yards for birds and undertake additional bird-helping activities, more research is needed to document how birds respond to their actions. This will require cooperation between professional researchers in local universities, conservation program administrators, and private landowners. Research may be conducted by professionals or trained volunteers, including “citizen scientists” who can make observations in their own yards. Studies should document the population of birds in managed landscapes, but should also strive to measure the productivity and survival of birds in urban areas in order to determine their true habitat value.

THE FUTURE OF URBAN BIRD CONSERVATION

Based on the trends outlined in this study, there is plenty of room for optimism about future of birds and bird habitat in American cities. Urban bird conservation programs are growing and expanding across the country. Regulations, zoning practices, and community planning efforts are increasingly taking wildlife into account. While city growth will continue to displace some native habitats, millions of acres of parks, preserves, and open spaces will be protected as habitat.

Even above and beyond this projection, this dissertation has identified the key elements that, if brought together, could improve the future of urban birds exponentially. To create this future will require the concerted and coordinated effort of local governments, nonprofits, and private citizens. While there are barriers to implementing a comprehensive urban bird conservation scheme, there are effectively no limits to the possibilities afforded by a creative, coordinated, and pro-active approach linking the adaptive management of the North American Bird Conservation Initiative with additional efforts to protect, create, and manage habitat and mitigate against the biggest urban hazards (Table 8.1)

Table 8.1 Elements of a comprehensive and coordinated urban bird conservation program.

1. Organize local bird conservation group to coordinate government, nonprofit, and private efforts.
2. Identify and prioritize birds of conservation concern in all urban zones and habitats—link to regional conservation priorities and determine habitat umbrella species that private landowners can most easily help in each urban zone.
3. Set population goals for priority species
4. Identify habitat requirements for population goals
5. Plan to acquire, restore, or manage habitat to meet population and habitat objectives—include efforts to engage private landowners and planning tools such as zoning and development guidelines
6. Create plan to address greatest urban hazards—especially window collisions and cat predation.
7. Implement plan through local partner groups such as neighborhood or watershed associations
8. Monitor bird populations through citizen science efforts and university research to determine if meeting goals
9. If needed, adapt management based on monitoring results

Organizing a local bird conservation group is the first and most important step in implementing a comprehensive urban bird conservation program. These need to be cooperative partnerships, or “joint ventures,” between government, nonprofit, and corporate interests. Partnerships like the Chicago Wilderness or the Kansas City Wildlands are already in a position to implement a comprehensive program, and with encouragement could adopt the pieces missing from their strategy. In other areas, local Audubon chapters could take it upon themselves to facilitate a partnership—though it may be more difficult in volunteer-run chapters without members who can commit to facilitating or even attending regular partnership meetings.

Identifying priority bird species requires intimate knowledge of local bird populations, as well as knowledge of regional NABCI priority species and conservation plans. Partners will need to reach out to the NABCI programs in their area for coordination and guidance. Since many areas of the city will require habitat restoration, and may never fully satisfy the needs of the highest priority species, the plan should include strategies to improve each zone of the city by creating habitat for appropriate umbrella species, such as those recommended through the Audubon At Home Birds to Help website.³⁶

Setting population targets for priority species will allow the group to become proactive “developers” of bird habitat, rather than just Not-In-My-Backyard opponents of urban development. The group can make annual and longer term plans to protect or create the habitat needed to sustain priority species throughout the urban area, and can enlist corporations, schools, and private homeowners to landscape their property as habitat for priority species. Cities should develop incentives for residential and commercial intensive greenroof installation, as well as naturalistic landscaping with native plants.

In addition to creating habitat, plans should address the biggest hazards birds face in the city—especially window collisions and cat predation. A Lights Out campaign and birdsafe design guidelines should be included in the plan to mitigate bird kills in the concrete canyons and asphalt savannahs, and homeowners should be encouraged to screen their windows to protect birds. To limit cat predation, a concerted effort should be made to pass mandatory spay and neuter as well as anti-roaming ordinances. Stakeholder

³⁶ 30 initial urban, suburban, and rural Birds to Help, and fact sheets with instructions for helping each

meetings will probably be necessary to develop working relationships with feral cat advocates, and to develop no-kill solutions, such as shelters or cat farms, that remove feral cats from the landscape.

Local university or other professional researchers should be enlisted to study local bird populations and how they respond to the planned landscape changes. In addition, private citizens can be enlisted as “citizen scientists” to record the birds using or nesting on their property through online tools such as eBird developed by Audubon and the Cornell Lab of Ornithology. Maps of local bird distribution are of priceless value when working with city planners. City-wide bird surveys, such as the Tucson Bird Count (Turner 2003), can generate maps to guide planning efforts, as well as keep track of how bird distributions change as habitats are protected and created.

By adopting an adaptive management approach, local partnerships can continually expand and modify their plans as needed to ensure that all hazards are being mitigated, habitats are being improved for birds, and priority species are maintaining their desired populations. Groups do not have to address all hazards, habitats, or species initially, but can expand their efforts as they attract partners and community support.

Perhaps the greatest need at this point is the commitment of an agency or nonprofit to foster and facilitate the creation of local bird conservation groups, and to help them adopt this comprehensive approach. In the 1930s, conservationist Ding Darling proposed forming similar local partnerships as the initial foundations of what

would become the National Wildlife Federation (Pearson 1937).³⁷ NWF turned away from this local organizational model to form statewide organizations and still doesn't have local chapters. Audubon, with its 23 state offices and 480 local chapters, is perhaps the ideal organization to undertake this effort. With funding from the USDA Natural Resources Conservation Service, the Audubon At Home program is developing a *Neighborhood and Community Bird Conservation Workbook* that will outline this comprehensive approach, but it remains to be seen if it will be able to enlist local chapters in following this agenda, or the resources and commitment to help chapters with their efforts.

Many communities probably already have enough of the required local government, nonprofit, and citizen-based resources available to form a group and initiate a more comprehensive urban bird conservation strategy. At times these groups will find themselves in competition with other urban regimes devoted to other types of urban development (Elkin 1985; Lewis 1996; Ward 1997; Warner & Molotch 2000), but they will be better able to compete or work with those other interests as united partners. By labeling the partnership as a biodiversity or habitat group, a group may be able to attract even more agency or corporate partners, than if it markets itself solely as a bird conservation group. Birds can be promoted as indicator species for local habitats, and other organisms or social issues such as park creation or watershed protection can be addressed as long as the interests and goals of the comprehensive strategy are upheld.

³⁷ Proposed countywide federations were to include Sportsman's Groups, Chambers of Commerce, Girl Scouts, Bird Clubs, 4-H Clubs, Women's Clubs, Farm Groups, Garden Clubs, Future Farmers of America, Schools, Boy Scouts, and Civic Clubs (Pearson 1937).

Regardless of how conservationists are organized, the growing American population will pose challenges to helping birds in cities. An additional 100 million Americans will live in urban areas by 2040, and new commercial and residential developments will continue to displace rural or undeveloped habitats to make way for the new immigrants and their children. Demographic shifts as well as regional and cultural differences might provide additional challenges and opportunities in some areas. Rapidly growing Hispanic communities may have different expectations about urban landscapes and experiences interacting with birds (Bonta 2003). African-American and other minority communities often have different concerns about environmental justice and the economics of urban development (Gottlieb 1993; Stern & Dietz 1994; Brosius *et al.* 1998). However, changing demographics may also provide additional opportunities for helping birds; as the large baby boomer population ages and retires, more volunteers will be available to promote private bird conservation efforts.

American cities will continue to harbor birds, and conditions in urban areas will most likely improve for many species. Looking abroad, there are similar prospects for urban birds in affluent countries and neighborhoods, where birds find purchase in parks, large lots, or small gardens. Bird and urban nature protection are well advanced in the UK, Scandinavia, Germany, and Australia (Marzluff *et al.* 2001). But the global megacities that house tens of millions of people, and the thousands of other foreign cities that still dwarf most American cities, are growing so rapidly and are usually so densely built up that they provide limited opportunities for birds. Without adequate open space to provide the habitat needed by birds, rooftop garden construction remains the only option for creating urban bird habitat. This may be feasible in affluent nations like Japan and

much of the European Union, where greenroofs are not only fashionable, but in many cases required in new developments, but they are completely out of reach for the impoverished residents of megacities in most of the developing world. Even when global cities try to protect habitat in nearby parks and preserves, conservationists are skeptical that these areas will be able to protect endemic birds and other wildlife in the face of rapid regional urbanization and resource exploitation (McDonald *et al.* 2008).

In our increasingly global and urbanizing world economic system, the resources required to build and maintain cities places an enormous burden on the world's ecosystems. There is no "first" or unspoiled nature, and the "second" nature of our own development creates human and bird winners and losers. Many birds are losing the habitats that they need, and many people are losing conscious connections to birds and the natural world. The social and ecological maladies that we have created necessitate a search for new ways of living and building cities that are better for people and wild birds alike. For over a hundred years, Americans have been making cities better for birds. A concerted program to build sustainable "Bird Cities of Tomorrow" may turn out to be a pipe dream to rival those of earlier utopians and social reformers. But birds will still flock to cities in 20, 50, or 100 years. By expanding on the bird-helping traditions explored in this study, our future may bring us more urban species and individual birds than ever before.

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Vita

Robby Scott Fergus was born in Corvallis, Oregon in 1968 to Gary Leon Fergus and Marilyn McNeal Fergus. After serving a mission for the Church of Jesus Christ of Latter-day Saints in Ecuador from 1988 to 1990, he received a B.A. in anthropology from Brigham Young University in Provo, Utah in 1993, and a M.A. in geography from the University of Texas at Austin in 1999. He founded the Hornsby Bend Bird Observatory in 1999, and served as the first executive director of the Travis Audubon Society in Austin, Texas from 2001 to 2003. Since 2004 he has worked for the Science Office of the National Audubon Society in Warminster, Pennsylvania, where he is the Senior Scientist for Urban Bird Conservation. He is married to Denise Petersen of Nibley, Utah, and is the father of three young birders.

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