Population demography of Gray Catbirds in the suburban matrix: sources, sinks and domestic cats

Anne L. Balogh · Thomas B. Ryder · Peter P. Marra

Urban areas are quickly spreading throughout the U.S. which as a result impacts much of the wildlife. As of today though, there is little known about how this increase impacts the productivity and survival of breeding birds in urban/suburban environments. This study looks to focus on this missing piece by determining nest and post fledging success. Nest success is defined as the probability that the young will survive both incubation and the nestling stages. Post fledging success determines how many individuals survive following leaving the nest and for how long they persist. The two together provide a larger picture of the natural process occurring in the beginning stages of a bird's life. Many factors influence these natural processes that are specific to the urban grid. For example some species may benefit from the reduction of native predators, supplemental food from feeders, or increased nest sites due to boxes. Unfortunately though, toxins and contaminants may be introduced more readily along with newly introduced predators such as the domestic cat.

This study in particular focuses on Gray Catbirds in 3 sites in suburban Washington DC in order to determine the rate of nest and post fledging success within the matrix, how the number of young and sex size influence post fledging success, and how predation pressure influences the survival probability of post fledgling birds. To do so nests were checked every 2-4 days during incubation and nestling until they fledged or failed. On the eighth or ninth day of the nestling stage individuals were banded with US Fish and Wildlife aluminum bands. To determine post fledging success, nestlings and newly fledged individuals were fitted with radio transmitters. Lastly, in order to assess predator abundance surveys were taken at each site siting hawks, Eastern Chipmunks, Gray Squirrels, Blue Jays, Domestic Cats, and American Crows.

All three sites had similar rates of fledglings along with brood and sex size. As a result these were not found to be the source of any significant disparity among sites. Differences became apparent when comparing post fledging success among sites. One site in particular had greater success in that more individuals fledged as well as persisted for longer. Interestingly enough no domestic cats were found along with fewer Gray Squirrels at this site. All other predators were found to be similar across the sites. This demonstrates the fact that Domestic cats, who are subsidized with provided food and shelter, largely affect the success of a fledgling in urban/suburban environments. Increased urban areas therefore may produce greater hurdles for breeding birds to face in the future.

Comparative effects of urban development and anthropogenic noise on bird songs

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As urbanization increases so does the noise that it produces. Birds rely on sound for communication in order to attract a mate, defend against one's territory, and in turn increase reproductive success. As a result increased urbanization may in fact affect both a bird's call and the frequency, how loud or soft it is, of one's call. Hard reflected surfaces may distort a bird's call by forcing it to bounce around rather than head straight to the targeted audience. Ambient noise has the ability to drown out a call all together. In turn it is possible that a bird may change the frequency of its own call to cope with these effects. It can then be expected that those with higher frequencies will do well overcoming loud ambient noise but will be more affected by reflective surfaces whereas those with low frequencies will be better equipped to deal with reflective surfaces ,due to less reverberation, than ambient noise.

The hypothesis of this paper covers 3 ideas: 1) the lowest frequency sound of birds will be affected by background noise but will not be affected by reflective surfaces and this will be more apparent in those who have the lowest frequencies when compared. 2) The maximum frequency sound will be affected by the amount of reflective surfaces but not by ambient noise and this affect will be stronger for species with higher frequency songs. 3) The frequency range of bird songs will be affected by the amount of urban development. In order to study this 8 types of birds were studied at 28 Neighborhood Nestwatch sites. Ambient noise was recorded as well as individual's calls, vegetation was surveyed, and impervious surface was measured. In all this provided a larger picture as to whether the bird was living in a more natural area or urbanized area and how vocally with this they dealt.

The largest sources of noise were air, road, and rail traffic along with construction machinery and appliances such as air conditioning units. It was determined that as ambient noise increased the lowest frequencies of bird songs increased but remained the same with the increase of reflective surfaces. Secondly as reflective surfaces increased the highest frequency songs of these birds decreased to prevent increased reverberation where as it stayed the same with increased ambient noise. Both of these finding support the hypothesis by stating that when ambient noise increases those with higher frequency songs are able to overcome the sound but must lower the frequency when more reflective surfaces are introduced. For those with lower frequency songs, they must increase the frequency to overcome the ambient noise but keep the low frequency when dealing with reverberations. These results may indicate that species with songs that are more susceptible to the effects of urbanization and noise may be more likely to adjust their songs. An issue arises when more than one factor is introduced. For example birds in urban environments would improve their song transmission by decreasing their song frequency, but when that environment is also loud, a decrease in frequency would worsen transmission. It is these issues that birds in urban areas must overcome as urbanization continues to increase.

The Neighborhood Nestwatch Program: Participant Outcomes of a Citizen-Science Ecological Research Project

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Science and technology are constantly providing new information and therefore not all are informed of these current scientific discoveries. This is true for the ever changing field of avian biology. The Neighborhood Nestwatch program was created in the hopes of bridging this gap by expanding scientific knowledge and creating a sense of place. Here, scientific knowledge is defined as an understanding of scientific content as well as a way of thinking that helps participants better comprehend the newly advanced technical field. A sense of place is includes awareness of one's own natural environment and the desire to care about and for this environment. Along with this Nestwatch participants provide the ability to collect data over a long period of time that can help researchers understand the ecology and population complexities of eight species of birds along an urban-to-rural gradient in the Washington, D.C., area.

During the program participants were asked to closely observe and report nesting behavior and nesting success of eight common backyard bird species on their property. They watched for banded birds returning to their property in following years to provide data on adult survival. Along with this Nestwatchers were encouraged to note behaviors and activities that linked birds to their habitat, other birds, and to populations of predators that may influence nest success. To do so, a scientist first came and banded birds, demonstrated how to track nest success and adult survival, along with interviewed the participant face to face. Follow up interviews asked for participants to share their knowledge of bird behavior and habitat requirements, express their understanding of individual bird behaviors/interactions, and address the components of sense of place. These included identifying new bird species, expressing wildlife knowledge other than avian types, awareness of the natural environment, perception of property, a sense of place and how their behavior changed.

It was found that while many participants were previously enthusiastic about birds, the amount of knowledge on this subject varied before entering the Nestwatch program. Following a visit many stated that they learned about new species they had not noticed previously in their yards, nest predators, and nest specifics. 90% of participants reported learning from participating in the project, and even the most experienced birders interviewed reported learning something new. A sense of place was fostered with many stating increased awareness of the value of the backyard as a habitat for plants and animals lead to more than half of participants changing some aspect of their behavior in relation to their yard. Many went on to study the subject further along with planting shrubs that would provide shelter or food resources for numerous sorts of backyard animals. It was also expressed by many participants that the face to face meeting of scientist and participant greatly increased their enthusiasm and confidence in their own ability to provide reliable data. This study along with numerous others provide the basis to a strong form of informal education about avian biology.

Mosquito Landing Rates on Nesting American Robins

Sean M Griffing, A Marm Kilpatrick, Larry Clark, and Peter P. Marra

Large amounts of mosquitos increase the likelihood of diseases spreading to susceptible hosts such as birds. Breeding individuals are increasingly vulnerable because not only are they living amongst large populations of mosquitos but nesting requires sitting still for long periods of time. Nesting adults provide an easy target when incubating eggs or nestlings. Nestlings ,or young who are still in the nest, as well may be susceptible do to the inability to out maneuver a mosquito along with fewer feathers to protect the skin. To fully comprehend the possibility of spreading viruses through mosquitos it is essential to also know the life span, abundance, and capability of a mosquito to transmit this disease.

This study focused on West Nile Virus in regards to its advancement and likelihood of an individual nesting adult or young nestling to contract the virus. The focus centered on American Robins who are common backyard birds throughout the entire year. Those who were bitten more often were believed to hold a greater risk of getting the virus. In order to do so infrared cameras, which detect body heat, were used placed near a nest for a period of 24 hours. This provided the information as to how many individual mosquitos landed on a nesting adult or nestling. Along with this both mosquito and American Robin behaviors were observed to determine whether actions played a part in resistance to the virus. Nests were detected by Neighborhood Nestwatch participants.

It was found that adults were bitten much more often than young nestlings with adult females receiving anywhere from 2,000-6,000 bites in a nestling period and similar amounts during egg incubation. This was due to brooding behavior in where an adult sits on the nest protecting the young from possible predators. Therefore those who displayed higher levels of parental brooding prevented their nestlings being bitten but became more susceptible themselves to the virus. As the breeding season progresses mosquitos become increasingly prevalent meaning that those who nest earlier in the season may have less risk of contracting the disease. Mosquito population growth as a result may spell out increased virus spread among this community.

Host heterogeneity dominates West Nile virus transmission

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Mosquitos are well known for being transmitters of spreadable diseases also known as infectious diseases. The West Nile Virus is a common disease spread from mosquito to largely the bird community. The rate of spread of this virus is dependent upon the variability of bird type hosted upon and the variability of infectiousness within the mosquito. Meaning that the virus may have a greater effect if the mosquito derives its meal from one type of bird rather than multiple types and it may be greater if the mosquito has a highly contagious strain. Birds then interact with each other possibly further spreading the virus with some species possibly being more physically resistant to the virus than others. This occurrence is known to happen in urban areas but is rarely studied. This study looks to determine how all these factors interact in the Washington DC and Baltimore areas.

In order to do so feeding patterns of mosquitos were observed and caught in order to be tested for West Nile Virus to determine which type of mosquito was the greatest host and who therefore would have the greatest impact. A count of birds and bird community make up was taken at five different sites in urban and residential sites. Along with this blood was taken from individual birds caught to search for virus antibodies suggesting a presence of the virus.

Among the types of bird studied were American robin, European starling, rock dove, mourning dove, gray catbird, house sparrow, and fish crow. Although American robins were much fewer in number, they were bitten much more often than any other studied bird. This demonstrates one type of mosquito's feeding preference to be largely skewed toward American Robins. This type of mosquito was also found to often times have a highly contagious form of the virus. On the other hand House sparrows were largely avoided by this type of mosquito. All together this means that robins, which occur across much of North America, may be an important host for increasing the virus's infectiousness and spread in urban and residential areas. The American robin could therefore be called a super spreader in regards to the West Nile Virus. It is in these urban and residential areas as well that humans have the highest recorded cases of the virus denoting the importance of understanding the complexities of disease spread, infectiousness of the disease, and how a host reacts to the disease.

DNA Vaccination of American Robins (Turdus migratorius) Against West Nile Virus

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American Robins are largely preferred by common mosquitos when compared to numerous types of bird species. Therefore it is found that they often carry the West Nile Virus which is suggested to have caused over 100 deaths and between 6,000-8,000 illnesses within the past six or seven years. American Robins, as a result are common spreaders of the disease by transmitting infected blood to non-infected mosquitos who will therefore continue the spread of the virus. Previous studies have provided a suggested solution by creating a vaccination that has been successfully used in many types of animals with no harmful side effects. Thus, the goal of this research is to determine whether this vaccine would reduce both the virulence (ability to spread) and infectiousness of American Robins.

To do so, six individual hatch year American Robins, meaning that they hatched and left the nest that year, were tested for West Nile Virus. Three of the six were given the vaccination and the remaining three were not vaccinated in order to provide a comparable population. Those with no vaccination were found to be infectious to mosquitos for up to three days following the beginning stages of the virus. Two of the vaccinated individuals showed no signs of the virus and one displayed some virulence but it was 20 fold less than that of the non-vaccinated individuals.

From this an individual's likelihood to spread the disease can be calculated and is called the host competency index. The index number for a unvaccinated individual is .34 meaning that on average 6.8% of mosquitos feeding on these American Robins would be able to transmit the virus where as 0% would be able to spread the virus on the two with no signs of the virus. These vaccinated individuals as a result, have either less virulence or no virus at all which in turn decreases their ability to spread the disease. Therefore it may be beneficial to vaccinate individuals from American Robin populations in order to reduce the amount of cases of illnesses and deaths reported in response to this virus.

West Nile Virus Epidemics in North America Are Driven by Shifts in Mosquito Feeding Behavior

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Each year the amount of West Nile Virus cases in humans rises largely by the end of the summer and beginning of the fall in North America. Earlier in the season fewer cases are reported and it has been suggested that this is a result of the American Robin population change. American Robins are the chosen bird species for common mosquitos along the east coast despite only making up a small part of the total bird diversity. The virus easily spreads from mosquito to American Robins as well as in the opposite direction therefore making the Robin a capable host and spreader of the virus. Following breeding though, in the spring and early summer, Robins disperse and become less numerous leaving the mosquitos to look elsewhere for a food source. At this time in the summer it is believed that mosquitos change their feeding patterns to focus largely on humans, effectively increasing the number of transmissions of the disease in human hosts.

To test this hypothesis and to understand the factors driving North American human West Nile Virus, data on the feeding behavior, population changes, and virus spread of mosquitoes, birds, and humans was studied. Mosquito density at each site was determined by collecting individuals who were then DNA tested to determine species type. The consumed blood of these mosquitos was then determined to be from that of an American Robin, human, other mammalian species, or another bird species. The density and diversity of bird populations was done using observations at each site.

Over 50% of bloods tested from the mosquitos were that of the American Robin despite only making up 4.5% of the avian community. Within four months the American Robin population declined as breeding finished and population dispersal began which coincided with the increased amount of human transmission. In contrast the avian population as a whole became dominated by House Sparrows who are largely avoided by these common mosquitos. Thus the shift in feeding is not a result of decreasing avian abundance but rather the result of the decline in abundance of their preferred host, the American Robin. Had mosquitoes continued to feed on humans by the same amount that they did in June, human epidemics would have occurred at much lower intensity and there would have been few, if any, infections after mid-September. Since the virus spreads well amongst American Robins and mosquitos the virus may have had the large opportunity to spread amongst both populations and become increasingly virulent which in turn has resulted in a larger human epidemic in the later months. Studies such as this are critical to reducing the impact of these and other devastating diseases.

Predicted and observed mortality from vector-borne disease in wildlife: West Nile virus and small songbirds

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When examining the spread of a virus through animal populations it is difficult to fully understand the taken path. This is resultant from the fact that it is challenging to find individuals who have perished and due to the rapid disappearance of their bodies owed to natural processes. This is true for the very contagious virus known as the West Nile Virus. This virus has been examined in larger animals such as crows but not for smaller birds due to the aforementioned issues. One of the best suggested ways to go about studying this disease is to conduct experimental injections of individuals in captivity. This though, can lead to small sample sizes for researchers and the ability to only study a few types of birds at a given time. This paper suggests how to use field work in order to estimate the transmission network of the virus in order for captive experiments to no longer be necessary.

To do so a study of wild individuals was done along with a captive study to highlight the similarity in findings. Tufted Titmouse, Carolina Wrens, and Northern Cardinals were examined by testing individual's blood for the virus. To test the possibility of mortality for the wild individuals an equation was applied using the fraction of each population that had antibodies, the probability of survival, the original population size, and the degree to which mosquitos feed more on one species versus the other. Utilizing the equation helped determine which bird type would be most susceptible and most likely to continue spreading the virus. The comparable captive study focused on watching the progression of this virus among Carolina Wrens and Tufted Titmouse.

The prevalence of antibodies amongst the wild population was highest among cardinals, followed by the wrens, with the lowest amount belonging the titmouse. Meaning that cardinals seemed to have the ability to better fend off the virus. It is suggested then that cardinals should have the lowest amount of prevalence of death among populations and Tufted Titmouse the most. Following the lab test many more Carolina Wrens persisted and did so with fewer behavioral symptoms when compared to the titmouse. This laboratory experiment therefore supports the information garnered using field work and the created equation. This demonstrates the ability of field work in this context to create reliable outcomes. The study also highlights the fact that mortality amongst wrens and titmouse may be greater than previously thought. Actions to reduce West Nile Virus impacts on these and other species include reducing mosquito larval habitat by removing man-made containers such as tires, clogged gutters, and disease reduction through habitat modification.

West Nile virus emergence and large-scale declines of North American bird populations

Shannon L. LaDeau1, A. Marm Kilpatrick2 & Peter P. Marra1

Emerging infectious diseases present a daunting challenge to the conservation of native species in the twenty-first century. However, identifying the impacts of an introduced disease and distinguishing it from other forces that influence population complexities (for example climate) is challenging and requires abundance data of populations that extend before and after the introduction of the virus. West Nile Virus has proven to be a hugely devastating virus to bird populations but few studies have primarily focused on this information to determine the virus's impact. The study tests the theory that West Nile Virus has caused significant population declines in a broad range of avian hosts across North America.

Here, 26 yrs. of Breeding Bird Survey data was utilized to determine the impact of West Nile on 20 potential avian hosts across North America. These species were common among sites and present when the virus first emerged. The species chosen also had available background information regarding susceptibility to West Nile Virus infection. Further, outside factors were considered to determine that any change was in fact due to the virus. When all information was gathered it was all entered into a computer model which determined from what the source of decline in species was resultant.

13 of the 20 species reached 10 yr. populations lows following the emergence of the West Nile Virus in much of the United States between 2002 and 03. Eight species recorded their lowest abundance in 26 yrs. Declines occurred in American Crows, American Robins, Chickadees, and Eastern Bluebirds which were all increasing before the arrival of the virus. This decline was most marked in American Crows who by 2005 experienced a population decline by 45% from 1998 levels. After significantly low abundances for both Blue Jays and House Wrens, their populations returned to expected population levels of 2005. Examining 26 years of data when considering all factors that may a role in population decline, it was found that the West Nile Virus was the driving factor behind dramatic and quick avian population declines. This coupled with outer existing stressors together may create too difficult challenges for wildlife to overcome.

Reproductive Success of House Wrens in Suburban and Rural Landscapes

Michael J. Newhouse, Peter P. Marra, L. Scott Johnson

Urbanization and suburbanization can impact the livelihood of a bird species. Though, this impact does not necessarily have to be detrimental. For instance the introduction of nest boxes and feeders can help a certain few. This study focused on examining this dynamic for House Wrens since it is unsure as to whether urbanization positively or negatively impacts the specie. House Wrens are small, migratory, insect consuming birds who nest in tree cavities or nest boxes in urban areas. In order to determine the impact of urbanization on these birds, reproductive success was examined meaning the number of eggs in the nest, the number of birds who hatch, and the number that successfully leave the nest. This also includes the size and physical health of the young while in the nest.

In order to study this dynamic, nest boxes were regularly checked during the egg and fledgling stage, or when young are present in the nest. The number of young who left the nest was recorded as the number that fledged. Nests that failed to produce any fledged young were a result of abandonment by the parents, predation, nest destruction by an outside source, or exceedingly cold temperatures. The number of trips made by parents to deliver food to the young was recorded along with wing length and weight of these young and how much time the female spent exhibiting brooding behavior. Brooding is when a parent stays at the nest in order to protect or keep the young warm. In this study, 202 of 210 nest boxes available to wrens were on properties owned by participants in the Neighborhood Nestwatch Program which provided a large sample size for this research.

It was found that House Wrens in both rural and urban areas commenced breeding at the same time and laid a similar amount of eggs. However House Wrens in rural habitats were less successful at producing nests that fledged at least one young. This can be attributed to greater amounts of predation in rural areas. Though, it was also found that young reared in suburban areas weighed significantly less and had shorter wings compared to those in rural areas. Parents in both areas appeared to deliver the same amount of food for their young which suggests that the lower weight and smaller size is due to a lower quality of food rather than less food. Therefore it is determined that urbanization may affect House Wrens both negatively and positively with more young making it out of the nest but being smaller in size.

The presence and impact of environmental lead in passerine birds.

Karin E. Roux and Peter P. Marra

Lead has long been an issue for wildlife causing the eventual ban of lead sinkers for fishing and lead bullets used in hunting. This has been the case particularly in rural areas but few have examined lead in urban areas and the resultant effects on wildlife. Birds store this lead in muscle tissue which builds up over time creating physiological and behavioral issues. This poison is often transferred through consumption. In urban environments birds who mainly eat insects ingest infected insects along with inadvertently consume contaminated soil. These ground feeding birds are therefore more likely than aerial feeders to ingest more lead. Those who feed on seeds and fruits may ingest lead due to the plant's uptake of lead through the root system from the soil. The objective of this study was to quantify soil lead levels along an urban to rural gradient, measure blood lead levels of birds at these sites, and determine the impact of lead on the body condition of these individuals.

A total of 53 Neighborhood Nestwatch properties were used to conduct the study. Without the use of these yards of participants urban wildlife research would be nearly impossible. Three samples of soil were evaluated at each site. Seven bird species were chosen to take blood samples from due to their dietary make up. Blood samples were also taken from American Robin and Gray Catbird nestlings, or young still in the nest. Nestlings can be an accurate reflection of the environment in which they are raised.

Soil in urban areas were found to contain much higher levels of lead than that of rural areas. All species of adult birds in urban areas had significantly higher blood lead counts than birds in rural areas. Those who foraged for food on the ground also demonstrated a higher blood lead level than those who intermixed their feeding with different sources. Gray Catbird nestlings showed significant evidence of worsened body conditions due to higher lead levels. All together urban areas held higher levels of lead which resulted in more lead build up in adult birds and lessened body conditions for young. It was determined that the largest source of the poison in urban areas was and is leaded gasoline residue. Soil found near roads consequently had higher levels of the poison. As urban areas continue to expand this lead consumption may become an even greater risk to avian communities.

Quantifying avian nest survival along an urbanization gradient using citizen- and scientist-generated data

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Since the early 1970s, the extent of urban area in the United States has more than doubled. This quick urbanization can create great difficulties for some wildlife while benefiting others. In order to fully understand the full picture, it is necessary to study this phenomenon over a long period of time and within rural, suburban, and urban areas. Studying nest predation along this urban gradient can provide powerful insights into the effects that urbanization may have on important population limiting parameters. Neighborhood Nestwatch is a citizen science program that has provided this information for approximately eight years and for five common species. The goal of this study is to examine nest success, or the ability of a nest to produce at least one young who will leave the nest, over a long period of time and throughout a gradient. Along with this it looks to determine whether citizen science driven program can generate reliable and accurate data.

Both scientists and citizens investigated avian nest survival along this gradient. In addition an experiment using artificial nests and plastic eggs placed in Neighboorhood Nestwatch yards helped determine which source of predation had the greatest impact on open cup nesters. Open cup nesters are bird species that do not nest within a tree cavity or nest box. During the spring breeding season of 2000-2008 a total of 405 nests of together American Robins, Northern Mockingbirds, Northern Cardinals, Gray Catbirds, and House Wrens were observed. On each visit the number of eggs, nestlings (young in the nest), fledglings (young who have left the nest), date of the first egg laid, date of hatching, and nest fate (fledged, abandoned, or predated on) was recorded.

Overall the results show that predation was a good parameter to predict nest survival. Four of the five had higher nest success in urban areas compared to rural environments. These urban areas could also be known as “safe zones” in this respect because they housed fewer predators. Predators such as American Crows and Blue jays may cause the most significant amount of nest failures in urban areas while mice, chipmunks, and squirrels are largely responsible for nest failures in rural areas. The House Wren, which is not an open cup nester but rather a cavity nester, had the highest probability of survival due to the difficulty for large predators to reach the nest. Lastly all data generated by citizen scientists were equivalent to that of Smithsonian scientists proving that citizen scientists provide a reliable and beneficial source of data for research and larger conservation. The data here suggests that while urbanization may benefit some breeding birds due to reduced predation and increased novel food sources it may also contain contaminants and increase nest parasitism (when one bird lays eggs in a nest created by another bird). For this reason it is integral to continue studies such as these to determine long term effects.

Characterizing avian survival along a rural-to-urban land use gradient

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As the developed land area in the United States is projected to nearly double between 2000 and 2025, understanding how organisms respond to these habitats is becoming increasingly integral for conservation efforts. Birds are a common animal that are found in rural, suburban, and urban areas. Negative impacts resultant from these urbanized areas for birds may include increased toxic contamination, less leaf cover for protection, and more manmade objects that increase collisions. Positively though, supplemental food through increased feeders and more nest boxes benefit some. Survivorship of a species may be effected by anyone of these impacts and therefore could be a driving factor behind their population gains or setbacks. It is suggested that if top down processes such as disease, collision, or pollution are the primary drivers of survival variation then survival should be reduced for all bird species in urban areas. In contrast, if bottom up processes, such as food availability, drive variation it should be expected that peak survivorship will occur suburban areas. These processes are inherent to food webs in where top down is reference to changes occurring at the last few stages such as increased bird-window strikes leading to fewer birds which in turn leads to a larger population of their prey, insects, and consequently changes the soil make up. A bottom up process could be seen as the opposite such as a change in soil leads to a decrease in the insect population and therefore a decrease in the insect eating avian community. This study suggests that bird populations among this urban to rural gradient are driven from bottom up processes.

Here, mark-recapture of seven types of birds, which entails banding individuals, and resight information from 2000 to 2012 was utilized. All were banded, weighed, had their wing and tail measured, and were determined to be either male, female, or juvenile. This was done using the Neighborhood Nestwatch program in where citizen scientists often provided both necessary information and the space to conduct this study. Without the use of these yards of participants urban wildlife research would be nearly impossible.

American Robins, Gray Catbirds, Northern Cardinals, and Song Sparrows had increased survival with increased urbanization. House and Carolina Wrens showed decreased survival as urbanization increased with their peak survivorship exhibited at rural sites. The four who had bettered survivorship are all generalists in that they consume many different types of food which allows for the ability to adapt to challenges associated with urban landscapes. Additionally, a considerable proportion of the diets of these species consist of fruit and insects, many of which are more abundant in urban– suburban environments. This supports the theory that bottom up forces are driving population changes in urban areas. House and Carolina Wrens may be experience a decreased due to fewer trees for available cavities for nests. As urban areas continue to expand it is progressively more important to fully comprehend how species and the newly created environment interact.

Neighborhood Nestwatch: Mentoring Citizens in the Urban Matrix.

Marra, P., and R. Reitsma

Nearly 1 million acres is converted to urbanized landscapes each year in the United States. As a result it is likely to assume that much of the wildlife who occupy these areas will be affected. Ironically, little is known about these impacts on this community. Therefore increasing the amount of research done on urban wildlife is necessary to the field of biological conservation. Along with this, increasing awareness and the understanding of the plight of urban wildlife amongst the general public, is integral to garnering this information. The Smithsonian Migratory Bird Center has addressed both these issues by introducing a project called Neighborhood Nestwatch. This program integrates the public into the process of research by employing their help as citizen scientists. The program was created in 2000 to educate a public audience about urban avian communities and to attempt to learn how urbanization affects the reproduction and survival of common back yard birds.

Once a year a participant is visited by a Smithsonian scientist during which together they capture and band eight different types of bird species. Banding entails putting a harmless and barely noticeable metal or plastic ring around the bird's foot for identification purposes. Measurements are recorded which over years provide information about the individual's health as well as the specie's health. Feather samples are taken which provide information as to possible toxins within the bird and genetic differences between individuals. Following a visit the participant will be more knowledgeable about the subject and aware of the importance of their back yard and actions.

The program has been overwhelmingly successful with 12 papers published within about a ten year span. It has also highlighted the importance of citizen programs by providing reliable and accurate data from its participants. These participants were found to be more engaged within the program when compared to completely internet based programs. This was due to the fostered scientist-participant relationship that motivated participants and provided the necessary skills. To date the program has also included 40 undergrad interns, two high school interns, 2 master's studies, 2 doctoral theses, and 3 post-doctoral studies. In all it successfully reaches out to over 1000 people a year.