



Developing and Implementing a Bird Migration Monitoring, Assessment, and Public Outreach Program for Your Community The BirdCast Project



E M P A C T

Environmental Monitoring for Public Access
& Community Tracking



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Developing and Implementing a Bird Migration Monitoring, Assessment, and Public Outreach Program for Your Community The BirdCast Project

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1 INTRODUCTION

Every year, several billion birds undertake seasonal migrations in pursuit of food, shelter, and nesting grounds. North America is the site of some of the world's most spectacular bird migration, and millions of American “birders” enjoy spending time in the field identifying the birds passing through their area. Migratory birds are delightful not only for birders, but also for countless other Americans who casually observe their comings and goings, particularly in the spring and fall. These birds also have a distinct economic value (nearly \$3 billion in the mid-Atlantic states alone) to the tourist and outfitting industries of the regions located along their flight path.

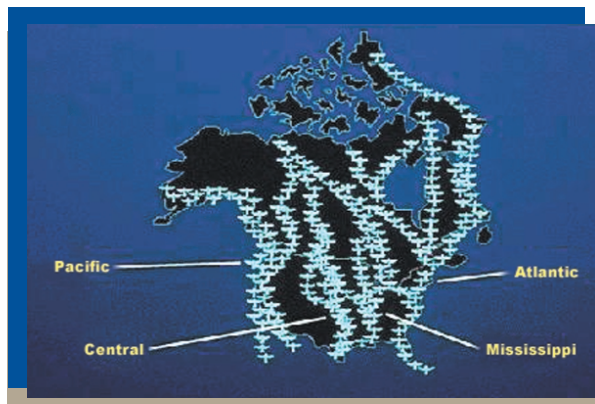
Aside from any immediate benefits they provide, migratory birds are valuable for the role they play in our ecosystems—in particular, for eating insects and thereby keeping pest populations under control. We also have reason to be concerned about the well-being of migratory birds that extends beyond any inherent value these birds may possess. As naturalist Roger Tory Peterson noted, birds are an “ecological litmus paper”—because of their rapid metabolism and wide geographic range, they often provide an early warning of environmental deterioration. Migratory birds depend on many different kinds of open space, such as swamps, marshes, meadows, and suburban parkland. Therefore, research and conservation aimed at keeping a particular bird population healthy may lead to the broader goal of restoring these threatened habitats.

When migrating, a bird may travel hundreds or even thousands of miles without stopping. The exertion of flying such long distances leaves birds exhausted and vulnerable. Many birds, particularly those that encounter adverse weather conditions, do not survive their journeys. Unfortunately, human activities can further increase the levels of stress and danger that a migratory bird faces. For example:

- ◆ Inopportune application of pesticides to lawns, gardens, and parks may poison a bird's food supply at just the moment when it is weakest and most in need of nourishment. In the United States, migratory birds are particularly vulnerable to pesticide application as they migrate northward in the spring.
- ◆ Lights on tall structures (such as skyscrapers and communication towers) may confuse and disorient birds, causing them to become exhausted and crash into objects. Similarly, birds injure or kill themselves by flying into panes of glass. These problems appear to be particularly severe on overcast nights when birds may circle a light source.



of North America, the sight of migrating



migration routes in North America



- ◆ The development of land for human purposes such as agriculture, housing, and commerce often renders it unsuitable for use by birds. Birds may be challenged not only by the loss of habitat in their breeding and wintering ranges, but also by loss of habitat at key stop-over points where they need to rest and regain strength over the course of migration.
- ◆ Humans have imported animals to North America that prey upon migratory birds (e.g., cats) or compete with them (e.g., starlings). These new biological threats, combined with decreasing quantities of suitable habitat, may reduce the population and range of a particular migratory bird species.



There is much that property managers and the general public can do to mitigate these problems if they are aware of them, interested in solving them, and educated about bird conservation. During a period of peak bird migration, pesticide applications can be delayed, bright building lights can be turned off, and cats can be kept indoors. Therefore, outreach programs designed to inform these audiences about the status of seasonal bird migration are a promising route to improving the conservation of migratory birds.



EPA has developed this technology transfer handbook primarily for community organizers, non-profit groups, local government officials, and other decision-makers who will implement, or are considering implementing, bird migration monitoring and public outreach programs. The handbook is designed with two main goals in mind. The first goal is to present a case study showing how one regional outreach program—EMPACT’s BirdCast project for the mid-Atlantic coast of the United States—provides information that allows property managers and the general public to assist migratory birds. The second—and perhaps more important—goal is to provide you with guidance for developing a similar program in your own region. The guidance in the handbook is based on the experience of the EMPACT BirdCast project, as well as that of other experts in the fields of ornithology and public outreach.



1.1 ABOUT THE EMPACT PROGRAM

This handbook was developed by the U.S. Environmental Protection Agency’s (EPA’s) EMPACT Program (<http://www.epa.gov/empact>). EPA created EMPACT (Environmental Monitoring for Public Access and Community Tracking) in 1997. It is now one of the programs within EPA’s Office of Environmental Information. EMPACT is a new approach to providing timely environmental information to communities across the nation, helping people to make informed, day-to-day decisions. Residents in 156 of the largest metropolitan areas in the United States have or will soon have an easy way to answer questions such as:



- ◆ What is the ozone level in my city this morning?
- ◆ What is the water quality at my beach today?
- ◆ How high is the ultraviolet radiation in my city today?
- ◆ What is the level of contamination at the hazardous waste site in my community?
- ◆ What are the levels of lead in the soil in yards in my neighborhood?

To help make EMPACT more effective, EPA is partnering with the National Oceanic and Atmospheric Administration and the U.S. Geological Survey. EPA is working closely with these federal entities to help achieve nationwide consistency in measuring environmental data, managing information, and delivering that information to the public.



EMPACT projects cover a wide range of environmental issues, such as groundwater contamination, ocean pollution, smog, drinking water quality, ultraviolet radiation, and ecosystem quality. Some of these projects have been initiated directly by EPA. Others have been launched by the EMPACT communities themselves.

1.2 ABOUT THE EMPACT BIRDCAST PROJECT

EPA's EMPACT program started funding the BirdCast project (<http://www.birdcast.org>) in 1999, and the project started public operation on April 1, 2000. The project began as a collaboration among EMPACT, EPA Region 3, EPA's Office of Pesticide Programs, the National Audubon Society, Cornell University's Laboratory of Ornithology, Clemson University's Radar Ornithology Laboratory, the Academy of Natural Sciences in Philadelphia, and GeoMarine, Inc. The four primary objectives of the project are:

- 1) To maintain an Internet Web site that posts educational information about bird migration and the steps that property managers can take to mitigate the danger and stress that migrating birds face when passing through an area.
- 2) To predict and monitor bird migrations on a daily basis using weather radar. The data gathered by radar are continually interpreted by trained scientists and presented using text summaries, charts, and radar maps. During its first year, BirdCast also experimented with using microphones to perform bioacoustic monitoring of bird migrations.
- 3) To collect and disseminate volunteers' reports of bird sightings. This information collection, known as "groundtruthing," is coordinated through the BirdCast Web site. Groundtruthing information is stored on a Web-accessible database called "BirdSource" that Cornell maintains. Visitors to the BirdCast Web site can query this database and display reports in chart or graph form.
- 4) To raise public awareness about the sensitivity of migratory bird populations. This public relations campaign, coordinated by National Audubon, involves generating press releases, working with local land managers, distributing promotional materials, and making presentations at conferences and conventions.

1.2.1 BIRDCAST'S REGIONAL FOCUS

To date, the BirdCast program has primarily covered bird migration along a portion of the "mid-Atlantic flyway," a coastal area between North Carolina and New England that experiences significant migratory bird activity each spring and fall. The initial focus of BirdCast's attention has been the city of Philadelphia. BirdCast established a local partnership with Philadelphia's local PBS station (WHYY) and the Academy of Natural Sciences to develop a public relations focus on the region surrounding this city. The BirdCast project's efforts to collaborate with land managers so far have consisted primarily of work with Philadelphia's Fairmont Park Commission. It is hoped that eventually BirdCast can be expanded to cover the entire Atlantic flyway. Birds could be tracked coming across the Gulf of Mexico and at their first landfall. Birdwatchers up the coast could be alerted to the status of the migrating birds and provided with additional early warning of their arrival.

Despite its current regional focus, BirdCast also hopes to expand to cover the entire United States by forming new partnerships with local governments and birding organizations. So far, BirdCast has succeeded at drawing both widespread media attention (it was discussed in more than over 100 news articles by spring 2000) and attention in venues of national importance (it has been covered by news reporters from both the New York Times and the Wall Street Journal).





1.2.2 BIRDCAST IN CONTEXT

The BirdCast project is a collaboration among individuals and organizations that made significant contributions to the field of bird monitoring both before and after receiving EMPACT funding. A brief history of these bird monitoring activities (and of radar ornithology in particular) will help to place BirdCast in its full context.

At the outset of World War II, almost immediately after the invention of tracking radar, British radar operators noticed that birds flying over the English channel would sometimes appear on their screens. At the time, this fact was noteworthy primarily because it was possible to mistake a bird for a fast-moving-ship—significant ornithological use of this phenomenon did not begin until the 1960s. Sidney Gauthreaux, now Director of the Clemson University Radar Ornithology Laboratory, began studying the radar detection of birds at that time and has accumulated over 35 years of experience with the method. In the 1970s, the United States Air Force also began studying bird migration as a serious hazard to the operation of military aircraft, which often fly at high speeds and low altitudes. The Bird Aircraft Strike Hazard (BASH) team organized by the Air Force began exploring radar's potential to provide early warning of potential bird collisions. Their efforts were significantly aided by the emergence of "Next Generation Radar" (NEXRAD) in the early 1990s. NEXRAD is a network of highly sensitive weather radar stations located throughout the United States. In 1995, Sidney Gauthreaux also began using NEXRAD in his ornithological studies.

Meanwhile, in the mid-1990s, the National Audubon Society and Cornell University's Laboratory of Ornithology began applying a very different emerging technology to the field of bird conservation. These two groups collaborated to develop BirdSource, a sophisticated computer database that uses the Internet to allow birders from across North America to send their observations to a central repository. With financial assistance from the Packard Foundation, these two groups spent more than \$2.5 million developing the BirdSource database as a nation-wide information technology resource for birders.

The idea of the BirdCast program emerged at a 1997 biodiversity meeting attended by personnel from both EPA Region 3 and the Department of Defense. EPA and DoD discussed the possibility of providing the public with near real-time information about bird migration using radar technology. BirdCast combined the capabilities of Clemson's Radar Ornithology Lab with the information technology capabilities of BirdSource so that members of the public would be able to not only view radar images but also submit data that might verify (i.e., "groundtruth") those images. EMPACT began funding the project through EPA's Office of Pesticide Programs and Region 3 in 1999, and BirdCast began its public operations in 2000.

1.2.3 RELATED BIRD MONITORING PROGRAMS

BirdCast is not the only program that is currently using radar technology to track bird migration. Additional groups, such as the ones listed below, either have pursued or plan to pursue radar tracking technologies:

- ◆ BASH, the U.S. Air Force's program to guard against collisions between wildlife and aircraft, has developed an Avian Hazard Advisory System (AHAS). AHAS can be accessed on the Web at <http://www.ahas.com>. This system uses radar to predict the risk of a bird-aircraft collision along various flight paths at various times.
- ◆ The Illinois Natural History Survey, the University of Illinois (<http://www.inhs.uiuc.edu>), and EPA Region 5 (<http://www.epa.gov/region5>) have pro-

posed setting up a project analogous to BirdCast for the Chicago region. The organizers hope to draw Chicago residents' attention to the unique role that their urban and suburban open spaces play in the migration of birds, thereby encouraging interest in the conservation of those open spaces.

1.3 ABOUT THIS HANDBOOK

A number of bird observatories throughout the United States have expressed interest in beginning projects similar to BirdCast. The Technology Transfer and Support Division of the EPA Office of Research and Development's (ORD's) National Risk Management Research Laboratory initiated the development of this handbook to help interested organizations learn more about BirdCast and to provide them with the technical information they need to develop their own programs. ORD, working with BirdCast, produced the handbook to leverage EMPACT's investment in the project and minimize the resources needed to implement similar projects in new areas.

Both print and CD-ROM versions of the handbook are available for direct online ordering from ORD's Technology Transfer Web site at <http://www.epa.gov/ttbnrmrl>. A PDF version of the handbook can also be downloaded from that site. In addition, you can order a copy of the handbook (print or CD-ROM version) by contacting ORD Publications by telephone or by mail at:

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Phone: (800) 490-9198 or (513) 489-8190

Please make sure you include the title of the handbook and the EPA document number in your request.

We hope that you find the handbook worthwhile, informative, and easy to use. We welcome your comments; you can send them by e-mail from EMPACT's Web site at <http://www.epa.gov/empact/comment.htm>.

1.4 FOR MORE INFORMATION

Try the following resources for more on the issues and programs this handbook discusses:

The EMPACT Program
<http://www.epa.gov/empact>

BirdSource
<http://www.BirdSource.org>

Cornell University Laboratory of
Ornithology
<http://birds.cornell.edu>

National Audubon Society
<http://www.audubon.org>

Ralph Wright
EPA Office of Pesticide Programs
(703) 308-3273

Ronald Landy
EPA Region 3
(410) 305-2757

Sally Conyne
National Audubon Society
(215) 297-9040

Steve Kelling
Cornell University Laboratory of
Ornithology
(607) 254-2478



This handbook provides information your organization can use to create and implement a Web-based bird monitoring program. It presents detailed guidance, based on the experience of the EMPACT BirdCast Project, on how to:

1. Identify target communities that would be interested in reporting on and following the progress of bird migration.
2. Record and present real-time information about bird migration using radar, weather information, and acoustic monitoring.
3. Collect groundtruthing information from volunteer birders and present it to the public.
4. Provide education and outreach to members of the public about what to do when migratory birds pass through their area.

This handbook provides simple “how to” instructions on each facet of planning and implementing a bird monitoring program, along with additional information about bird migration:

- ◆ **Chapter 3** discusses bird migration as a general conservation issue and how the different members of a bird migration monitoring organization work with each other to help birds as they migrate.
- ◆ **Chapter 4** discusses instrument-based observations of birds.
- ◆ **Chapter 5** covers a variety of issues relevant to volunteer groundtruthing, including a detailed description of BirdCast's policies and experiences working with volunteer birders.
- ◆ **Chapter 6** treats the methods and strategies a bird monitoring organization may make use of to conduct public outreach and education.
- ◆ **Appendix A** presents examples of education and outreach materials from the BirdCast project.

Interspersed throughout the handbook are success stories and lessons learned in the course of the EMPACT BirdCast project.

3

BEGINNING A NEW BIRD MIGRATION MONITORING PROGRAM

This chapter provides guidance on important first steps that you will need to take as you start your bird migration monitoring program. Section 3.1 provides a brief overview of the structure of a bird migration monitoring program and outlines the roles and responsibilities of program partners, based on the EMPACT BirdCast Project model. Section 3.2 discusses the critical process of selecting program partners who can best help you meet your program's objectives within your target community.

The information in this chapter is designed primarily for managers and decision-makers who may be considering whether to implement bird migration monitoring programs in their communities, as well as for organizers who are implementing such programs.

3.1 PROGRAM STRUCTURE: OVERVIEW OF A BIRD MIGRATION MONITORING PROGRAM

The EMPACT BirdCast project is a multifaceted project that engages a variety of activities—everything from distributing posters to counting birds. These activities can be grouped into four main categories, which make up the main components of the project: administration and public outreach, radar analysis, database management, and volunteer groundtruthing.

The following paragraphs summarize these activities to provide an overview of how the EMPACT BirdCast program works. These activities are described in greater detail in Chapters 4 through 6.

General Administration and Public Outreach. The administrator and staff of BirdCast are responsible for the primary public relations and outreach efforts of the project. This includes managing the distribution of posters about pesticide use, maintaining contacts with news media organizations to ensure that BirdCast stays in the public eye, issuing periodic press releases, and working with local land managers to encourage bird-friendly gardening practices. The administrator also provides a broad range of support tasks related to the project's birdwatching volunteer program. These tasks include providing advice about making bird identifications, making quality control checks of data submitted by volunteers, and networking to recruit new volunteers. The BirdCast administrator also serves a central liaison with the other BirdCast staff, including the radar analyst and the chief database base manager.

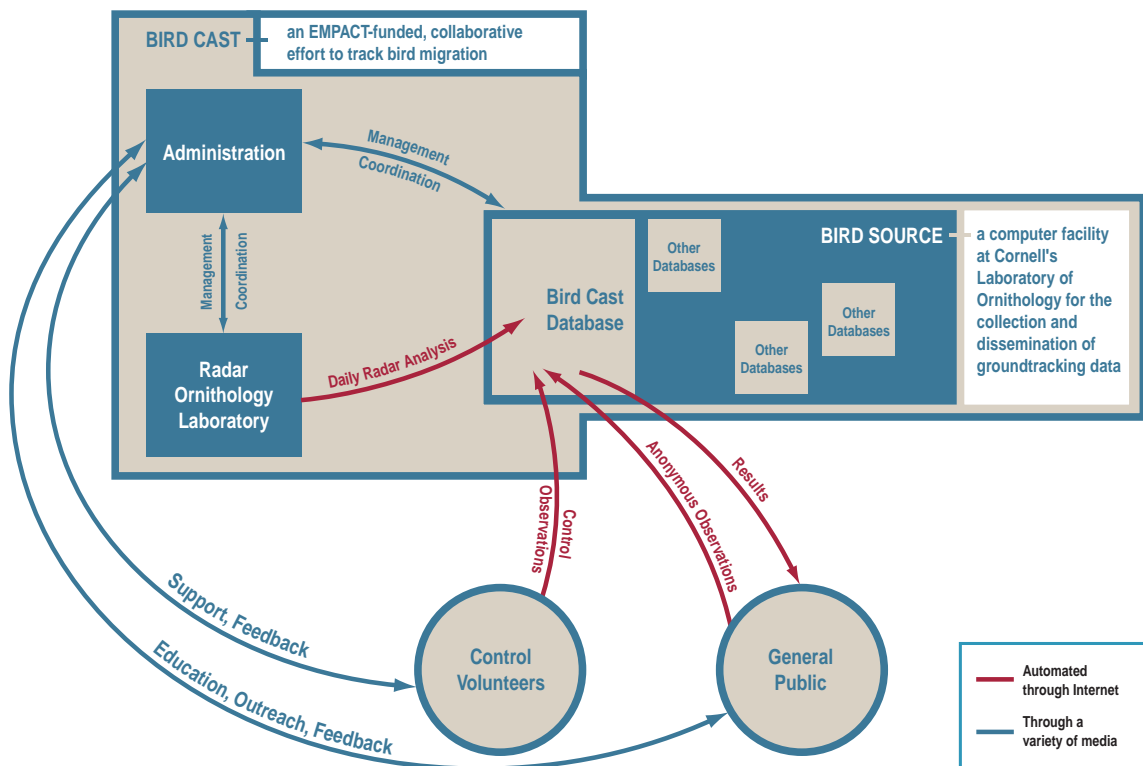
Radar Analysis. The chief radar analyst and his assistant are responsible for predicting the degree of bird migration activity in upcoming evenings and for measuring the actual amount of bird migration using radar data. The radar analyst (and/or his assistant) must make daily reports of predicted and observed migration during the periods of bird migration (in the spring and the fall) but have fewer regular duties during the “off season.” They seek out and contract information service providers to ensure a constant supply of radar data during the periods of migration. Once per day, the radar analysts submit their predictions and observations to the database administrator via the Internet.

Database Administration. BirdCast's database administrator and his staff ensure that the public has access (via the Internet) to the information submitted by the radar analyst. In the case of BirdCast, the database is actually maintained as a separate organization called

BirdSource. BirdSource is an entity distinct from BirdCast and it maintains a variety of other Web-enabled birding databases. The BirdCast database administrator issues user identifications to new volunteers, implements backups and system security measures, and coordinates the programming of changes to the database system. Also, while BirdCast's bioacoustic monitoring was being conducted, the project was coordinated by the database administrator.

Volunteer Birdwatching. BirdCast's volunteers provide the “groundtruthing” information necessary to verify the observations made using radar instrumentation. Volunteers are recruited by the project administrator and contact her with any questions or comments they may have about their participation in the program. Registered volunteers make observations several times a week and record their findings directly to the BirdCast database (using the Internet).

The flow chart below summarizes the basic structure of the BirdCast project. The chart identifies the main activities of the project, the team members responsible for these activities, and the flow of work among team members. It also indicates where in this handbook you can go for more information about specific activities.



3.2 SELECTING PROGRAM PARTNERS

As described in Chapter 1, BirdCast is a partnership of several public and non-profit organizations. These have included university laboratories, a wildlife conservation society, a park management authority, and a natural history organization. The reason BirdCast is composed of such a wide range of partners is that its goals require the use of a wide range of

of skills and community connections. None of the individual organizations, working by themselves, would have been as effective as the collaboration of many different organizations, each possessing complementary skills and abilities.

For example, the staff of Clemson University's Radar Ornithology Lab have specialized skills in forecasting and analyzing bird migration patterns using radar images and other weather data. The National Audubon Society, on the other hand, has an extensive media infrastructure for presenting bird conservation information to the public and can easily enlist the support of birding communities. Cornell's Laboratory of Ornithology, in conjunction with the National Audubon Society, has invested in the development of BirdSource, a sophisticated Web-enabled database for the collection and distribution of bird monitoring data.

In starting your own bird monitoring program, you'll need to assemble a team of individuals or organizations who offer a similar range of skills and qualifications. To select partners or team members, you should think about how each will fit into the overall program structure, and how different partners can work together to create a successful program. You will also need to consider their relationship to the region where you will be monitoring bird activity. For example:

- ◆ A small, grass-roots organization that already has strong ties to the community can be ideal for providing public outreach and obtaining volunteer birdwatchers. Local chapters of birding clubs, natural history associations, or conservation groups can all be good choices. (For a directory of birding clubs in the United States, see: (<http://birding.about.com/hobbies/birding/library/blalphausclub.htm>.)
- ◆ A university with an ornithology laboratory would make a good partner for identifying and interpreting radar images of birds. A professor or graduate student working in such a lab might either already have the necessary skills or be able to acquire them for the benefit of the bird monitoring project.
- ◆ A government agency, university, or private company that employs persons with a range of programming and "new media" skills would make a good partner for the purposes of establishing a Web site where the public can access up-to-date radar images and submit and retrieve groundtruthing observations. Building such a Web site from the ground up may require access to staff trained in JAVA programming, Web page design, network administration, and database building.

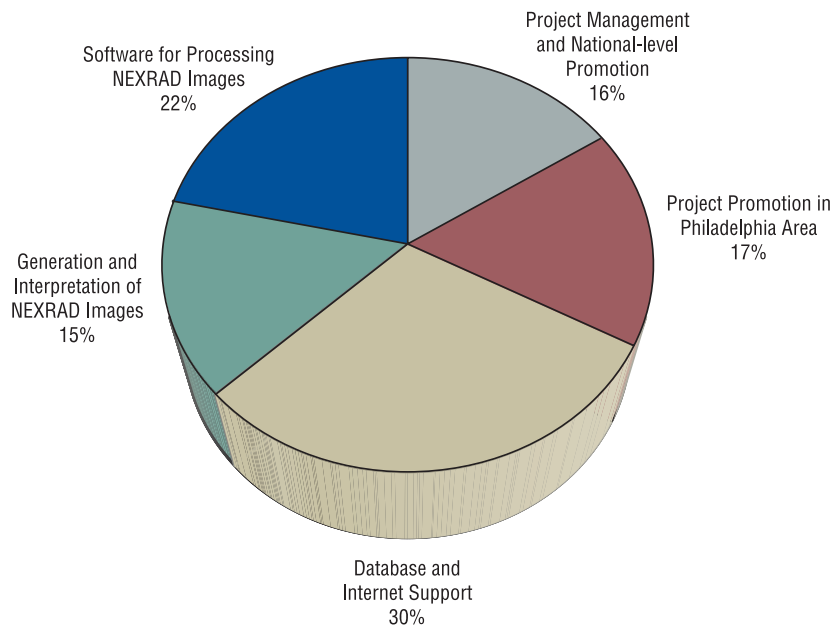
3.3 FIGURING COSTS

One of the important first steps for your organization to take when it is considering setting up a bird monitoring program is to estimate how much your planned activities will cost. Although your program need not be as large or ambitious as BirdCast's, you may find it helpful to know how much money BirdCast spent in its first year of operation.

In its initial year (between December of 1999 and November of 2000) EMPACT provided BirdCast with \$449,500 for operations and set-up. As shown above, these expenses break down into five categories, each of which was handled by a separate entity:

- ◆ **Project management and national level promotion** was handled by National Audubon Society. This cost \$71,000 or 16% of the overall EMPACT budget for BirdCast. This category covers all the public promotion of BirdCast that went on during the year, excepting a local media campaign in Philadelphia.





- ◆ **Project promotion in the Philadelphia area** was handled by the Academy of Natural Sciences. This cost \$76,500 or 17% of the overall EMPACT budget for BirdCast. The Academy was responsible for encouraging local news media to discuss BirdCast and reporting its findings.
- ◆ **Database and Internet support** was provided by the staff of the BirdSource project at Cornell University. This support cost \$136,000, or 30% of the overall EMPACT budget. BirdSource staff maintained the BirdCast Web site, set up and managed a database for groundtruthing observations, and coordinated BirdCast's bioacoustic monitoring program.
- ◆ **Generation and interpretation of NEXRAD images** was performed by Clemson University's Radar Ornithology Laboratory (CUROL) for a fee of \$68,000, or 15% of the overall EMPACT budget. As described elsewhere in this report, CUROL submitted daily radar information about bird migration to the BirdCast Web site.
- ◆ **Software for Processing NEXRAD images** was developed by GeoMarine Software for \$98,000, or 22% of the overall EMPACT budget. GeoMarine developed software algorithms for distinguishing radar signals reflected from birds from those reflected from clouds.

This cost breakdown represents the first-year of a cutting-edge program and should not be taken as completely representative of the ongoing costs of other bird monitoring programs, particularly those that are smaller in scale. For example, BirdCast organizers learned that it was neither necessary nor feasible at present to automatically distinguish birds from precipitation with software algorithms. The expense associated with this component of the program, therefore, was not carried forward into future years and need not be incurred by newer monitoring programs.

4

INSTRUMENT-BASED OBSERVATION OF BIRD MIGRATION

Flying takes a lot of work. While larger birds (such as raptors, cranes, and waterfowl) will migrate during daylight hours, most songbirds migrate on clear, calm nights when weather conditions are most favorable to powered flight. Unless there is a full moon out, lack of light can make it almost impossible to visually observe migrating songbirds. Birders can take note of where such birds land in the morning, but actual songbird migration is typically recorded using special instruments.

The primary foundation of BirdCast's predictions and observations of bird migration is the information provided by a network of WSR-88D weather stations located throughout the United States. These weather stations (and the data they produce) are collectively referred to as Next Generation Radar (NEXRAD). BirdCast has also experimented with bioacoustic monitoring of nocturnal bird migration. Although this technique has proved promising, it is not currently in widespread use due to cost considerations.

4.1 WHAT IS NEXRAD AND WHAT CAN IT DO?

Like all radar systems, NEXRAD identifies the location of distant objects by transmitting radio signals and analyzing the returning signals that have been reflected off of those distant objects. Unlike previous radar networks, which were composed of WSR-57 and/or WSR-74C radar stations, NEXRAD radar is also able to measure the radial velocity of objects by recording the Doppler shift of the reflected radar. (The Doppler shift is the difference between the frequency of the transmitted radar signal and the reflected signal—if

the reflected signal is higher frequency than the transmitted signal, it is an indication that the reflecting object is moving toward the radar station; conversely, if the reflected signal is at a lower frequency, it is an indication that the object is moving away from the radar station).

In addition to this new ability to detect object velocity, NEXRAD is also distinguished by increased object detection sensitivity. This is particularly important for ornithologists because birds are relatively weak reflectors (compared to the objects usually detected with radar,



NEXRAD Radar Station in Mount Holly, New Jersey

such as clouds, airplanes, and ships). NEXRAD is capable of detecting birds flying at a range of heights and can provide a rough idea of the altitude at which a particular group of birds is flying. NEXRAD is so sensitive that radar ornithologists need to learn how to differentiate birds and insects—both can be detected.

Finally, NEXRAD provides information about the reflectivity of a particular object (i.e., how effective a particular object is at reflecting radio waves). Reflectivity can be determined by a number of different factors but in the case of migrating birds, it provides indirect information about the number of birds traveling in a particular area.



In summary, then, NEXRAD can help determine:

- ◆ The **location** of a group of migrating birds, including general altitude information.
- ◆ The **speed** with which the group birds are moving towards and away from a particular radar station.
- ◆ The **approximate quantity** of migrating birds in a particular area. Quantitative NEXRAD estimates are calibrated by “moonwatching” (counting the number of birds that fly across a visible full moon) and by making next-morning ground observations.

4.2 WHAT IS BIOACOUSTIC MONITORING AND WHAT CAN IT DO?

BirdCast staff have been experimenting with bioacoustic monitoring as a way of keeping track of nighttime bird migrations. Bioacoustic monitoring is the process of recording bird calls and matching them to a library of the bird calls of different species. When birds fly at night, they typically make frequent 50- to 100-millisecond vocalizations. Some birders can make fine distinctions between certain kinds of birds simply on the basis of these calls (e.g., the distinction between the Veery Thrush, the Gray-Cheeked Thrush, and the Hermit Thrush). Although birders can perform something like bioacoustic monitoring right in their heads, BirdCast staff are developing a computerized system to automate and standardize the process of recording, filtering, and identifying bird calls.

A bioacoustic monitoring station, typically located on the property of a volunteer birder, consists of a computer with a sound processing card and a specially designed outdoor microphone. The microphones used in bioacoustic monitoring can detect noises made by birds that fly up to 1,500 above the ground. Throughout an entire evening, the computer automatically analyzes the sounds picked up on the microphone and digitally records those sounds that appear to be made by birds. In the morning, a volunteer uploads this “filtered” recording to the Cornell Laboratory of Ornithology, where more sophisticated computer software enters the information into a database and attempts to determine which species are represented in the recording.

The BirdCast program has recently found it necessary to curtail its bioacoustic monitoring program—only a very few stations are currently in use and there are no current plans to establish new ones. The greatest barrier to the more extensive use of bioacoustic monitoring has been the cost of manufacturing the special microphones for the monitoring stations. The basic materials for the microphones are quite inexpensive, but because production quantities were extremely low, the microphones were being hand-built by laboratory staff at Cornell. The microphones currently cost about \$2,500 apiece, but BirdCast staff imagine that the microphones could be dramatically reduced in price if some way were found to mass produce them.

Additional limitations of bioacoustic monitoring include the following:

- ◆ Weather conditions can affect both the likelihood that birds will make noises and the ease with which those noises can be picked up with a microphone. Thus, it is difficult to disentangle weather variability from variability in the numbers of migrating birds.
- ◆ Many species of birds do not make noises while flying. Therefore, it is difficult to gauge overall numbers of migrating birds solely using this method.



- ◆ Bioacoustic technology is in an early stage of development. The software that is used to quantify and identify birds on the basis of sound recordings is still quite experimental and there has not been enough time for scientific literature to accumulate on this topic.

4.3 HOW DO NEXRAD, BIOACOUSTIC MONITORING, AND VOLUNTEER GROUNDTRUTHING FIT TOGETHER?

It is noteworthy that the altitude detection range for bioacoustic monitoring (0-1,500 feet) does not overlap with the detection range for NEXRAD radar (generally between 3,000 to 6,000 feet). The non-overlap of these two ranges complicates the correlation of bioacoustic results and NEXRAD results, as it is possible for certain bird species to be picked up by one kind of instrument and not the other. Due to the influence of variable weather conditions and a lack of complete information about the altitude at which different bird species fly when they migrate, it is not possible to precisely predict which species will fly within the altitude range of which instruments on any given evening.

Groundtruthing data collection, covered in greater detail in Chapter 5, is an essential complement to both NEXRAD radar interpretation and bioacoustic monitoring. One reason for this is the fact that it is difficult to ascertain what kinds of birds are migrating through an area solely from NEXRAD data. In combination with coordinated groundtruthing data, however, it is sometimes possible to associate particular clusters of reflectivity with particular species of birds. Groundtruthing also helps to calibrate the quantitative estimates of birds made from radar and it serves as a quality control check of the basic reporting information provided by radar and bioacoustic monitoring.

Until recently, the BirdCast Web site combined the daily results of NEXRAD observations, bioacoustic monitoring, and groundtruthing in a single display. The purpose of this display was to show how each of these methods produced results that were similar to those of the other methods. Under ideal circumstances, for example, all three methods would predict the same degree of migration activity. This display has been recently discontinued on the grounds that some viewers may have found it too complicated.

4.4 HOW CAN A BIRD MONITORING ORGANIZATION BEGIN USING NEXRAD TO OBSERVE AND PREDICT BIRD MIGRATIONS?

The essential first step in setting up a radar component for your migration monitoring program is to contact an organization that is already experienced in this work, such as the Clemson University Radar Ornithology Laboratory or the Illinois Natural History Survey. Such contact is essential for obtaining advice about the feasibility of your project and about the best way to obtain the expertise necessary to accomplish your project. Depending on the training and availability of your organization's staff, you will probably need to either delegate your actual NEXRAD analysis to an experienced laboratory or send a staff member for training at such a laboratory. Both of these plans would require negotiating a working partnership with an organization possessing expertise in radar ornithology.

The use of NEXRAD to forecast bird migration, in the words of one practitioner, "is a difficult task that requires laboratory and field experience as well as an appreciation for meteorological phenomena." The interpretation of NEXRAD radar to observe current migration is a similarly complex task. At present, it is an undertaking suitable for a graduate level or post-doctoral ornithologist who has received hands-on training with an expert.





4.5 HOW DID BIRDCAST IMPLEMENT THE NEXRAD COMPONENT OF ITS BIRD MONITORING PROGRAM?

In July 1998, Dr. Sidney Gauthreaux of the Clemson University Radar Ornithology Laboratory (CUROL) helped propose the BirdCast project to EPA's EMPACT Program. His proposed task involved forecasting bird migration twice a day (mid-morning and mid-evening) over the Delaware Valley and then using Doppler weather surveillance radar (i.e., the NEXRAD network of WSR-88D stations) to validate the forecast and measure the actual amount of bird migration that occurred over the area. The text files and graphic radar files were to be sent to the BirdCast Web server at the Laboratory of Ornithology at Cornell University and posted on the BirdCast Web site. GeoMarine, another partner in the project, was to supply hourly WSR-88D imagery that had been processed to eliminate echoes from weather and other non-bird targets. The hourly images would also be posted on the BirdCast Web site. A proposal was developed in August 1998 and work began after Clemson University signed a subcontract with National Audubon Society in mid-March 2000.

4.5.1 ACTIVITIES IN SPRING 2000

The first task was to purchase a host computer (Dell Dimension XPS T600MHz, Dell Computer Corporation) that could be used to download the WSR-88D images from the NEXRAD Information Distribution Service (NIDS) provider, download the weather data necessary for generating a migration forecast, and serve as host computer where Cornell could electronically "capture" forecast text files, analysis text files, and the mosaic radar image files. CUROL used Marta Systems, Inc. as the NIDS provider. CUROL was familiar with Marta Systems' software, so it could easily make the mosaic images of the radar displays from the Delaware Valley. In order to work from remote locations, CUROL also purchased a Gateway Solo 9300 CX laptop computer. This allowed laboratory staff to work on forecasts and analysis while at home or traveling by communicating with the Dell host computer over the Internet. CUROL believes that laptops are essential for producing consistent and timely results for display on the BirdCast Web site.

During a previous research project in the middle 1970s, Dr. Gauthreaux developed a multi-variate forecasting model to predict the amount of bird migration in the Athens, Georgia, area. The input variables for this model were the weather predictions for the period in question. Dr. Gauthreaux generated this model by step-wise regression analysis, choosing an array of weather variables that best explained the variation of nightly bird migration amounts. No existing forecasting models of bird migration were available for the Delaware Valley area and time constraints prohibited the development of a model for the region. Given this situation, CUROL used the Athens forecast model for the spring 2000 BirdCast effort.

From 31 March through 30 May, Dr. Gauthreaux or graduate students Andrew Farnsworth or Jonathan Ariail gathered weather data via the Internet from weather stations in the Delaware Valley for input to the Athens model. The model generated a forecast of the amount of migration expected over the Delaware Valley. The model was run before noon to forecast the amount of migration expected that evening at 10 PM, and it was run before midnight to forecast the amount of migration expected the following morning at 10 AM. In addition, to verify the accuracy of their forecasts, CUROL downloaded radar imagery from five WSR-88D stations (KAKQ in Norfolk, VA; KLWX in Sterling, VA.; KDOX at Dover Air Force Base, DE; KDIX at Ft. Dix near Philadelphia, PA; and KCCX at State College, PA) and made mosaic images showing the amount of bird migration over the Delaware Valley at the forecast times. The laboratory analyzed and interpreted the mosaics so that the viewer of BirdCast would be able to discriminate birds from weather and insects.

Each morning before noon and each evening before midnight, CUROL staff placed the text file of the forecast, the text file of the analysis, the graphic file of the radar reflectivity mosaic, and the graphic file of the radar velocity mosaic in separate folders on the Dell host computer. The BirdCast server at Cornell automatically downloaded the files and posted the materials on the BirdCast Web site. Except for a few glitches near the beginning of the project, the CUROL efforts proceeded with no problems.

4.5.2 LATER SEASONS (FALL 2000 AND SPRING 2001)

CUROL was encouraged to continue with the BirdCast program because of its success in forecasting the amount of bird migration during the initial BirdCast effort. There were a number of changes between the second season of BirdCast and the first. For example, BirdCast coverage was expanded in this season to include the state of New York. Also, because only a very small amount of bird movement had been found in the mid-morning hours, CUROL discontinued forecasts and analyses of daytime bird migration.

CUROL learned from the spring 2000 effort that using a single model to forecast migration amount over the entire BirdCast area resulted in inaccurate forecasts for some areas. In an effort to overcome the geographical limitations of the spring 2000 model, CUROL developed two models specifically for the BirdCast area using a step-wise regression analysis of forecast weather variables and the amount of bird migration measured (i.e., the relative reflectivity of targets [dBZ] displayed in WSR-88D images). CUROL used WSR-88D data collected during the fall migration of 1999 for another CUROL project and Local Climatic Data (LCD) for September and October 1999 that it purchased from the National Climatic Data Center (NCDC) for two stations: Albany, New York, and Washington, D.C. By the spring of 2001, CUROL had developed more than 30 regional models.

As in the spring of 2000, at 2 PM every day CUROL placed a text file containing the evening forecast, a text file containing the analysis of the previous evening, the graphic file of the radar reflectivity mosaic, and the graphic file of the radar velocity mosaic in separate folders on CUROL's BirdCast host computer. As in the spring the Cornell BirdCast server collected these files and posted them to the CUROL portions of the BirdCast Web site. The ability to generate a forecast each day, including days on which both forecasters were traveling or away from the CUROL host computer, was greatly enhanced by a laptop computer with an FTP program that allowed the forecasters to upload text and graphics remotely. With the exception of some initial glitches that were quickly corrected, CUROL's models worked well. A sample of the Web page products for an afternoon posting (in this case for the afternoons of 28 and 29 September 2000) can be found in Figure 1.

4.5.3 FEEDBACK AND CONCLUSIONS

CUROL received overwhelmingly positive feedback from the public with regard to its forecasting and the radar ornithology tutorial that it developed for the BirdCast Web site. Although the forecasting and analysis portion of the BirdCast project is complete, CUROL seeks to develop better forecast models. As it refines its methodology for building models and its understanding of the interactions and correlations between specific weather variables and the amount of bird migration, the accuracy of its forecasting will continue to improve. Models are an absolute necessity for any attempt to track bird migration over large spatial scales (such as the entire eastern seaboard), and improved accuracy will improve scientists' ability to understand where and when large movements of migrating birds will occur.



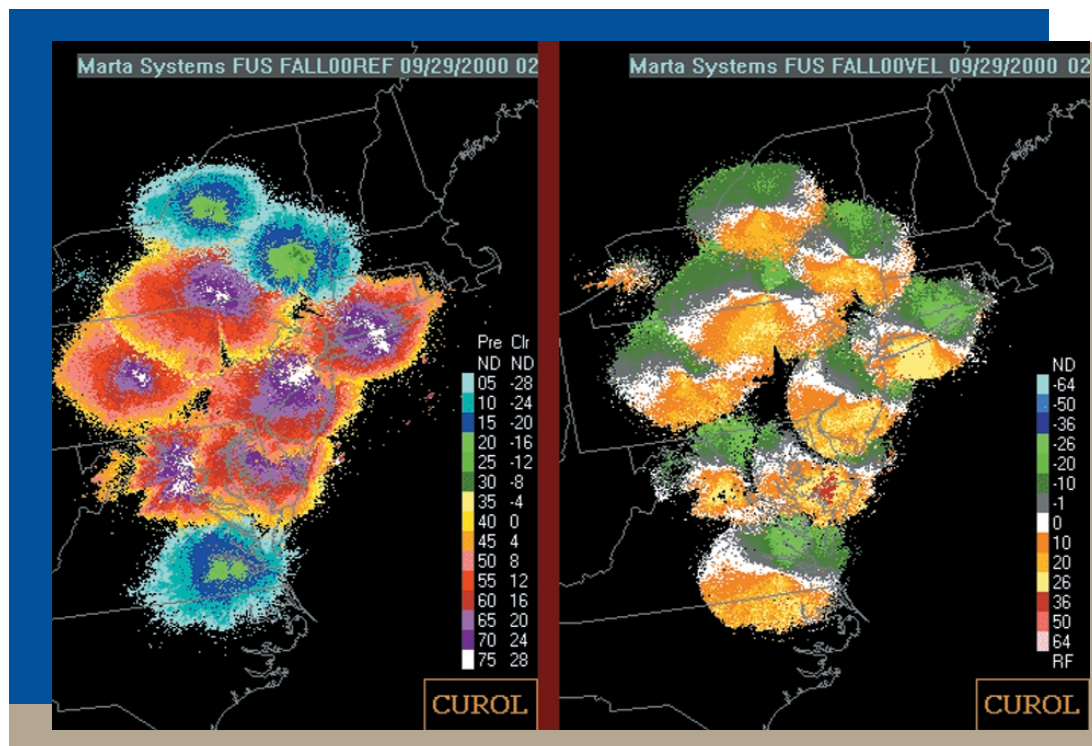


Figure 1. NEXRAD radar images of bird migration on September 28: reflectivity (l) and velocity (r).

Analysis 28 September evening:

Weather conditions over the BirdCast area were favorable for bird migration. Northerly winds, clear skies, and cool temperatures associated with a strong ridge of high pressure over the area facilitated southward movements of migrants across the region. The reflectivity image (above left) shows extensive moderate to high densities (15-28 dBZ) of non-precipitation reflectors over the coverage area. The velocity image (above right) shows most of these reflectors are moving S and SSW at 20-50 knots on N and NW winds at 5-10 knots. These are likely birds. Migration amount was moderate to high across the region, with bird densities reaching 600-1150 birds per cubic kilometers (25-28 dBZ) in many areas.

—Andrew Farnsworth, Clemson University Radar Ornithology Laboratory

Forecast 29 September evening:

Weather conditions over the BirdCast area will not be favorable for bird migration. E and S winds and warming temperatures associated with high pressure off the coast of New England will keep most birds on the ground. Migration amount will be low to moderate, reaching densities of 80-120 birds per cubic kilometer (12-16 dBZ).

—Andrew Farnsworth, Clemson University Radar Ornithology Laboratory.

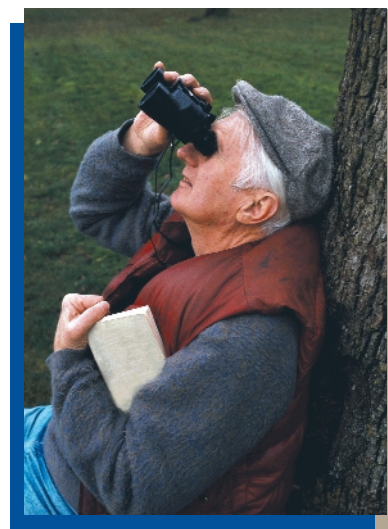
The ornithological community uses the term “groundtruthing” to refer to a particular process of corroborating and supplementing instrument-based observations of birds (such as NEXRAD signals). This procedure is straightforward: one recruits birders in the area in question to count and identify birds there. A collective groundtruthing program serves a variety of purposes:

- ◆ It complements the radar data provided by NEXRAD.
- ◆ As a form of “citizen science” it encourages birders to become increasingly engaged in environmental science and conservation.
- ◆ It makes birding more fun by organizing an audience for the observations of individual birders.

This chapter is oriented toward helping the administrators of bird monitoring organizations develop and manage groundtruthing programs. It describes BirdCast’s sophisticated Internet-based groundtruthing database (BirdSource). However, a groundtruthing program need not use precisely this kind of tool to manage its information. Regardless of a particular program’s data distribution/collection needs, the experiences of the BirdCast program may provide valuable insights.

5.1 HOW DOES GROUNDTRUTHING COMPLEMENT RADAR ANALYSIS?

The eyes and ears of a careful observer offer the most direct indication of the number and type of birds in a particular area. Therefore, such observations can serve as a means of calibrating, validating, and supplementing NEXRAD images of bird migration. As described in Chapter 4, NEXRAD does not provide a direct sampling of the number of birds traveling through a particular area and provides very little information about what kind of birds are being detected. All it can do is record the radio reflectivity at a particular distance and angle from the station. During spring migration in particular, there appears to be a high correlation between nights when radar shows bird-like signals and mornings when birders see a lot of new birds on the ground in nearby areas. Radar ornithologists are still in the process of developing relationships between radar activity at a particular place and time and groundtruthing results at other places and times. Therefore, there is heightened value in a coordinated program of groundtruthing and radar imaging—the connection between the two data sets is as valuable as the sets themselves. In the future, for example, it may be possible to track the migration of individual species of birds using a combination of radar and extensive groundtruthing.



Dedicated birdwatchers are often eager to contribute their observations to groundtruthing programs.



5.2 HOW DOES BIRDCAST CONDUCT ITS GROUNDTRUTHING PROGRAM?

Over an average week of operation, the BirdCast Web site receives more than 300 reports of bird activity from its volunteers. The project then presents this information (in the form of charts and graphs) to the Web site's visitors, who number over 80,000 in a 2-month migratory season. As these figures indicate, BirdCast's groundtruthing program requires significant information technology infrastructure and program administration. Whether your organization is planning a groundtruthing program of similar scope or one that will be smaller scale, a knowledge of the methods and experiences of BirdCast in this endeavor is likely to be helpful.

5.2.1 BIRDCAST'S INFORMATION MANAGEMENT INFRASTRUCTURE

As described in Chapter 3, BirdCast's operation relies on a substantial prior investment of time, money, and labor in the establishment of BirdSource's information technology infrastructure. This infrastructure consists of:

- ◆ **Software:** an Oracle database customized to handle groundtruthing data, JAVA applications to process the information requests of users of the BirdSource Web site, and a GIS tool that allows users to specify the latitude and longitude of their observation site by zooming in from a map of the mid-Atlantic United States.
- ◆ **Hardware:** A four-processor server computer to maintain the BirdSource web site, an uninterruptable power supply and tape backup system, and Internet connection service for the computer.
- ◆ **Support Staff:** one full-time network administrator and five JAVA programmers.

This infrastructure, which cost \$2.5 million to establish, is larger and more robust than what is necessary to simply record and present groundtruthing information. One proposed bird monitoring program, based in the Chicago area, expects to meet its information technology needs for 2 years at a cost of \$100,000 per year. A potentially economical option for supporting groundtruthing programs may be to collaborate with BirdSource staff at Cornell's Laboratory of Ornithology. BirdSource staff expect that they could provide complete information technology support for an initial outlay of \$35,000-50,000 and a maintenance fee of \$5,000-10,000 per year. Depending on the goals and needs of your organization's groundtruthing program, it may not even be necessary to spend this much. One group planning to set up a groundtruthing program in the Chicago area has estimated that they could store their data using spreadsheet software and would not even need to dedicate an entire Windows workstation to the task.

5.3 BIRDCAST'S ADMINISTRATIVE PROCEDURES

BirdCast records the birding observations of both registered and unregistered visitors to its Web site. The former are called "control" observations and the latter are called "anonymous" observations.

5.3.1 COLLECTING CONTROL OBSERVATIONS

Control observations are repeated visual inventories of birds obtained by regularly visiting a particular site during a bird migration season. They are made by committed, experienced birders known by or referred to the site's administrator. It is one of the primary tasks of the administrator to identify these individuals, provide them with support and guidance, and monitor and edit their contributions to the database.



The site administrator actively recruits individuals to serve as control observers through several avenues:

- ◆ Personal networking within the local birding community.
- ◆ Appeals to local conservation groups, such as chapters of the Audubon Society and the Nature Conservancy.
- ◆ Postings to e-mail distribution lists dedicated to birding.

A control observer needs to be reasonably experienced at quantifying and identifying birds in his or her area. He or she must also have enough free time, energy, and commitment to make frequent visits to an observation site. Ideally, a volunteer should be able to make these visits during the early morning hours (between sunrise and roughly 9 AM) when migratory birds are most active. It is also very helpful for a volunteer to be able to recognize birds by their songs as this is the most rapid way of identifying the presence of a particular species of bird. (The Cornell ornithological laboratory makes recordings of bird songs that volunteers can use for training purposes.)

At present, BirdCast has not established a formal procedure for screening observers or checking their qualifications, as most control observers are friends or colleagues of the project organizers. Some control observers, however, are individuals unknown to BirdCast staff who have spontaneously approached the project about participating. It is assumed that an inexperienced birdwatcher would tend to be discouraged by the time commitment required in making regular observations over a prolonged period, so there is a process of “self-screening” inherent in signing up volunteers.

Lessons Learned: How frequently should control observers go into the field?

In the experience of BirdCast organizers, control observers should ideally make five visits to a single observation site during each week of a data collection period. A typical observation session takes between 1 and 2 hours, depending on the observer's time constraints and the abundance of birds at the observation site. This schedule of frequent observations increases the likelihood of “catching” the migration of different species of birds through an area. The goal is to have the observation record reflect the variability of the birds' presence or absence at a particular location rather than the variability of the observer's presence or absence.

In the mid-Atlantic region of the United States, spring migration period takes place over a relatively short period of time: roughly from April 15 to May 15. Fall migration, however, is more difficult to observe completely because it takes place over a more extended period of time. In the fall of 2000, BirdCast experienced significant difficulties with volunteer burn-out when it asked control observers to work from September 1 to November 1. In the future, BirdCast is planning to implement a staggered observation schedule that will keep observers' commitment limited to approximately 1 month. Volunteers living at higher latitudes will begin and end their observing earlier than will volunteers living at lower latitudes.





Once the site administrator has identified a new control observer, she briefs him or her about the standard observation protocols used by the project and issues that person a new User ID for logging into the site. Also, new control observers need to be shown how to use BirdSource's interactive map to estimate the latitude and longitude of their observation site.

The interactive map is a software component of the BirdSource Web site in which users "zoom in" to their observation site by clicking on a map of the United States. Once a user has selected a particular location, the software calculates that location's latitude and longitude.

Once they have registered and determined the location of their observation site, control observers use their User ID to access data entry pages on the BirdCast Web site where they can enter:

- ◆ The date and time of their observations.
- ◆ Whether or not they recorded every species that they saw.
- ◆ The birders' estimation of their own skill at identification.
- ◆ The physical environment and weather at the place of observation.
- ◆ The numbers and kinds of different birds counted.
- ◆ Any additional information not provided elsewhere in the form.

The administrator has ongoing responsibilities for answering any questions the control observer may have and for editing the data provided by the observer. The purpose of this editing process is to ensure that the data provided by the control observers is of a high quality. Editing requires some local birding expertise—one must review the submitted observations and make judgment calls about whether they are reasonable, questionable, or obviously erroneous. The administrator flags control observations that appear problematic and follows up with the observer to resolve her concerns. The following signs, when they appear repeatedly or in combination with each other, may cast doubt on an observer's results:

- ◆ Species that are extremely rare for the area, particularly in large numbers.
- ◆ Species that are extremely rare for a particular time of year (particularly record-setting early sightings of a species).
- ◆ The omission of migratory species that are quite common for the particular area and time.

None of these signs is a certain indication that a set of observations is invalid, but they may prompt the BirdCast administrator to request additional information from the observer, such as sketches, notes, photographs, and the names of co-observers. Following is a sample letter from BirdCast that requests additional information in a non-confrontational manner:



May 10, 2001

Dear Mr./Ms _____

I'm interested in learning more about the birds you've reported to our project and the site from which you're reporting. As you probably know, you've had some extraordinary sightings during the two days for which you've reported. Standard procedure for our BirdSource projects is that we request verification for unusual reports before the data is entered in the database.

Several of these would be all time early records for your immediate area and the numbers you report for some species are unusually large. On the other hand, your report for a species like Yellow-rumped Warbler is very low.

We are making a great effort to report only species and numbers that were well seen and absolutely identified. Only sightings of this type will give our project credibility and, in the long run, benefit bird conservation efforts. With this in mind, would you review your reports that I have listed below and answer the following questions?

Was the bird well-seen? for how long?

Is this a positive identification? Which of the field marks were observed?

Was the bird photographed? Was it seen by additional observers?

Were notes taken? Sketches made?

American Black Duck - Wild bird? late

Yellow-bellied Flycatcher - early

Golden-crowned Kinglet - late

Philadelphia Vireo - 1 unusual, 2 extremely rare

Bay-breasted Warbler - early, 2

Cerulean Warbler - early, 2

Mourning Warbler - early

Yellow-breasted Chat - early, 2

Rusty Blackbird - late, unusual, 10 birds

I would also like to have more information about the site where you observed these species. Is this land named? Is it public or private?

Thanks very much for providing us with this information and thanks for your patience.

Sally Conyne

Audubon





BirdCast also has a number of proactive strategies for limiting the amount of potentially unreliable observations that it receives. These strategies include:

- ◆ Putting caps on the number of individual birds of a particular species that can be reported.
- ◆ Phrasing data entry questions clearly to avoid misunderstanding.
- ◆ Offering assistance in the identification of birds to volunteers.
- ◆ Creating area-specific checklists of birds for volunteers to use in data entry. This prevents the reporting of obviously erroneous reports (e.g., roadrunners in upstate New York)



Lessons Learned: Data Entry Burdens

One of the lessons that BirdCast organizers learned when they established their volunteer groundtruthing program was that they needed to minimize the data entry requirements for their volunteers. Some of the first volunteer observers complained that the observation protocols took too long to key into the computer. BirdCast has reduced the length of its protocol since then to make volunteers' jobs easier.



5.3.2 COLLECTING ANONYMOUS OBSERVATIONS

Visitors to the BirdCast Web site do not need to register or commit to making a schedule of repeated observations in order to submit data to the BirdSource database. Any birder visiting the site may submit information as an “anonymous” observer. Strictly speaking, these observers are not always anonymous because they are encouraged to submit their e-mail address along with their observations. The term is meant in distinction to the control observers, who are either known by or referred to the BirdCast staff.

The data entry form used by anonymous observers and the data they submit are very similar to those of control observers. There are number of differences, however, between how control and anonymous observations are handled. Unlike control observations, anonymous observations do not include information about the latitude and longitude of the observation site. Instead, observers simply list the postal code of their area. Also, BirdCast does not (at present) conduct any quality control editing of anonymous observations. BirdCast staff currently do not have enough time to manually edit the anonymous observations, which are of somewhat less value than the control observations because they are not made regularly. BirdCast hopes, however, that in the future they will be able to institute computer-based “filters” that will provide automated quality control of anonymous data.

5.3.3 DISPLAYING GROUNDTRUTHING INFORMATION

Visitors to the BirdCast Web site have two options for displaying observation data. They may either:

- ◆ **Select a single observation location.** The user then views a table (such as Figure 2 and Figure 3) of different kinds of birds counted at that single observation location (either an anonymous observation postal code or a specific control site). The table also lists the numbers of each kind of bird, and the numbers of reports of each kind of bird. The user may select whether this table lists results for the entire migration period or for a specific date.



- ◆ **Select a single species of bird.** The user then views a graph (such as Figure 4 and Figure 5) of how many times that bird was sighted during each day of the migration period. The graph includes combined information from all the control sites but excludes anonymous observations. This is because anonymous observations are not edited for accuracy and are not likely to be made regularly at any single location.

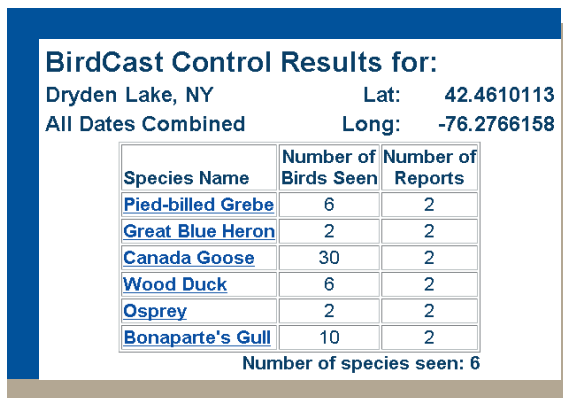


Fig 2. Single observation location: Dryden Lake, NY.

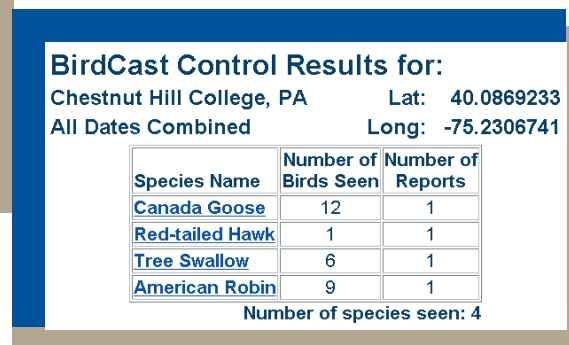


Fig 3. Single observation location: Chestnut Hill College, PA.

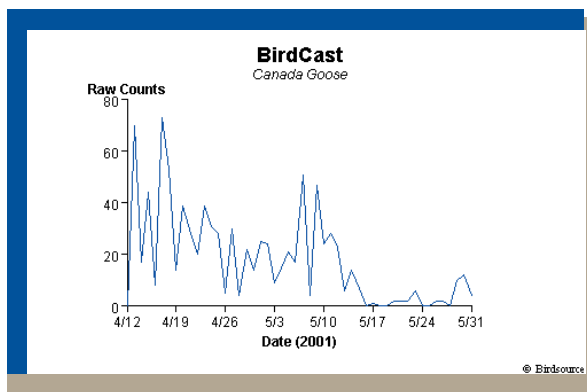


Fig 4. Single species count: Canada Goose

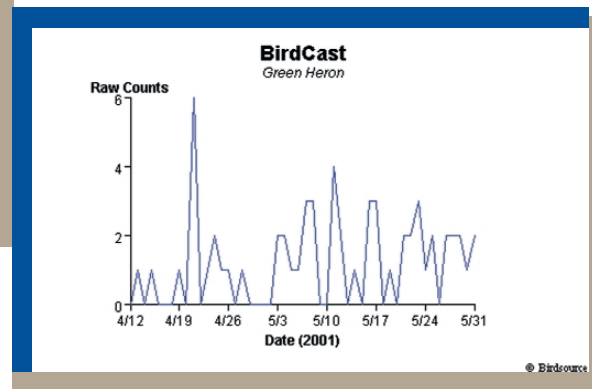


Fig 5: Single species count: Green Heron

MEET TWO BIRDCAST VOLUNTEERS



Chuck Hetzel

Chuck Hetzel, one of BirdCast's control observers, doesn't have to go any farther than his back yard to collect data for the project. That's because he's fortunate enough to live at the edge of the Schuylkill Valley Nature Center near Philadelphia. Mr. Hetzel first heard about BirdCast through his local bird club—the Cornell Laboratory of Ornithology was looking for volunteers in his area to host bioacoustic monitoring stations in their homes. Through this introduction to Cornell's research program, he became involved in making regular control observations for BirdCast. It usually takes him between 1 and 2 hours to record the birds in his backyard, which he does nearly every day of the migration period around 7 AM. With more than 50 years of birding experience, he doesn't need to take an identification guide into the field with him; all he needs is a notepad or a tape recorder for keeping track of the types and numbers of birds that he sees (or hears). Mr. Hetzel enjoys the extra motivation to go birdwatching that BirdCast provides—in sharing his observations through the BirdCast database he enjoys an extra feeling of accomplishment and satisfaction about birdwatching.



Hannah Suthers

Hannah Suthers makes her control observations at an abandoned 108-acre farm in central New Jersey. The farm, which has recently been converted into a wildlife sanctuary, is slowly reverting back to forest. This makes it a fascinating birding site because the land's habitat is undergoing continual transformation. Ms. Suthers has more than 50 years of experience as a bird bander and for more than 20 years has been studying how the farm's changing habitat has affected the population of resident birds in the area. Now in her retirement, she continues to publish articles related to avian population biology and trains graduate students from nearby Princeton and Rutgers Universities in bird banding. After a friend referred her to the BirdCast project, Ms. Suthers started working as a volunteer for it, tallying migratory birds at the sanctuary. During the BirdCast observation period, she aims to be in the field on a daily basis, tallying birds by sight and sound. She carries a small notebook with her and jots down her tally in alpha codes. A counting session can take anywhere between 1.5 to 4 hours, depending on the time of season and how many different species are present. It can be tiring getting up so early in the morning on a regular basis, she admits. Though she does not need to go out as frequently to spot-map the singing males on their breeding territory, she feels that to get an accurate picture of migratory movements one needs to go into the field daily. One of the most pleasant aspects of the work is the opportunity to greet all her "old friends" as they fly through her area each migration season.

This chapter provides guidance on setting up and maintaining an education and outreach component of a bird migration monitoring program. Section 6.1 provides tips on developing an outreach plan for your program, with a focus on defining goals, key messages, and target audiences. Section 6.2 describes a variety of outreach tools that can be used, and provides examples of outreach materials developed by the BirdCast project. Section 6.3 describes the challenge of evaluating the success of your education and outreach program, and Section 6.4 lists some additional sources of information for education and outreach.

The information in this chapter is designed primarily for managers who are implementing bird migration monitoring programs, as well as for education and outreach workers who are responsible for communicating about these programs.

6.1 DEVELOPING AN OUTREACH PLAN

BirdCast represents a milestone for radar ornithology, a field that has evolved slowly for more than 30 years, advanced by a handful of scientists working mostly in isolation. BirdCast's breakthrough is that it is the first program to bridge the gap between these scientists, collecting and interpreting radar images in their labs using highly specialized technologies and techniques, and the general public. The founders of BirdCast also recognized that "a picture is worth a thousand words"—a live visual image, such as a radar image of birds migrating, or digital photos or videos from groundtruthers, would more likely stimulate action than just a verbal description of migration.

Communication is at the heart of the BirdCast mission: to provide the public with timely information on the status of bird migrations, and to educate land managers and the broader public about actions they can take to assist birds during their migration and reduce the number of birds that die while passing through. An effective education and outreach program, therefore, is key to the project's success.

BirdCast's education and outreach program is run primarily by the National Audubon Society. Staff from Audubon's Citizen Science Program work together with Audubon's public relations department to create educational materials, write and distribute press releases, develop and deliver presentations, and conduct direct outreach to land managers. Other BirdCast partners (including staff from EPA's Office of Pesticide Programs, EPA Region 3, Cornell University's Laboratory of Ornithology, and Clemson University's Radar Ornithology Laboratory) contribute to the outreach effort as well, mostly by delivering presentations. In addition, Philadelphia's Academy of Natural Sciences, a founding partner of BirdCast, developed many of the project's original outreach materials.

The first step to creating an effective education and outreach program of your own is to develop an outreach plan. This plan will provide a blueprint for action. It does not have to be lengthy or complicated, but it should define four things: What are your outreach goals? Who are the target audiences? What are the key messages and types of information that you want to deliver? And what outreach tools will you use to reach these audiences? Let's look at each of these questions in turn.



6.1.1 WHAT ARE YOUR OUTREACH GOALS?

Defining your outreach goals is the first step in developing an education and outreach plan. Outreach goals should be clear, simple, action-oriented statements about what you hope to accomplish through outreach. Here are some sample goal statements that a BirdCast-type program might develop for its outreach effort:

- ◆ Convince all local television stations in the region to give a brief report on bird migration after the weather forecast, or to run at least one report on bird migration per migratory season.
- ◆ Place a story on bird migration in the major newspaper of each state in the region.
- ◆ Deliver a presentation to each bird club or Audubon chapter in the region.
- ◆ Conduct direct outreach (e.g., via letter or phone call) to the managers of all public parks in your region.
- ◆ Attract 100,000 visitors per year to your Web site.



Where possible, outreach goals should be measurable. This will help you when it comes time to evaluate the success of your program (see Section 6.3). Abstract statements of good intention (e.g., “increase the public’s appreciation of the wonders of bird migration”) do not make effective outreach goals, even if such statements accurately describe one of your main motivations for starting a BirdCast-type program.



6.1.2 WHO ARE YOUR TARGET AUDIENCES?

The second step in developing an outreach plan is to clearly identify the target audience or audiences for your outreach effort. As illustrated in the sample goals above, outreach goals often define their target audiences. You might want to refine and add to your goals after you have specifically considered which audiences you want to reach.

The target audience for the BirdCast project is broadly defined as land managers and the general public. Yet within these groups there are a number of sub-audiences, each with specialized interests. For example, among the general public there are (according to a 1998 report of the U.S. Fish and Wildlife Service) roughly 55 million people who consider themselves bird enthusiasts, and within that number there is a smaller pool of deeply committed birders. Your goals for conducting outreach to these committed birders may be different than your goals for the general public. Likewise, the category of “land managers” includes park managers, city officials, utility land managers, building managers, golf course managers, and others. Here again, you will want to tailor your message for the specific audience.

Before you can begin tailoring messages for your different audiences, however, you will need to develop a profile of their situations, interests, and concerns. This profile will help you identify the most effective ways of reaching the audience. For each target audience, consider:

- ◆ What is their current level of knowledge about bird migration and birds in general?
- ◆ What do you want them to know about birds and migration? What actions would you like them to take?
- ◆ What information is likely to be of greatest interest to the audience? What information will they likely want to know once they develop some awareness of bird migration issues?
- ◆ How much time are they likely to give to receiving and assimilating the information?



- ◆ How does this group generally receive information?
- ◆ What professional, recreational, and domestic activities does this group typically engage in that might provide avenues for distributing outreach products? Are there any organizations or centers that represent or serve the audience and might be avenues for disseminating your outreach products?

Profiling an audience essentially involves putting yourself “in your audience’s shoes.” Ways to do this include consulting with individuals or organizations who represent or are members of the audience, consulting with colleagues who have successfully developed other outreach products for the audience, and using your imagination.

6.1.3 WHAT ARE THE KEY MESSAGES AND TYPES OF INFORMATION THAT YOU WANT TO DELIVER?

The next step in planning is to think about what you want to communicate. In particular at this stage, think about the key points, or “messages,” you want to communicate. Messages are the “bottom line” information you want your audience to walk away with, even if they forget the details.

A message is usually phrased as a brief (often one-sentence) statement. For example:

- ◆ Populations of migratory birds are declining and vulnerable.
- ◆ The BirdCast Web site provides you with real-time information about the status of bird migrations.
- ◆ You can take steps to help protect migrating birds.

Outreach products often will have multiple related messages. Consider what messages you want to deliver to each target audience group, and in what level of detail. As stated above, you will want to tailor different messages for different audiences.

Let’s look at how this can be done. For instance, let’s say that you are writing a press release for distribution to newspapers and other general interest publications. Your audience, the average reader of these publications, has relatively little interest in birds. What should be the focus of your press release? Probably you will want to concentrate on a few simple messages: that bird migration is a fascinating and magnificent phenomena; that populations of migratory birds are declining and vulnerable; and that individuals can help protect migratory birds through simple steps such as keeping cats indoors, providing food and water, and avoiding pesticide use during the peak of migration (you would probably time your release for distribution just prior to peak migration).

On the other hand, if you were composing a press release for placement in bird club newsletters, you would probably spend less time preaching the wonders of migration (after all, here you would be preaching to the converted) and more time addressing complex issues of special interest to birders: how the technical aspects of radar ornithology work, how birders can attract birds to residential yards by creating a landscape of native plants, how to choose pesticides that cause less ecological harm. Your press release could also provide detailed information on how birders can participate as citizen scientists in BirdCast’s groundtruthing efforts. (See Appendix A, pages 49 to 50, for an example of a press release for bird club newsletter.) Alternatively, you could choose to deliver all of this information through a presentation at a bird club meeting.





Here's another scenario: Let's say you are targeting the managers of a number of large buildings in a downtown area. In this case, your message might be very focused and simple: that tall, brightly lit buildings threaten migratory birds by disrupting their ability to navigate, and that building managers can prevent bird deaths by turning off lights during peak migrations. But the real challenge here would be reaching these building managers with your message. Could you issue a press release or media advisory? Possibly, but even if the local newspapers picked up the story, there's no guarantee that the target audience would read it. No, in this case, the only way to ensure that your message reaches the target is to contact the building managers directly through a letter or phone call. In fact, you might have to follow up with repeated letters or phone calls. This type of direct outreach is time-consuming and can be a drain on resources, but in some circumstances it is absolutely necessary.



Tall, brightly lit buildings threaten migratory birds by disrupting their ability to navigate.

6.1.4 WHAT OUTREACH TOOLS WILL YOU USE?

As the above examples illustrate, one of the challenges of conducting outreach and education, besides tailoring your message for the intended audience, is choosing the best outreach tool or approach for delivering your message. There are many different types of outreach products in print, audiovisual, electronic, and event formats (outreach tools used by the BirdCast project are described in the next section). It's up to you to select the most appropriate products to meet your goals within your resource and time constraints. Questions to consider when selecting products include:

- ◆ How much information does your audience really need to have? How much does your audience need to know now? The simplest, most effective, most straightforward product generally is most effective.
- ◆ Is the product likely to appeal to the target audience? How much time will it take to interact with the product? Is the audience likely to make that time?
- ◆ How easy and cost-effective will the product be to distribute or, in the case of an event, organize?
- ◆ How many people is this product likely to reach? For an event, how many people are likely to attend?
- ◆ What time frame is needed to develop and distribute the product?
- ◆ How much will it cost to develop the product? Do you have access to the talent and resources needed for development?
- ◆ What other related products are already available? Can you build on existing products?
- ◆ When will the material be out of date? (You probably will want to spend fewer resources on products with shorter lifetimes.)
- ◆ Would it be effective to have distinct phases of products over time? For example, a first phase of products could be designed to raise awareness, followed at a later date by a second phase of products to encourage changes in behavior.

- ◆ How newsworthy is the information? Information with inherent news value may be rapidly and widely disseminated by the media.

The key here is to make good use of the resources available to you. In the best of all worlds, you would have the time and budget to personally contact every land manager in your region and to craft customized press releases for every type of publication and every audience. But it is unlikely that you will have the resources to do everything you'd like to do. The goal, then, is to pick your spots wisely. Reach as many people as you can, but also focus on those audiences that are most receptive to your message. If you have only limited time for direct outreach, concentrate on land managers who control critical habitat.

6.2 EDUCATION AND OUTREACH TOOLS

This section describes a variety of outreach tools used by the BirdCast project. Examples of specific outreach materials developed by BirdCast can be found in Appendix A.

6.2.1 BIRDCAST WEB SITE

In addition to hosting radar images, daily migration forecasts, and groundtruthing data, the BirdCast Web site (<http://www.BirdCast.org>) also contains an array of outreach and educational information designed to assist the public in the protection of migrating birds. Major educational pieces on the site include:

- ◆ Guidance on appropriate timing and application of pesticides to minimize birds' exposure.
- ◆ Tips on preventing bird deaths caused by collisions with household windows.
- ◆ Advice on controlling domestic cats to prevent predation on migratory birds.
- ◆ Information on how tall buildings and radio towers can disorient birds, causing them to crash or drop from exhaustion.
- ◆ Tips on bird feeding and watering, and on providing habitat for migratory birds during stopovers.

Many of these educational pieces are provided in hard copy in Appendix A of this handbook. Others can be found online (go to <http://www.birdcast.org/ucanhelp.html>). If you are developing a BirdCast-type program of your own, you can use these pieces as a model to stimulate ideas for your own outreach language. If you are a member of the public interested in birds and migration, you can read these materials to learn about steps that you can take to protect migrants.

One of BirdCast's mottos is: "Engage, educate, activate." The BirdCast Web site is a key tool for accomplishing each of these goals. The site is designed to be both attractive and interactive. The homepage, for example, features a colorful poster by Charley Harper, entitled "Mystery of the Missing Migrants," along with a species key to help visitors identify the birds depicted in the poster. Any birder visiting the site is welcome to submit data on his or her bird observations (see Section 5.3.2, Collecting Anonymous Observations), and visitors can also search the database of groundtruthing observations to view tables and summary graphs. In addition, throughout the site there are numerous links that visitors can follow to gather additional information and access other resources.





The goal of all this interactivity is to engage visitors, interest them in the plight of migratory birds, and give them a chance to participate in protecting and researching the lives of migrants. The outreach materials are there to educate them. The site also features several text pieces on the aesthetic and economic values of migrating birds, along with the beautifully written preface to Scott Weidensaul's book, *Living on the Wind: Across the Hemisphere with Migratory Birds*, which BirdCast was able to use with the permission of the author.

6.2.2 POSTERS AND OTHER PRINT MATERIALS

Because BirdCast is a Web-based project, it has developed relatively few educational and outreach materials for distribution in hard copy. When the project was first launched, a press packet was created for distribution to reporters and other media outlets, containing news clippings and other outreach materials. But this is no longer in use.

The main item that BirdCast partners distribute in hard-copy format is a poster entitled "Audubon Guide for Healthy Yard and Beyond," which was developed by the National Audubon Society. The poster lists actions that home owners can take to limit pesticide use and create healthy habitats for birds and wildlife. It also includes a guide to home pesticides, with information on chemicals, their uses, their toxicity to wildlife, and alternatives to the chemicals. Altogether, over 1 million copies of the poster have been distributed through Audubon chapter offices, bird-oriented stores, parks departments, and other groups.

To request copies of the poster, e-mail healthyhabitats@audubon.org. A version of the poster can also be found online at:

<http://www.audubon.org/bird/pesticides/10%20COMs%20boxes.html>.

Lessons Learned: Conducting Outreach Via Television Stations

When BirdCast was first launched, one of the original goals was to encourage television coverage of bird migrations. BirdCast's founders envisioned that there would come a day when weather forecasters would routinely include migration updates as part of their nightly reports. But that day has unfortunately not yet arrived.

As part of its education and outreach program, BirdCast has made a concerted effort to conduct outreach to newscasters and weather forecasters. The idea has been to combine radar images with photographs and educational information on protecting migrants, creating a package that will appeal to television stations. But so far the results have been discouraging. Though several stations have produced short news pieces on BirdCast, the general response has been that the BirdCast outreach materials are inappropriate for television in that they lack visual appeal. Newscasters have stated that the radar images are too esoteric and difficult to interpret.

In the future, the BirdCast project will continue to look for creative ways to package its outreach materials for television. The Illinois Natural History Survey, another organization that has succeeded at getting a local television station to make use of NEXRAD images of bird migration, has some ideas for getting television stations interested. The Survey suggested pointing out to television weather forecasters that significant bird migration usually coincides with "meteorologically boring periods" when they might lack weather-related material to discuss. The Survey also suggested developing simplified visual displays that convey basic information (e.g., presence/absence of birds, relative abundance of birds, general direction of bird movement) in a manner that parallels the other displays on the weather forecast.



6.2.3 PRESS RELEASES

Press releases are a key tool in BirdCast's education and outreach efforts. Writing a single press release and distributing it to dozens of publications simultaneously is a cost-effective way of reaching a large and varied audience.

The National Audubon Society's public relations department leads BirdCast's efforts to conduct outreach through the media. A PR department is an ideal choice for this job for two reasons: 1) PR staff have the writing, editing, and outreach skills needed for developing stories that will appeal to various news outlets, and 2) PR staff already have contacts and working relationships with individual journalists, editors, and newscasters. An experienced PR worker knows how to work with people in the media, feeding them the information they need to get stories into print and on the air.

For BirdCast, the Audubon PR staff have done several rounds of outreach to the media, each timed to coincide with a major migration (spring or fall). Their technique, which has produced excellent results so far, has been to write a single, in-depth press release and distribute it to a list of roughly 500 reporters whom Audubon has worked with in the past. (Examples of these press releases can be found on pages 45 to 48.) In some cases, Audubon staff precede the press release with a phone call or e-mail to the reporter, meant to kindle interest in the story. In other cases, Audubon sends the press release first, then follows up with an e-mail or phone call.

Once a reporter has expressed interest in BirdCast, the PR staff work with him or her as necessary to get the story into print. Some reporters (maybe half) request additional interviews with BirdCast partners or want help identifying a local angle for the story (for example, a reporter from a small city newspaper may want to interview members of a local bird club). Other reporters will develop a story using little more than the information and quotes found in the press release and other materials found online.

This type of personal contact with members of the press is crucial, as is the strategy of targeting individual reporters or newscasters. The odds of placing a story fall drastically if you just send a press release to a news desk or editorial department, since most publications are inundated with dozens (if not hundreds) of press releases daily. Audubon's PR staff always send press releases directly to a particular reporter, and virtually every story they've placed has been written by a reporter whom Audubon had worked with in the past.

What if you don't have a contact at a particular publication? One thing you can do is to read some back issues of the publication, looking for a reporter who has demonstrated some interest in topics related to your project. If the publication is a daily newspaper, it will likely have a beat reporter who focuses primarily on science and/or the environment. Outdoors writers often have an interest in bird migration, especially if their columns cover hunting and waterfowl migration. BirdCast has placed several stories with gardening columnists, and numerous technology reporters have also written about the project, focusing on the BirdCast Web site or on the project's use of advanced radar technology.

Once you have targeted a particular reporter, write him or her a personal e-mail or call directly. Pitch the story, keeping your presentation short and to the point. Ask the reporter if he or she would be interested in reading your press release (or, better yet, simply attach the release to an e-mail as an electronic file). Also, it never hurts to demonstrate that you are familiar with a reporter's work by complimenting or mentioning some article that he or she wrote in the past.





How many publications or news outlets should you target? The simple answer is, as many as possible. However, there are different ways to use the resources available to you. One approach would be to identify a limited number of publications that you view as critical, and then to spend extra time and resources doing everything you can to place a story with them (this might involve customizing your press release or following up repeatedly with a reporter). If you don't have existing contacts with the news outlets in your area, this type of intensive, focused effort might be necessary.

Audubon's PR staff have taken the approach of writing one major press release for each migratory season (spring and fall) and distributing it to hundreds of media outlets throughout the mid-Atlantic flyway, from New York to Maryland and the Washington, D.C. area. Audubon's staff spend virtually no time customizing press releases for particular publications, though they have issued press releases for particular occasions. For example, in September 2000, Audubon issued a spur-of-the-moment press release urging health officials not to spray for West Nile Virus on a weekend when BirdCast was predicting that a large wave of migratory birds would pass through the area. (See pages 47 to 48 for a copy of this release.)

Audubon's primary goal each migratory season has been to place a story in the major paper of each state in the region, with the idea that smaller papers will pick up the story after seeing it in a major paper (this has turned out to be true). The results of this PR effort have been excellent. More than 100 articles on BirdCast appeared in spring 2000, including prominent articles in the Philadelphia Inquirer, New York Times, Wall Street Journal, USA Today, and other major publications. Articles also appeared in virtually every Audubon chapter and independent bird club newsletter from northern Virginia to southern New York. Additionally, BirdCast was the subject of stories in Scientific American and National Audubon magazines, and the project was also featured on National Public Radio.

Lessons Learned: Dealing with the Redundancy Issue

Audubon's PR staff have found that one of the main challenges associated with conducting BirdCast outreach through the media is the issue of redundancy. Birds migrate through the mid-Atlantic flyway twice each year, in spring and fall. Ideally, BirdCast would like to have the media cover both migrations, every year. However, once a publication has covered the story once or twice, reporters and editors no longer consider it newsworthy.

Audubon's PR staff constantly search for creative ways to work around this problem. One strategy is to look for a "news peg" or tie-in, some newsworthy happening that can provide the basis for an article. For example, you might craft a press release about International Migratory Bird Day (an annual event set on the second Saturday in May), and slip in some information about your program within the body of the text. Audubon staff used a similar approach when they sent copies of the poster "Audubon Guide for Healthy Yard and Beyond," to all of the reporters in their database; the idea was to generate articles about the effects of pesticides on migrating birds and other wildlife, with BirdCast as a subtext.

The key point here is that your program doesn't have to be the main focus of every press release you send out. Look again at the press release on pages 47 to 48. The main message of this release was an urgent recommendation that health officials not spray for West Nile Virus on a weekend of intensive bird migration. Yet the press release also managed to provide a thorough description of the BirdCast project, and it also touched on a number of other important messages: the decline in numbers of migrating birds; their vulnerability to pesticides and other man-made threats; and steps individuals can take to protect migrants.

6.2.4 DIRECT OUTREACH TO LAND MANAGERS, BUILDING MANAGERS, AND OTHERS

Property managers (including park managers, city officials, utility land managers, building managers, golf course managers, and others) are a key target for BirdCast's outreach and education efforts. Many property managers, especially in urban areas, control large chunks of open or undeveloped land that provide important habitat for migrating birds. These managers can help protect migrants by avoiding pesticide applications during migratory stopovers and by considering the birds' needs when making other management decisions.


BirdCast relies on direct communication when conducting outreach to property managers. This typically involves calling or writing property managers a few times a year to update them on the status of bird migrations and to remind them of the need for environmentally responsible management practices. In general, BirdCast has found direct outreach to be a relatively time-consuming process (especially in comparison to outreach through the media, where a much larger audience can be reached with a single press release). In the future, the project may attempt to make more use of volunteers in its direct outreach efforts.

Following are a few examples of effective direct outreach, taken from the work of BirdCast and other groups:

- ◆ In Philadelphia, BirdCast has worked closely with the Fairmount Park Commission to encourage environmentally responsible land management and to raise awareness of the plight of migrating birds. The Commission oversees a system of parks, golf courses, and baseball fields in the city, and works with other land and utilities managers in the Philadelphia area. BirdCast wrote to alert the Commission about the value of the parks' habitat to migrating birds and the timing of migration. BirdCast provided copies of the poster "Audubon Guide for Healthy Yard and Beyond," for the commission to distribute, and provided all facility managers under their jurisdiction with guidance on environmentally responsible pesticide application (e.g., how to alter the use of specific chemicals and minimize the impacts on migrants).
- ◆ The City of Chicago and the U.S. Fish and Wildlife Service have signed an innovative "Treaty for Birds," which features an effort by downtown building owners to turn off their lights during migration periods. Members of the mayor's Wildlife and Nature Committee worked with Chicago's Building Owners and Managers Association to spread the word to owners of downtown skyscrapers. Members of the Bird Conservation Network assembled the information needed to convince building owners that this action was warranted, and helped to identify buildings that were known for their high bird mortality.



Large areas of open or undeveloped land, such as city parks, provide important habitat for migrating birds.

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- ◆ In the Chicago area, a partnership of researchers, government scientists, city officials, and conservationists is proposing to use radar ornithology to identify key stopover habitat for migrating birds. The partners will then use direct outreach to educate land managers about the habitat needs of migrating birds, and to ask them to take steps to protect and enhance bird habitat (e.g., by controlling the spread of buckthorn, an invasive plant that impacts biodiversity).

6.2.5 PRESENTATIONS

BirdCast partners regularly deliver presentations on the project to school groups, bird clubs, American Birding Association meetings, Audubon chapters, and other groups. The partners have developed several PowerPoint presentations for this purpose. These include:

- ◆ An overview of the project.
- ◆ A more detailed presentation on how BirdCast integrates multiple monitoring techniques (radar, groundtruthing, acoustic monitoring) to achieve a unified analysis of bird migration.
- ◆ A presentation focusing on the radar ornithology component.

All of these presentations make use of screen captures from the BirdCast Web site, sample radar images, and graphs from the groundtruthing database to give the audience a genuine feel for how BirdCast works.

6.2.6 LISTSERVS

A ListServ is an automated system that automatically redistributes e-mail to names on a mailing list. Users can subscribe to a mailing list by sending an e-mail note to a mailing list they learn about; the ListServ will automatically add the name and distribute future e-mail postings to every subscriber.

There are numerous bird-oriented ListSers around the country. Some of these have a regional focus, and are used by birders to compare field notes and share notable sightings. Others are devoted to bird conservation, activism, and other topics of general interest. For an index of ListSers administered by the National Audubon Society, go to <http://list.audubon.org/archives/>. The American Birding Association also maintains a state-by-state list of birding ListSers, available at <http://www.americanbirding.org/resources/reschat.htm>.

BirdCast's education and outreach program utilizes ListSers as a medium for distributing information about the program, such as press releases and announcements. ListSers make an ideal tool for targeting an audience of committed birders. They are also cost effective, since there is no charge for subscribing to (or posting messages on) most ListSers.

BirdCast has also occasionally used ListSers as a tool for recruiting birders for the project's groundtruthing efforts. By monitoring the discussions at particular regional ListSers, BirdCast staff have been able to identify birders who are both committed and skilled and then contact them directly via e-mail. For more information on recruiting birders for groundtruthing, see Section 5.3.1.

6.3 EVALUATING THE EFFECTIVENESS OF OUTREACH EFFORTS

BirdCast has found no easy or cost-effective way of measuring the success of its education and outreach program. Since the ultimate goal of the program is to encourage behavior changes (e.g., changes in the way people use pesticides), the only true measure of success would be to document behavior changes on a large scale. Doing this is beyond the scope and means of the project.

Due to these limitations, BirdCast's partners have been forced to rely on other indicators as a measure of the program's effectiveness. For example:

- ◆ Between September 1 and October 21, 2000, the BirdCast Web site received 1,867,163 "hits" and 147,423 visitors. These numbers show, among other things, that many people are returning to the site multiple times.
- ◆ In the spring of 2001, roughly 100 to 150 people per week were submitting "anonymous" bird observations to the BirdCast database. (See Section 5.3.2 for more information on collecting anonymous observations.)
- ◆ More than 100 articles on BirdCast appeared in the spring of 2000, including prominent articles in major publications such as the Philadelphia Inquirer, New York Times, Wall Street Journal, and USA Today. The combined readership of these publications is in the many millions.

If nothing else, these numbers indicate that BirdCast has reached thousands (if not millions) of people, raising their awareness about the plight of migratory birds and things they can do to help. The numbers also seem to show that thousands of people are engaged in the project and are participating on some level (for example, by returning to the BirdCast Web site repeatedly, or by submitting their own bird observations). Overall, it appears that BirdCast is succeeding in its mission: to engage, to educate, and to activate.

6.4 FOR MORE INFORMATION

The BirdCast Web site: <http://www.birdcast.org/>

To access BirdCast's educational pieces online, go to: <http://www.birdcast.org/ucanhel.html>

Scott Weidensaul's *Living on the Wind: Across the Hemisphere with Migratory Birds* (Northpoint Press, 1999) has been called "a nimble summation of current thinking on bird migration and attendant environmental themes" (Kirkus Reviews).

To request copies of the poster "Audubon Guide for Healthy Yard and Beyond", developed by the National Audubon Society, e-mail healthyhabitats@audubon.org. A version of the poster can also be found online at:

<http://www.audubon.org/bird/pesticides/10%20COMs%20boxes.html>

For an index of birding Listservs administered by the National Audubon Society, go to <http://list.audubon.org/archives>

The American Birding Association maintains a state-by-state list of birding Listservs, available at <http://www.americanbirding.org/resources/reschat.htm>



APPENDIX A

BIRDCAST EDUCATION AND OUTREACH MATERIALS



PESTICIDES: IS YOUR BACKYARD SAFE FOR BIRDS?

Our lawns and gardens are like other environments. Plants, insects and other animals all interact and affect one another. Altering a part of that system can have unintended effects on other components of it. This is an important thing to keep in mind when considering whether or not to apply pesticides around the home. Pesticides are not only lethal to pests, but to other wildlife as well. Here are three important rules to consider before applying any pesticides:

- 1. Make sure you actually have a pest problem.** Learn to identify pests and to determine at what stage they actually become a problem. Many times people treat for pests that are either not present, or not present in large enough numbers to cause problems.
- 2. Know your pesticides.** Read the labels on your pesticides CAREFULLY. Learn to identify what active ingredients are contained in the product. Read about the potential effects these pesticides can have on the other organisms in your yard and community.
- 3. Check for alternative treatments.** Make it a priority to use the least toxic method to control any pests or diseases. Many simple, non-toxic solutions are as easy to employ and as effective as chemical solutions. Contact your local garden center and Cooperative Extension for advice.

Making your garden or lawn more community friendly isn't difficult and may actually save you time and money. Plus a little bit of education and a few changes around your home can have a lasting effect on migratory bird populations and other wildlife.

To learn more about the pesticides commonly used around the home, refer to Audubon's pesticide summary at <http://birdsource.cornell.edu/birdcast/pestsum.html>.

Other useful pesticide web sites:

EPA's Office of Pesticide Programs: <http://www.epa.gov/pesticides>

The National Pesticides Telecommunication Network:
<http://ace.orst.edu/info/nptn/index.html>

Toxicology and Environmental Health Information: <http://sis.nlm.nih.gov/tehip.htm>

Look up all the registered pesticide products containing certain active ingredients:
<http://www.cdpr.ca.gov/docs/epa/epachem.htm>

The American Bird Conservancy's Pesticide Pages:
<http://www.abcbirds.org/pesticideindex.htm>





WINDOWS: AN INVISIBLE THREAT TO MIGRATING BIRDS

Fact: Every year millions of birds die when they crash into windows in homes, schools, skyscrapers, factories, office buildings, and other sites.

Why: The transparent quality of windows makes them virtually invisible to birds, often until it is too late to stop short. It is difficult for a bird in flight to distinguish between glass and open space. It may see reflected vegetation in the window, but not the glass itself.

What You Can Do: There are different steps you can take in your home to prevent needless bird deaths caused by invisible windows.

- ◆ **Move your bird feeder.** Make sure your bird feeder is either a minimum of 3 meters away from windows, or less than 1 meter away. Birds may still fly into the window if you move the feeder closer, but they will not have enough momentum to injure themselves.
- ◆ **Reduce transparency and reflectivity.** Change the angle or surface of the window to lessen the transparency and reflectivity. Cover the window's external surface with a film, change the lighting, and keep all curtains closed or add external blinds.
- ◆ **Mark the window.** You can etch the surface of the glass or streak it with a bar of soap. Hang strips of newspaper or ribbons, place strips of masking tape on the window. (These are more temporary measures in case there is a severe problem. However, most of these solutions are inconvenient or unsightly.)
- ◆ **Apply netting.** Perhaps the best and most permanent solution is to stretch netting across the windows. Fine black netting that is used to protect berry bushes and fruit trees is available at many garden shops, home centers, and feed mills. Stretch the netting across the window or across a frame that can be installed outside the window. Be sure it is stretched with adequate tension to hold it several inches from the window's surface. Birds may continue to fly towards the window, but they will bounce off the mesh unhurt.
- ◆ **Hang hawk silhouettes.** Attach hawk silhouettes to the window's surface. These shapes probably decrease collisions because they break up the smooth reflective surface and make the glass more "visible" rather than because they are shaped like hawks; but, in any case, they seem to help. The silhouettes are most effective if used in multiples. It is helpful also to attach the silhouettes by a suction cup or a hanging device from the outside so that movement caused by wind will catch the birds' attention. Most people think that the graceful shapes are interesting rather than unsightly. They're available commercially but they're also easy to make. (See the below instructions.)

Materials:

- ◆ black, light-weight plastic
- ◆ clear, outdoor tape
- ◆ scissors
- ◆ a template or model of the shape (approximately 8 inches from bill to tail and 12 inches from wing tip to wing tip)—go to <http://birdsource.cornell.edu/birdcast/images/hawk.gif> for print-ready template

Simply trace or carefully draw the shape on the plastic, cut out the silhouette, and tape it to the outside of the window. Be sure to place several on any large expanse of glass. One word of caution: you should check with the manufacturers of thermopane windows before you place anything on the glass surface. If this presents a problem, hang the silhouette from the sash around the window.

Not only can you make your house safer for birds, but by making several silhouettes and giving them as gifts to friends, neighbors, and even that office building with the big glass windows down the street, you can also encourage others to make their houses bird-safe.

Other Useful Window Web Sites:

National Audubon Society: <http://www.audubon.org/educate/expert/window.html>





DOMESTIC CATS: A CAUSE FOR CONCERN

Fact: Every year hundreds of thousands of birds are killed in the United States by free-roaming domestic cats.

Why: Cats are natural hunters. Even your cute house pet is innately a predator. But while hunting is an instinctual behavior, cats are not a natural link in local food chains. Cats were introduced to North America by humans towards the end of the 19th century as a method of pest control. Since then feline populations have exploded out of control. Their predatory activities are an unnatural burden on birds. Keeping your cat well fed does not deter it from attacking birds; hunting birds is a natural behavior unrelated to a cat's hunger. You may not see your cat in action, but if you routinely let it outside it is likely to be killing up to 10 birds every year. With nearly 60 million pet cats in America today, that is a significant number of bird kills. Combined with many other threats birds face, this adds significantly to their struggle to survive. When you allow your cat to roam free outside, you are risking the lives of countless birds. You are also risking the life of your cat; those that are kept indoors live happier, healthier, and longer lives.

What You Can Do: A cat is only responding to a natural instinct. Ultimately you are responsible for your cat and its behavior.

- ◆ Keep your cat indoors, especially during the peak migratory seasons in fall and spring.
- ◆ Put an alarm collar on your cat. Many collars exist which will hamper the cats' stalk and attack. These collars will not harm the cat, but will give an unsuspecting bird ample warning to escape before a cat strikes. Bells alone will not stop a cat from attacking.
- ◆ Spay your cat. Make sure you spay or neuter your cat to help keep the cat population in check.
- ◆ Help stray cats. In addition to house pets, there are millions of stray cats in the United States, all a potential threat to native wildlife. You can take in some of these cats or call a local animal shelter.
- ◆ Keep birdfeeders out of reach. Make sure the birdfeeder in your yard is not cat accessible. Keep it high and away from windows and vegetation.
- ◆ Join the Indoor Cat Campaign. Encourage others to keep their cats indoors. Check out the American Bird Conservancy "Cats Indoors" at <http://www.abcbirds.org/catindoo.htm>

Other Useful Web Sites:

American Bird Conservancy: <http://www.abcbirds.org>

May 13, 2000 is National "Keep Your Cat Indoors" Day



MAN-MADE OBSTACLES POSE PROBLEMS FOR MIGRATING BIRDS

Fact: Millions of birds die every year in building collisions.

Why: Tall buildings and their lights pose a serious threat to migrating birds. The feat of migration is already a dangerous one with the natural hazards due to weather, predators, and food scarcity. Birds are exhausted and hungry and yet humans have created tall obstacles to complicate an already difficult journey.

Birds use a variety of different cues to navigate their migration route, including the pattern of the stars, topographic features, earth's magnetic fields, and the location of the setting sun. If any of these cues are disrupted or unclear, for example during cloudy weather, the birds will have difficulty staying on their path. The lights of tall buildings and radio towers only contribute to this confusion. The lights will often overwhelm natural cues and disorient the birds. These confused birds will then circle the lighted structures, not because they are attracted to the light, but because they are following an erroneous and obscure cue. Blinking lights, which often adorn radio towers, and bad weather only further contribute to the problem. Eventually many of these birds will collide with the building, with each other, or will drop from exhaustion.

This problem is increasing as more and more highrise buildings are constructed. The now popular glass skyscrapers, found brilliantly lit at night, are augmenting the dangers.

Not all birds die from the collisions. Some will only be stunned with minor injuries, but often these dazed birds will fall prey to predators, cats and other birds, lurking on city streets. Many will panic upon finding themselves in the midst of a busy, morning, urban setting.

Another related danger to nightflying migrants are the broadcast radio towers which may stand 200-2000 feet into the night sky. There are around 75,000 towers currently built in the United States and with the current progress of Internet and satellite technology another 5000 to be added every year. Each of these towers may kill hundreds to thousands of birds in a single migratory season. Add lights and bad weather to the scenario and the death rate grows even higher.

What You Can Do:

- ◆ Turn off all lights during the peak migration seasons in fall and spring.
- ◆ Write letters to the owners of tall skyscrapers requesting that lights be turned off at night during peak migration periods.
- ◆ If you find a stunned bird, carefully place it upright inside a brown paper bag and transport it to a safe area where it can recover before resuming its journey.

Other Useful Web Sites:

Fatal Light Awareness Program: <http://www.flap.org>

Towerkills: <http://www.towerkill.com>





NATIVE PLANTS AND BIODIVERSITY

We have peppered our continent with new houses, sidewalks, lawns, and regimented landscapes that are relatively devoid of seedpods, berries or other natural food sources. Imagine a different type of “yarden”: birds chirping, butterflies flitting, bees busily transporting pollen, and wildlife drinking and bathing in the rainwater you collected in your yarden. You can create this scene, and in so doing, you’ll find that you’ll have to replace plants less often and use less pesticide, time, money, and water.

To begin the transformation from traditional landscape to nativescape:

- ◆ Identify your existing plants, then explore forests and other natural areas to examine differences. Never remove plants from the wild.
- ◆ For a gradual transition, retain high maintenance areas close to the house while establishing a natural garden toward the edges and back of your property.
- ◆ Consider neighboring property. Cooperate with your neighbors and extend existing plantings to create larger joint habitat.
- ◆ Reduce lawn by breaking it up with curved borders around gardens, trees, shrubs and groundcovers to create an “edge effect.”
- ◆ Select native plants to attract birds through all seasons and allow space for natural growth patterns (less pruning).
- ◆ Consider tall native grasses (quail and other grassland species are declining), flowering annuals and perennials, and shrubs for shelter and food.
- ◆ Consider removal of overgrown, unattractive plants that offer little wildlife value.
- ◆ Add to your plan a little at a time. Enjoy a work in progress while reducing the area of lawn.
- ◆ Plant more than one of a plant, as larger patches are more visible to birds. Plant them in an irregular pattern so that it looks more natural.

AVOID TOXIC CHEMICALS. Birds eat the treated insects and berries.

Remember, numerous plant species attract a greater variety of birds and other wildlife. Check links below to find out more and where you can find native plants.

Learn more about how to reduce the use of pesticides, find alternatives, and create a healthy backyard by region

- ◆ Pesticide and garden tips: Ten Commandments for a Healthy Yard:
<http://www.audubon.org/bird/pesticides/10%20COMs%20boxes.html>
- ◆ The Environmental Protection Agency’s Biopesticides site:
<http://www.epa.gov/pesticides/biopesticides/>

- ◆ Backyard Conservation: 1-888-LANDCARE,
<http://www.nhq.nrcs.usda.gov/CCS/Backyard.html>
- ◆ Native plants and gardening links: <http://plants.usda.gov/plants/links.html>
- ◆ Native plant societies by region: <http://www.nanps.org/associations/frame.shtml>
- ◆ Green Landscaping with Native Plants: <http://www.epa.gov/greenacres/>
- ◆ Audubon Habitat Collection from Monrovia: 1-888-PLANT IT

Further Reading:

The Bird Garden by Steve Kress

Bird Gardening Book by Donald and Lillian Stokes

The Chemical Free Lawn by Warren Schultz

Going Native by Brooklyn Botanic Garden

Landscaping for Wildlife by Carrol L. Henderson

*Redesigning the American Lawn - A Search for Environmental Harmony by Bormann,
Balmori & Geballe*

For additional information contact:

Director, Pesticide Initiative & Healthy Habitats
National Audubon Society
HealthyYards@Audubon.org





CITIZEN SCIENTISTS LEND A HAND TO BIRDS THIS FALL

Award-Winning Web Site Combines Technology and Bird Science to Help Birds Get Home Safely

New York, NY August 28, 2000 – This fall, migratory birds will face a number of life threatening challenges in their journey south. In addition to predators, difficult weather, and long distances, birds this year must contend with man made threats including potential poisoning from the pesticides employed to combat the West Nile Virus. With the help of citizen scientists and state-of-the-art forecasting technology, birds migrating through the Mid-Atlantic may get a break.

“Using the most advanced migration monitoring techniques, in combination with the efforts of the public, BirdCast www.BirdCast.org will become one of the most effective ways to track bird movement, and protect bird species,” said Audubon’s Senior Vice President for Science, Frank Gill. “From September 1st through November 15th, National Audubon Society urges citizens from New York to Washington, D.C. to report bird sightings to BirdCast and to take action to aid birds.”

As birds migrate, major factors contributing to their demise include pesticide use; loss of feeding and watering opportunities; impact with radio, television, and cellular towers, and brightly lit office buildings which disorient birds, causing them to crash. Scientists recognize that migrating birds are in decline—down by nearly 50% since the 1960’s.

BirdCast, enabling scientists to predict bird migration through a specific region, offers practical uses for homeowners and public officials. Using BirdCast, homeowners will be advised as to when to avoid spraying pesticides in their gardens, provide seed and water, and when to keep their cats indoors, in order to keep bird populations alive and well. Building owners can use BirdCast to determine when to turn off disorienting lights that often cause birds to crash into windows and die.

Public Health officials are also urged to make use of BirdCast. “This fall, BirdCast has an unintended and immediate use for county health officers,” continued Audubon’s Gill. “BirdCast will provide guidelines on when to suspend spray operations, helping officials avoid unnecessary bird deaths and violations of federal Migratory Bird Laws.”

BirdCast, a project of National Audubon Society, Cornell Lab of Ornithology, and Clemson University Radar Ornithology Lab, made its debut this past spring and was a resounding success. Funded by the Environmental Protection Agency’s Office of Research and Development and the Office of Pesticide Programs, the project was granted the “Dr. Copernicus Award” by the Copernicus Education Gateway, a Web site that features the best educational sites for students and teachers. Using radar pictures, audio samples and most importantly, personal observations (or “groundtruthing,”) scientists were able to make predictions and draw conclusions about songbird migratory behavior.

Participants from the mid-Atlantic region watched the skies, reported their findings to the BirdCast site and were then advised when to keep their cats indoors, to refrain from pesticide use, and to provide food and water in order to protect migrating birds in their region. Of particular interest to the thousands who visited BirdCast were the “10 Commandments to a Healthy Yard” and “The Audubon Guide to Home Pesticides,” still available at the site <http://magazine.audubon.org/backyard/backyard0005.html>.

“By encouraging the public to report bird sightings in their region, BirdCast has and will continue to enable scientists to gather valuable information on migratory movements,” said Gill. “The project will not only increase scientific knowledge but also encourages people to make informed decisions about when to apply pesticides, let their cats out or undertake other activities that might cause birds harm.”

This fall, with additional support from the EPA’s Office of Pesticide Programs, BirdCast will expand into the states of New York and New Jersey. Scientists will generate morning and evening pictures of warbler, waterfowl, and hawk migration through the region using NEXRAD (Next Generation Radar). These snapshots of bird migration and weather events will be accompanied by interpretation and predictions from the Clemson Lab so that the general public and city officials can both observe and assist migratory birds.

“BirdCast has already inspired the general public to use this new technology to observe birds and ultimately become partners in conservation,” said Sally Conyne, Director of Citizen Science for Audubon. “This fall we are eager to track bird movement once again. Web users will be able to obtain daily forecasts of bird movements, learn about the best bird-viewing spots and find out how human activity impacts birds. In addition, the site now includes general information about migration, some late-breaking pesticide news, and a variety of tips for the fall gardener.”

Aside from adding color and music to our lives, birds serve as important environmental indicators, helping scientists assess the health of an ecosystem. Evidence of a declining bird species in a particular region may indicate another problem such as the loss of food or water sources, the destruction of specific habitats, or contamination by a toxic element. Despite the significant role birds play in local ecosystems, every year the numbers of migratory birds that return to the Mid-Atlantic region, and other parts of the country, decreases. These decreases may indicate problems with broad environmental implications, problems that can impact us in many ways.

Founded in 1905 and with over a 550,000 members and supporters in 530 chapters throughout the Americas, the National Audubon Society conserves and restores natural ecosystems, focusing on birds, other wildlife, and their habitats for the benefit of humanity and the earth’s biological diversity.

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NATIONAL AUDUBON SOCIETY URGES NY, NJ & CT HEALTH OFFICIALS NOT TO SPRAY PESTICIDES THIS WEEKEND

Largest Wave of Bird Migration This Fall Predicted to Pass Through Tri-State Area

New York, NY September 15, 2000- Using the latest technology in bird tracking techniques and the efforts of citizen scientists through BirdCast.org, National Audubon Society predicts the largest wave of migration will occur this weekend- and strongly urges county officials to suspend pesticide spraying operations in the tri-state area.

"This weekend will be one of the best opportunities for people to see a wide variety of species of migrating songbirds and hawks, and to contribute their sightings to BirdCast," said Sally Conyne, Director of Citizen Science for Audubon. "On the other hand, this weekend will be one of the worst times for pesticide sprayings to occur, due to the unknown effects of the use of Scourge and Anvil on birds and the consequent reduction of their food source. By not spraying pesticides in the tri-state area this weekend, county and city officials will avoid unnecessary bird deaths and violations of federal Migratory Bird Laws."

Migratory birds usually face a number of life threatening challenges in their journey south. This weekend, in addition to predators, difficult weather, and long distances, birds must contend with man made threats, especially potential poisoning from the pesticides employed to combat the West Nile Virus. With the cooperation of health officials, help of citizen scientists and state-of-the-art BirdCast technology, birds migrating through the Mid-Atlantic may get a break.

"In combination with the efforts of the public, BirdCast www.BirdCast.org will become one of the most effective ways to track bird movement, and protect bird species," said Audubon's Senior Vice President for Science, Frank Gill. "From September 1st through November 15th, National Audubon Society urges citizens from New York to Washington, D.C. to report bird sightings to BirdCast and to take action to aid birds."

As birds migrate, major factors contributing to their demise include pesticide use; loss of feeding and watering opportunities; impact with radio, television, and cellular towers, and brightly lit office buildings which disorient birds, causing them to crash. Scientists recognize that migrating birds are in decline—down by nearly 50% since the 1960's.

BirdCast, enabling scientists to predict bird migration through a specific region, offers practical information for homeowners and public officials. Using BirdCast, homeowners will learn when to avoid spraying pesticides in their gardens, when to provide seed and water, and when to keep their cats indoors, in order to keep bird populations alive and well. Building owners can use BirdCast to determine when to turn off disorienting lights that often cause birds to crash into windows and die.

BirdCast, a project of National Audubon Society, Cornell Lab of Ornithology, Clemson University Radar Ornithology Lab, and Academy of Natural Sciences made its debut this past spring and was a resounding success. Supported by the Environmental Protection Office of Pesticide Programs and Mid-Atlantic Office (Region III), the project was granted the "Dr. Copernicus Award" by the Copernicus Education Gateway, an educational Web site for students and teachers. Using radar pictures, audio samples and personal observations (or "ground truthing,") scientists were able to make predictions and draw conclusions about songbird migratory behavior.

Participants from the mid-Atlantic region watched the skies, reported their findings to the BirdCast site and were then advised when to keep their cats indoors, to refrain from pesticide use, and to provide food and water in order to protect migrating birds in their region. Of particular interest to the thousands who visited BirdCast were the “10 Commandments to a Healthy Yard” and “The Audubon Guide to Home Pesticides,” available at the site <http://www.birdsource.org/birdcast/pestsum.html>.

“By encouraging the public to report bird sightings in their region, BirdCast has and will continue to enable scientists to gather valuable information on migratory movements,” said Gill. “The project will not only increase scientific knowledge but also encourages people to make informed decisions about when to apply pesticides, let their cats out or undertake other activities that might cause birds harm.”

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BirdCast & NEXRAD

In the early days of World War II, British radar operators noticed mysterious, ethereal shadows drifting across their screens. Those apparitions, so wonderfully dubbed angels by pioneering radar technicians, heralded the beginnings of radar ornithology. Radar's first major contribution to ornithology took form only a few years later when in 1958 Sidney Gauthreaux, then a high school student in New Orleans, postulated that if radar can see planes and weather, why not birds? Only a few years later, as a Louisiana State graduate student, he found his proof. His radar images definitively proved the existence of massive trans-Gulf migrations. Prior to these observations, there was a continuing belief that the majority of migrants held to a more land bound, clockwise pattern; arriving in North America via Mexico.

Through the 60's, 70's, and 80's, however, radar's promise failed to fully evolve. There were a few notable discoveries, such as in 1989 when Gauthreaux, working from archival images, awakened the ornithological world to the precipitous decline in migrating flocks—down by nearly half when compared to the 1960's. The existing radar of the day, however, was proving largely inadequate. It lacked not only the necessary resolution, but it also failed to provide a three dimensional view.

In the early 1990s, however, change was coming. The new, highly efficient NEXRAD Doppler radar (Next Generation Radar) began to be placed in service. The Air Force started investigating NEXRAD's utility in their Bird Aircraft Strike Hazard Program (BASH). During this period, portable NEXRAD units were teamed with vertically mounted thermal imaging units so that the images captured by the radar could be visually verified. Elsewhere, graduate students under Sid Gauthreaux were making their own exciting discoveries. Their breath-taking images of giant expanding aerial doughnuts were found to be thousands of Purple Martin radiating from critical roosting sites each morning.

Radar ornithology work is now taking place in many parts of the country and it is soon to come to the Mid-Atlantic. With the support of the Environmental Protection Agency's Office of Research and Development and the Office of Pesticide Programs, a coalition consisting of National Audubon, Cornell's Laboratory of Ornithology, and Clemson's Radar Ornithology Laboratory, "BirdCast" will be coming soon to a computer near you on September 1, 2000. To access BirdCast you will go to the existing Audubon/Cornell Web site—BirdSource <http://www.BirdSource.org>. Throughout periods of peak migration, BirdCast will provide a morning and evening, unfiltered snapshot of the eastern region of the US from New York through Virginia. The birds and weather shown in these images will be accompanied by interpretation and a migration prediction provided by the Clemson Lab.

Is this work being done just as a special favor for birders? Well, not exactly. You can think of BirdCast as an early alert and an environmental billboard on the Internet. Linked to BirdCast will be messages such as admonitions against the use of certain pesticides as well as a number of other migrant-friendly changes that people can make in their backyards. We'll advise the residents of the region about the pests that actually pose local threats and the safest management strategies. Included at the site are two charts of special interest—"10 Commandments for a Healthy Yard" and "The Audubon Guide to Home Pesticides." With the completion of data collection this migration season, we hope to use the interpreted and ground-truthed images in pinpointing critical habitat in need of protection.

While all of this seems reasonably simple and employs proven technology, it's not simple at all. In fact, it's really research in the development stage. What has been sorely lacking in the past is you. Most earlier radar work has been lacking a critical component—ground-truthing. Dozens, hundreds, and, indeed, thousands of sets of eyes are needed to verify what the radar images are capturing and to that end, BirdCast will have an interactive component and will allow you to log on and enter your daily sightings. These will feed directly into our database and be available to everyone in real-time.

So, BirdCast needs you. Dust off those bins and get ready to head to your favorite haunts. While we encourage all of you to post each and every sighting, of greatest value will be sightings coming from those who can afford the time to make regular observations. Those of you who would like to participate on a daily or regular basis or if you would like additional information please contact Sally Conyne sconyne@audubon.org. These data you collect will greatly enhance our overall understanding of migration patterns and movements. And this project will educate a multitude of people about how their backyards can be made friendlier and healthier for our angels. So, please, help us help the birds.



