The All-Bird Bulletin

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Advancing integrated bird conservation in North America

Blue Sky: Opportunities for Advancing Bird Conservation Over the Next Ten Years

Brian Smith, David Pashley, and Ed Laurent, American Bird Conservancy

Human activities through the centuries (e.g., urban development, change in land use) have altered landscapes and ecological processes to the detriment of many bird populations. However, our knowledge of interactions among species and their habitats, the tools we use to describe and predict them, and the conservation activities we implement in order to reduce or mitigate impacts to habitats are increasingly powerful. Increasing efficiency and effectiveness in our conservation planning, implementation, monitoring, and communication activities will improve our abilities to stabilize and increase populations of priority species. Yet, many impediments lie in the way of progress. We must therefore exploit recent advances in conservation science to continue building a better understanding of how and why bird populations change over time and what we as conservationists must do to support their sustainability.

The articles in this Special Issue of *The All-Bird Bulletin* are based on presentations given at the Fourth International Partners in Flight Conference in McAllen, Texas in February 2008. The "Blue Sky" session was designed to explore recent conceptual impediments and advances in bird conservation, ideally creating a 'road map' to guide the bird conservation community over the next ten years. Speakers were asked to specifically address: (1) opportunities for advancing data collection methodologies, (2) habitat descriptions and functional connectivity in space and time, (3) threats and their impacts on populations, (4) ways to improve information sharing, and (5) strategies for the implementation of conservation planning, including the formation of partnerships to enhance knowledge and deliver conservation.

As the following articles show, data gathered by the conservation community has vastly improved monitoring protocols and created powerful planning tools, robust databases, and unique partnerships. However, there is much work that needs to be done. Assumptions that underlie predictions must be tested; spatial data use and validation must be expanded and improved; monitoring strategies must be improved and implemented; data must be curated and archived properly to ensure long-term usefulness; partnerships must become function-based and multi-disciplinary; and the bird conservation community must lead in the development of education and communication tools that will motivate a movement among the public, policy-makers, and industries. In short, we are improving *our* collective knowledge about bird populations and how they interact with the landscape, but we need far more enthusiastic support from *others* to influence conservation policies, funding, and actual conservation outputs.

We hope this special issue of *The All Bird Bulletin* will stimulate further discussion about opportunities and impediments facing the bird conservation community over the next decade. Addressing these issues, as well as many others, will be to our collective advantage in both the short- and long-term.

Sources of Measurement Error, Misclassification Error, and Bias in Auditory Avian Point Count Data

Theodore R. Simons, U.S. Geological Survey and North Carolina State University (NCSU), Kenneth H. Pollock, NCSU, John M. Wettroth, Maxim Integrated Products, Mathew W. Alldredge, Krishna Pacifici, and Jerome Brewster, NCSU

The most common method of estimating avian abundance is the point count where a single observer records all birds seen or heard at a point during a prescribed interval (usually 3-10 minutes). It is estimated that between 1,000 and 2,000 independent programs currently gather long-term data on bird abundance in the U.S. and Canada. Hundreds of thousands of point counts are conducted annually in North America across a spectrum of scales, from short-term site-specific studies to long-term continental-scale surveys such as the Breeding Bird Survey. Surveys of breeding birds rely heavily on auditory detections, which can comprise 70% of observations in suburban landscapes, 81% in tropical forests, and up to 97% of observations in closed-canopy deciduous forest. Avian point counts vary due to actual differences in abundance, differences in detection probabilities among counts, and differences associated with measurement and misclassification errors. Unless detection probabilities are estimated directly, it is often impossible to determine if differences in counts over space or time are due to true differences in abundance or to differences in detection probability.

Most practitioners assume that current methods for estimating detection probability are accurate, and that observer training obviates the need to account for measurement and misclassification errors in point count data. Our approach combines empirical data from field studies with field experiments using a system for simulating avian census conditions when most birds are identified by sound (Figure 1). The system uses a laptop computer to control up to 50 amplified MP3 players placed at known locations up to 200 meters around a survey point. To date we have simulated over 5,000 unlimited radius point counts with 50 observers. The system can realistically simulate a known population of songbirds under a range of factors that affect detection probabilities. Validation experiments evaluate traditional methods for estimating detection probabilities such as distance sampling, and new approaches that incorporate information from multiple observers, the time sequence of observations, and combined methods.

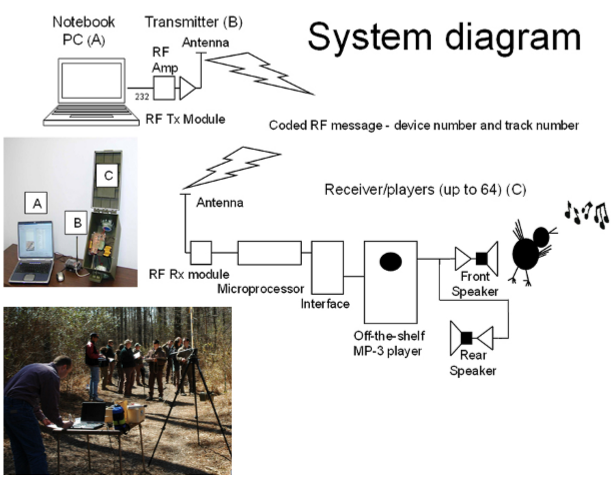
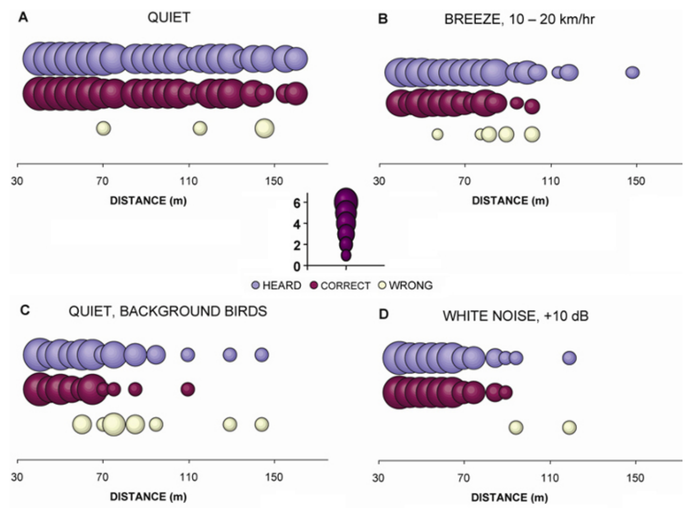


Figure 1. Point count simulation system and observers participating in a field experiment.

Our objectives are to identify the factors that influence detection probability on auditory point counts, quantify the bias and precision of current sampling methods, and find new applications of sampling theory and methodologies that produce practical improvements in the quality of bird census data. We have found that factors affecting detection probabilities on auditory counts, such as ambient noise, can cause substantial biases in count data. Figure 2 illustrates the number of six observers able to hear (Heard), correctly identify (Correct), and number of observers who misidentified (Wrong) calls of Black-throated Blue Warblers (*Dendroica caerulescens*) at 25 distances between 40 m and 160 m. Calls were played randomly at each distance for approximately 20 seconds. Experiments were replicated under four ambient noise conditions: (A) quiet (mean ambient noise 40.6 dB, S.D. 4.47 dB), (B) breezy (10 – 20 km/h gusty winds, 55.4 dB, S.D. 3.87 dB), (C) quiet conditions with three background birds Winter Wren (*Troglodytes troglodytes*), Yellow-throated Warbler (*Dendroica dominica),* and Ovenbird (*Seiurus aurocapillus*) singing 40 m behind or to either side of the observers, and (D) quiet conditions with white noise added (10 dB above ambient). White noise (uniform power, spectral frequency = 1.0) was played from a speaker facing the observers at a distance of 10 m.

Results illustrate how detection distances decline and identification errors increase with increasing levels of ambient noise. Overall, the proportion of birds heard by observers decreased by 28% ± 4.7% under breezy conditions, 41% ± 5.2% by the presence of additional background birds, and 42% ± 3.4% by the addition of 10 dB of white noise. To provide some context for our ambient noise experiment we asked observers to record ambient noise levels on 21 Breeding Bird Survey routes across North Carolina in 2006. Note the proportion of North Carolina BBS counts in which ambient noise levels exceed 40 dB (Figure 2. Ambient noise experiments indicate that an increase in ambient noise from 40 dB to 50 dB produces a 42% average reduction in the counts of six common species. Thus, if ambient noise levels along these North Carolina routes increased by 10 dB over the past 20 years, we would expect BBS counts of species detected by ear to decline over that interval by about 40%—even if populations were stable.



Distance sampling data are subject to substantial measurement error due to the difficulty of estimating the distance to a sound source when visual cues are lacking. Misclassification errors are also inherent in time of detection methods due to the difficulty of accurately identifying and localizing sounds during a count. Factors affecting detection probability, measurement errors, and misclassification errors are important but often ignored components of the uncertainty associated with point-count-based abundance estimates. The PIF network can serve as an important conduit for promoting the adoption of sampling methods that account for sources of bias and measurement error.

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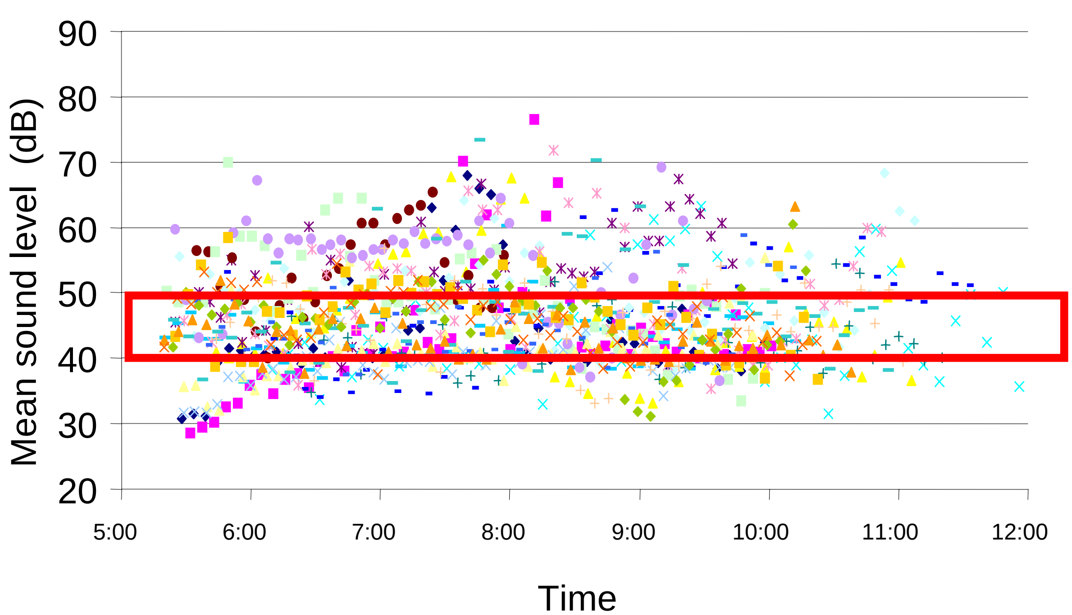

Figure 2. *Upper* - number of six observers able to hear (Heard), correctly identify (Correct), and number of observers who misidentified (Wrong) calls of Black-throated Blue Warblers at 25 distances between 40 and 160 m. Calls played randomly at each distance for approximately 20 seconds. Experiments were replicated under four ambient noise conditions: (A) quiet (mean ambient noise 40.6 dB, S.D. 4.47 dB), (B) breezy (10 – 20 km/hr gusty winds, 55.4 dB, S.D. 3.87 dB), (C) quiet conditions with 1 – 3 background birds (Winter Wren, Yellow-throated Warbler, and Ovenbird) singing 20 m behind or to either side of the observers, and (D) quiet conditions with white noise added (10 dB above ambient). White noise (uniform power, spectral frequency = 1.0) was played from a speaker facing the observers at a distance of 10 m. *Lower* - Measured levels of ambient noise on 20 North Carolina Breeding Bird Survey routes in 2006. Observers conducted 50 3-minute unlimited radius point counts along a 40 km route. Symbols represent the mean of three sound pressure readings measured along each route using a Martel Electronics model 325 sound level meter (accuracy ± 1.5 dB).

Using Constant-effort Mist-netting and Mark-recapture Data to Identify Factors Driving Dynamics and Trends of Populations

James F. Saracco, David F. DeSante, and M. Philip Nott, The Institute for Bird Populations

Populations of many landbird species have declined in recent decades. Acknowledgement of declines has led to the establishment and funding of major conservation programs such as Partners in Flight, the North American Bird Conservation Initiative, and the Neotropical Migratory Bird Conservation Act. Yet, despite tremendous recent efforts to manage and conserve important habitats for declining populations, there has been little evidence of broad-scale improvement in trends.

Effective management of habitats and the conservation of bird populations can be facilitated by monitoring vital rates (reproduction, recruitment, survival) in addition to abundance and trend. Advantages of such "demographic monitoring" are manifold. First, demographic monitoring emphasizes processes, rather than the resulting patterns. Because it is the process (demographic rate), not the pattern (abundance), that is directly affected by environmental factors (e.g., stressors or management actions), changes in vital rates can more accurately and sensitively reflect short-term and local environmental change. Information on demographic rates can lend insight into the stages of the life cycle that are most important for limiting bird populations, particularly for migratory species. Finally, demographic rates can be modeled as functions of environmental variables (e.g., land use, habitat, climate, weather), and these relationships can be incorporated into population models to assess the health and viability of populations.

Collection of demographic data is relatively difficult (compared to occupancy or abundance/trend data) because it requires that large numbers of birds be captured, marked, and recaptured to obtain precise estimates (or indices) of demographic rates. Nevertheless, via hundreds of partnerships established since 1989 as part of the Monitoring Avian Productivity and Survivorship (MAPS) program, we have been largely successful in collecting these types of data for small landbird species that are readily captured in ground-level mist nets.

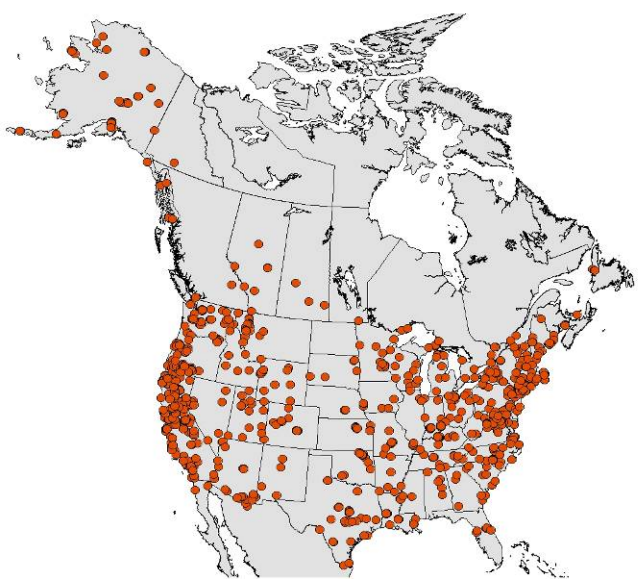

Fig. 1. Distribution of MAPS stations established and operated since 1989.

The MAPS program consists of a network of constant-effort mist-netting and bird-banding stations operated across North America. MAPS goals include the estimation of adult apparent survival rates and indexing of productivity for more than 100 landbird species, and the modeling of estimates and indices of vital rates as functions of environmental variables to inform management. Approximately 1,000 banding stations have been operated as part of the MAPS program (Fig. 1), of which nearly 500 are operated each summer. A large number of these MAPS stations (~ 25%) are long-term monitoring sites that have been in operation for more than 10 years. Approximately 20% of MAPS stations are operated on public lands (primarily federal) by interns recruited and trained by The Institute for Bird Populations; the remaining stations are operated by independent researchers and bird banders on both private and public landholdings.

MAPS data are lending insight into spatial variation in vital rates and the links between vital rates and population trends for many bird species of conservation concern. In many cases, it appears that conditions experienced during the non-breeding season are important drivers of population change. For this reason, we established two winter monitoring efforts to complement MAPS. As with

MAPS, both winter monitoring programs rely on mist-netting and bird-banding data to provide data on demographic rates and the condition of individual birds.

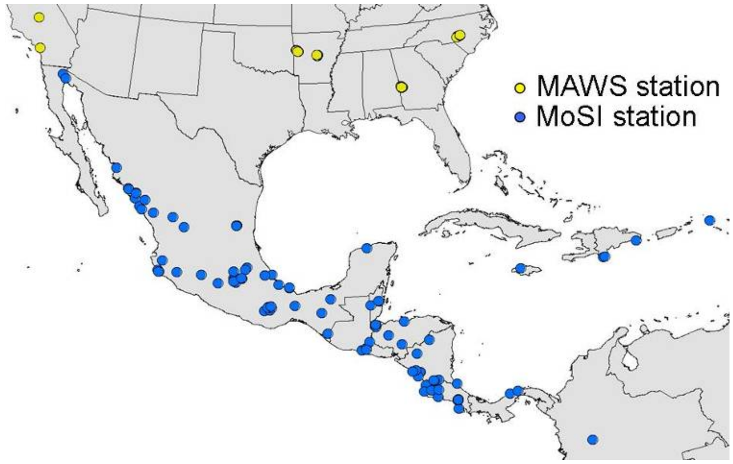

Fig. 2. Distribution of winter banding stations operated as part of the MAWS and MoSI programs since 2002.

The first of the wintering monitoring programs, MoSI (Monitoreo de Sobrevivencia Invernal), targets long-distance migrants that overwinter largely in the Neotropics, while the second, MAWS (Monitoring Avian Winter Survival) targets species that overwinter primarily in the southern United States. MoSI, now in its sixth season, has involved at least 58 partners from 14 countries. More than 130 MoSI banding stations have been operated for at least one winter season (Fig. 2). Many MoSI stations have been established and operated in Important Bird Areas and sites that are state or national protected areas. The MAWS program was initiated in 2003 as a four-year pilot project on four southeastern U. S. military installations. Several independent MAWS station operators have also contributed data to the program.

MAWS and MoSI share common goals. These include: (1) estimating both overwintering apparent survival and between-winter apparent survival, (2) indexing body condition for a suite of target species across their wintering ranges, (3) identifying spatial patterns in apparent survival and body condition, (4) linking survival and body condition to habitat, and (5) using models of survival and body condition to inform management and conservation on overwintering areas. Additionally, morphometric data and stable isotope and genetic data derived from the MAPS, MAWS, and MoSI programs can be used to help establish patterns of migratory connectivity. Such data will be critical for directing management and conservation efforts to those areas where they are most likely to be effective.

Successes of these monitoring efforts to date are encouraging and show that with coordinated effort, participation by diverse agencies and organizations, and a common set of protocols and goals, demographic monitoring can provide critical data for directing bird conservation efforts. Challenges for the future relevance and utility of these programs include targeted program growth to more effectively sample species and habitats of high conservation priority, integration of sampling with broad-scale count-based monitoring programs (e.g., the North American Breeding Bird Survey), and continued development of analytical methods that can more fully exploit the richness of spatially-explicit demographic data.

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Wilson's Warbler, /Donna Dewhurst

Advancing Our Understanding of Functional Connectivity with Empirical Studies and its Implication for Avian Conservation

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Functional connectivity plays a central role in avian conservation given its relevance to fitness and persistence. Broadly, functional connectivity refers to the degree to which the landscape facilitates or impedes movement among resource patches. Connectivity is described in terms of landscape composition and configuration but is a function of species-specific needs and life history traits. It entails defining the scale at which resource patches are functionally connected for the species through the influences of physical and biological constraints upon a particular process.

Much has been learned in recent years about functional connectivity. Emphasis, however, has been placed on quantifying the structural connectivity of landscapes in absolute terms, without reference to any particular organism. Results are typically expressed using landscape and patch metrics such as aggregation and contagion (McGarigal et al. 2002). When organisms are included in the description of connectivity, it is usually through metrics such as inter-patch distance, distance traveled, or frequency of movement events (Tischendorf and Fahrig 2000).

Few studies have reported functional measures of connectivity that are based on behavioral responses to landscape elements. Reporting behavioral responses to landscape elements is considered essential to attain greater progress in our understanding of connectivity (Belisle 2005). Measures of behavioral responses to landscape elements include residency time (expressed as local survival), condition or state of individuals, and the motivation for individuals to move. The latter attributes provide measures of the willingness of individuals to take risks to meet their needs given the structure of a landscape.

While many of the factors that influence functional connectivity are well known for some species (e.g, Red-cockaded Woodpecker, *Dendrocopos borealis*), they are poorly known for most, particularly for species during migration. This is a conservation challenge that underscores the importance of considering life history strategies and the proximate and ultimate factors that impinge over a species' annual cycle. Identifying the geographic links during annual migratory cycles serves to prioritize habitats for conservation. However, prioritization schemes should also reflect an understanding of how those geographic links influence the species' fitness (Norris and Marra 2007). Recent advances in molecular genetic and other techniques (e.g., isotopes) have been used to discern patterns of migration connectivity, and provide possible avenues to establish linkages among site quality, migration chronology, and demography. For managers, this means not only being cognizant of the migration strategy (e.g., time minimizers), which might influence the number of stops and mean length of stay, but also taking in consideration how habitat management, which changes landscape structure, will influence behavioral responses that might foster fitness.

We highlighted selected results of an empirical study on migratory Semipalmated Sandpipers (*Calidris pusilla*) in South Carolina to illustrate how these factors were considered as part of an effort to refine shorebird conservation strategies in southeastern United States. The study consisted of management experiments designed to enhance foraging habitat quality via water level manipulations of three clusters of managed wetlands separated by 2-4 kilometers. Within each cluster, foraging substrates were exposed using two hydrologic regimes: a gradual drawdown over the migration period and a rapid drawdown designed to coincide with peak migration. Habitat quality was characterized by water depth (indicator of habitat and prey access), prey density, and abundance of shorebirds. The latter measurement was intended to capture the possible influence of social factors in behavioral responses to habitat management. Extraneous variables such as wind direction and speed were also measured because they influence mean length of stay by shorebirds.

The mosaic of foraging conditions resulting from management activities permitted estimation of two parameters of interest using multi-state modeling techniques. These were residency rates (i.e., probability of surviving and remaining in a given cluster) and movement probability (i.e., probability of moving from one cluster to another). Both are behavioral responses of migrant shorebirds estimated as a function of the distance among clusters and physical and biological attributes, such as water depth, prey density, and abundance of congeners, that might influence a bird's decision to stay or move on to another cluster, or leave the conservation area all together. Results showed that movements occurred in response to habitat quality changes between clusters 2-2.5 km apart but not between clusters separated by 4 km. Prey density and shorebird abundance lead to greater residency times (i.e., lower movement probabilities). Prevailing winds (southerly) also influenced residency time, underscoring the possibility that extraneous factors play a role in observed responses not attributable to management.

As stressed above, there is a need to report behavioral responses and other biological processes in the context of connectivity studies, and to elucidate how behavior and landscape spatial structure interact to influence connectivity. This line of questioning requires that connectivity be defined as a dependent variable instead of an artifact of a GIS process. Inferences from such studies can also benefit from defining habitat patches in terms of the process of interest, which is often species-specific. Likewise, the 'matrix" or space between patches and spatial configuration cannot be ignored or considered inert. This is because the composition and location of patches in the matrix may have profound influences on functional connectivity or the tradeoffs between taking risks and meeting needs via behavioral responses.

We view our case study as an example of how functional connectivity and management interact at the stopover site level. Our motivation was to benefit fitness of shorebirds via improved conditions to meet energetic requirements. We helped define how factors affecting habitat quality (e.g., prey density, water depth) available at various spatial scales within a conservation area (functional connectivity) could be combined to benefit the users during a period of high energetic demand. Benefits to survival could also be accrued, albeit they are more difficult to estimate. For example, a coordinated management scheme integrating connectivity and habitat quality could minimize the likelihood of departures by migrants from a conservation area in search of more suitable foraging habitats. Gains in survival could be accrued by minimizing unnecessary movements that might increase chances of mortality (e.g., predation).

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Literature cited

Belisle, M. 2005. Measuring landscape connectivity: The challenge of behavioral landscape ecology. *Ecology* 86:1988-1995.

McGarigal, K., S. A. Cushman, M. C. Neel, and E. Ene. 2002. *FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps*. Computer software program produced by the authors at the University of Massachusetts, Amherst. Available at www.umass.edu/landeco/research/fragstats/fragstats.html

Norris, D. R., and P. P. Marra. 2007. Seasonal interactions, habitat quality, and population dynamics in migratory birds. *Condor* 109:535-547.

Tischendorf, L., and L. Fahrig. 2000. On the usage and measurement of landscape connectivity. *Oikos* 90:7-19.

Environmental Data for Predicting the Spatial Distribution of Bird Populations

Edward J. Laurent, American Bird Conservancy

Predictions of bird species occurrences, densities, and population rates are typically dependent on environmental data. These data are used to describe the attributes of locations where birds were observed and where they are expected to be. Increasingly, environmental data are spatially and temporally explicit through reference to a point or area in space and time.

Environmental data are collected both directly and remotely. "Habitat" data, (see Hall 1997, Morrison et al. 1998) describing locations where individual birds were observed, are often collected directly in the field through physical measurements. For example, we may sample trees within a defined area to arrive at an estimate of basal area or stems per hectare. If the sampling locations are geo-referenced through the use of a global positioning system (GPS) receiver, then the estimates can be interpolated and/or extrapolated over space to create maps of the variables.

Interpolation (Figure 1) is the act of estimating an unknown value at a location based on known values at surrounding locations. Interpolation methods typically assume that environmental variables are stationary processes (i.e., there is no systematic change in the mean and variance of the variable over space or time). For this reason, interpolation is most appropriate for describing fine scale gradients across a relatively homogeneous area (e.g., variation in seasonal soil moisture across a forest stand) or broad scale gradients across relatively homogeneous regions (e.g., variation in monthly precipitation across a continent; see http://www.prism.oregonstate.edu/).

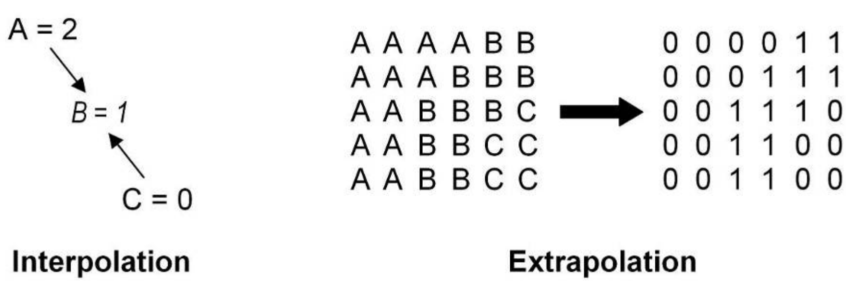

Figure 1. Simple hypothetical examples of interpolation and extrapolation. Interpolation is used to estimate unknown values (B) based on nearby known values (A and C). Extrapolation is also used to estimate values based on known information. In this example, it is known that a species has occurred in locations with resource B but not with resources A and C. Therefore the species is predicted as occurring (1) everywhere B occurs but not (0) where A and C occur.

Extrapolation, on the other hand, is the estimation of a value based on known information at the same location. It can be thought of in terms of an "if then" statement (e.g., if known value < 9 then the species is present). Maps created through extrapolation therefore do not need to assume that variables are stationary processes because extrapolation methods are dependent on existing map inputs (e.g., if map cell value < 9 then the species is present). Extrapolated map inputs may include other maps of estimated values predicted through interpolation (e.g., temperature, precipitation) or extrapolation (e.g., land cover, land form). In fact, predictions of bird species occurrences, densities and population rates are often made through a secondary extrapolation from remotely sensed image values, whereby (1) a land cover map is extrapolated from imagery and then (2) bird species variables are extrapolated through relationships with land cover. It is therefore prudent for bird conservationists and land cover map makers to collaborate on inventory and monitoring strategies that collect both bird and land cover data in ways that are useful for interpolation and extrapolation (e.g., Urban 2002).

Land cover is probably the best known subject of map extrapolation for bird conservation purposes. These maps are increasingly relied upon for policy and management decisions. Because of their broad utility, there has been a push for land cover maps of increasing thematic resolution (i.e., map legends with more land cover classes) so that they better represent how humans and wildlife species perceive and respond to landscape heterogeneity. Land cover map classes have therefore progressed from very generic descriptions such as "Deciduous forest" (2001 National Land Cover Dataset; http://www.epa.gov/mrlc/nlcd-2001.html) to much more specific ones such as "Southern Appalachian Oak Forest" (Southeast Gap Analysis Project; http://www.basic.ncsu.edu/segap/EcoSys.html) as new extrapolation methods, intermediate data layers, and classification systems become available. Many recently classified land cover maps can be downloaded for free through the Multi-Resolution Land Characteristics Consortium (http://www.mrlc.gov/) and the USGS Gap Analysis Program's Online GAP Data Explorer Tool (http://www5.basic.ncsu.edu/). Another relevant broad scale mapping effort is currently underway by the Landscape Fire and Resource Management Planning Tools Project (Landfire; http://www.landfire.gov/) for purposes of predicting vegetation, wildland fuel, and fire regimes across the United States.

Until at least 2011, however, there will be less of the data that has historically served as the foundation for land cover maps. This is because the sensors on both the Landsat 5 and 7 satellites, which have collected a majority of the data used for classifying land cover maps over large regions of the U.S. and elsewhere, have mechanical problems (http://landsat.gsfc.nasa.gov/about/timeline.html). A Landsat Data Continuity Mission is scheduled for launch in July 2011. Until then, the availability of cloud-free Landsat images is greatly diminished and a complete halt to data collection is possible.

A free alternative to Landsat images are those collected by the MODIS sensors on the Aqua and Terra satellites (http://modis.gsfc.nasa.gov/). In addition to raw and processed spectral intensity values, there are many available data products extrapolated from MODIS data. Some examples include maps of land cover, vegetation indices, and estimates of primary productivity. However, there is a tradeoff in the spatial versus temporal resolution maps derived from Landsat versus MODIS data. Landsat data is of finer spatial resolution (30 m pixels) but relatively coarse temporal resolution (16 days) whereas MODIS data is of relatively coarse spatial resolution (250 m, 500 m, and 1 km pixels) but finer temporal resolution (1-2 days). MODIS data therefore offer more opportunities for cloud-free imaging of any given location and have greater potential for measuring and monitoring relationships between birds and environmental conditions over time. However, the use of MODIS data, with pixels larger than that of many bird species average activity areas, necessitates the consideration of population responses, rather than individual responses, to changing environmental conditions.

In summary, environmental data are collected, interpolated, and extrapolated in many ways. Some data, such as Landsat images, that have been very useful in the past may not be available in the future. However, other environmental datasets, such as MODIS data products, have great potential and should receive more use. Furthermore, collaboration among environmental data developers and users has the strong potential to result in more accurate maps that describe the world in ways that better address the information needs of the bird conservation community.

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Literature cited

Hall, L.S., Krausman, P.R. & Morrison, M.L. (1997) The habitat concept and a plea for standard terminology. *Wildlife Society Bulletin*, 25(1), 173-82.

Morrison, M.L., Marcot, B.G. & Mannan, R.W. (1998) *Wildlife-Habitat Relationships: Concepts and Applications*. The University of Wisconsin Press, Madison.

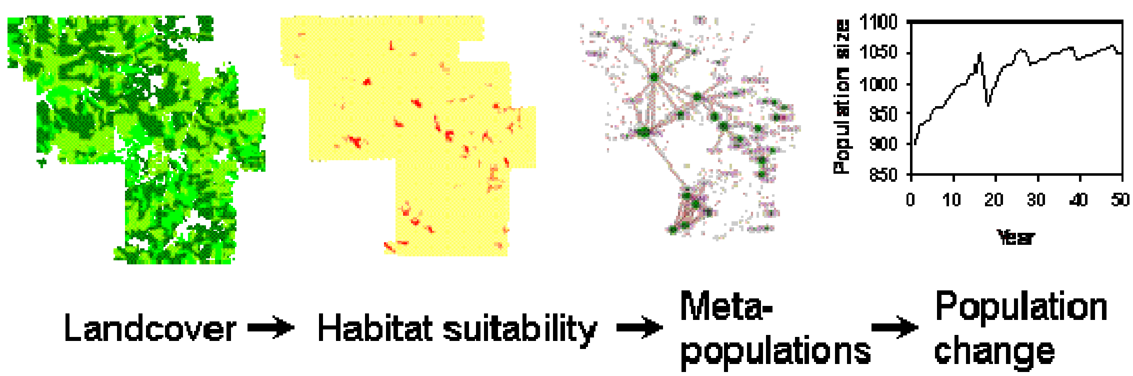
Urban, D.L. (2002). *Tactical monitoring of landscapes. In Integrating Landscape Ecology Into Natural Resources Management* (eds J. Liu & W.W. Taylor), pp. 294-311. Cambridge University Press, New York, New York.

Bridging the Gap Between Habitat-modeling Research and Bird Conservation with Dynamic Landscape and Population Models

Frank R. Thompson, III, U.S. Forest Service Northern Research Station

Habitat models are widely used in bird conservation planning to assess current habitat or populations and to evaluate management alternatives. These models include species-habitat matrix or database models, habitat suitability models, and statistical models that predict abundance. While extremely useful, these approaches have some limitations. They are generally static and don't easily address succession, land management, or disturbance. They generally address the amount of habitat or habitat suitability and, if linked to bird numbers, they assume available habitat is occupied. The assumption that all available habitat is occupied, or that breeding habitat is limiting, can be tenuous modeling Neotropical migratory birds.

The use of dynamic landscape modeling can be very valuable to wildlife conservation planning (Akçakaya et al. 2004, Wintle et al. 2005, Shifley et al. 2006). A failure to account for succession, natural disturbances, changes in land use, or planned management activities can result in inaccurate or biased estimates of habitat suitability, abundance, or viability. Dynamic landscape models simulate vegetation and landscape processes and project landscapes forward in time in a spatially explicit way. One simple way to use these landscape models is reapply the types of wildlife models mentioned above to forecasted future landscapes (i.e., Shifley et al. 2006). However this approach doesn't really model population processes but instead applies a static wildlife model to future conditions. A more desirable approach may be to integrate a dynamic population model with a dynamic landscape model (i.e., Akçakaya et al. 2004, Wintle et al. 2005). Dynamic population models typically project populations forward in time using a population stage matrix that is parameterized with productivity and survival information.



Population vital rates can be linked to habitat or patch characteristics. For example, productivity can be a function of the amount of edge or patch size. These models can also incorporate uncertainty resulting from variation in our estimates of vital rates or from true process (biological) variation in the rate of interest. The end product can be a projection of population size over time or statistics such as the probability of persistence.

As the objectives for conservation become more oriented toward population or viability goals, the appeal of dynamic modeling should be obvious. So what's required to implement these approaches? Similar to habitat based modeling, a GIS environment is needed to model habitat suitability and identify patches of suitable habitat across a landscape. However, there is also a requirement for knowledge of population vital rates and assumptions about dispersal and density dependence, which is generally harder information to come by than knowledge of habitat suitability.

I believe, as others have suggested (Akçakaya et al. 2004, Wintle et al. 2005), that dynamic landscape metapopulation models have great utility for conservation planning. The widespread adoption of these approaches may be hindered, however, by stricter requirements for new data and skills compared to earlier approaches. Spatially explicit information on habitat composition and structure is required to map habitat suitability, to simulate habitat and landscape change, and to dynamically link landscape or habitat change models to avian population models. This spatial data will likely come from existing and new remote-sensing products or from spatial modeling of existing stand or point-based inventories.

The implementation of dynamic modeling and adoption into conservation planning can be facilitated in several ways. Conservation teams should not be afraid to try models with existing knowledge; but document assumptions and try to examine the sensitivity of results to assumptions. The models will require continued and new studies of population vital rates rather than just habitat and abundance. New monitoring programs should address assumptions concerning population processes as part of an adaptive management process, in addition to the traditional surveillance monitoring of trends in abundance. Also, the effort and knowledge needed to implement dynamic landscape metapopulation models will likely restrict their use to a limited number of priority species while simpler approaches can be applied in coarser-grained planning. Within this context it's good to remember that comparisons of alternative modeling approaches is good science, and that comparison of results from dynamic landscape metapopulation models with more broadly applied habitat or abundance-based approaches can serve as a form of validation.

And finally, as the complexity of planning tools and approaches increases, I believe effective conservation will increasingly demand partnerships among scientists, managers, and planners and regional partnerships to share products—and this is essentially the Partners in Flight model!

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Literature Cited

Akçakaya, H. R., V. C. Radeloff, D. J. Mladenoff, and H. S. He. 2004. Integrating landscape and metapopulation modeling approaches: viability of the sharp-tailed grouse in a dynamic landscape. Conservation Biology 18:526–537.

Shifley S. R., F. R. Thompson, III, W. D. Dijak, M. A. Larson, and J. J. Millspaugh. 2006. Simulated effects of forest management alternatives on landscape structure and habitat suitability in the Midwestern United States. Forest Ecology and Management 229:361–377.

Wintle, B. A., S. A. Bekessy, L. A. Venier, J. L. Pearce, and R. A. Chisholm. 2005. Utility of dynamic-landscape metapopulation models for sustainable forest management. Conservation Biology 19:1930–1943.

Fox Sparrow, /Carla Stanley

The Avian Knowledge Network: The Role of Bioinformatics in Partners In Flight

Steve Kelling, Cornell Lab of Ornithology

Effective bird conservation requires identification of environmental features that are most important in determining where birds will and will not live. Not only do we need such information to react to current problems, but we also need to be able to forecast which species will be at heightened risk in the future and take action at a point when the economic costs of management are lower and probabilities of success higher. But ecological systems vary through space and time, which presents two fundamental challenges. First, we need a consistent source of data that spans entire continents. Second, we need to make very sophisticated analytical tools that can identify impacts of environmental change at the appropriate scale and make their results available to a wide range of audiences in an intuitive and informative format.

Bioinformatics is the science of biological information and includes the management and processing of data through data curation, computationally intensive computing, and statistical analysis. The Avian Knowledge Network (AKN) (http://www.avianknowledge.net) is bringing bioinformatic concepts to the PIF community, where it serves as an organizing structure for data curation, and provides a platform for exploration and analysis of these data across broad ecological landscapes.

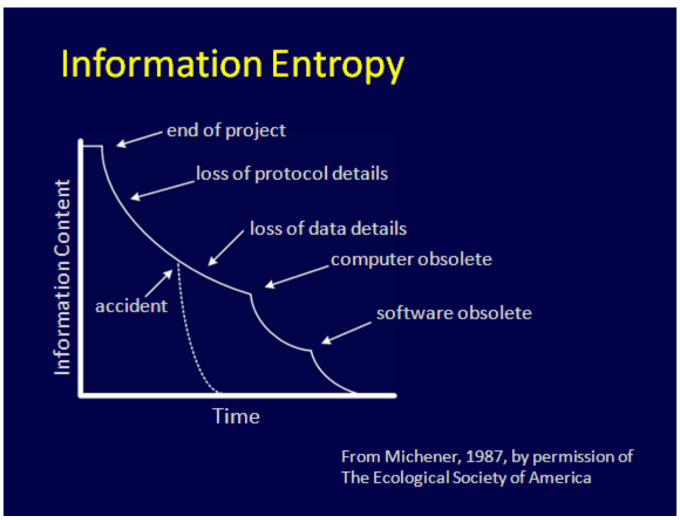

Figure 1. Information entropy: The natural tendency for the information gathered in a study to degrade over time.

Data: Data management is typically the last concern of a researcher developing a project to gather observations of birds, with the result that most data are stored in simple spreadsheets with little effort to describe and preserve their contents. Consequently, it is estimated that as many as 5% of all bird records that have been collected are being lost annually. This is because many investigators do not realize the significance of their data outside their own specific requirements, which leads to a natural tendency for the information gathered in a study to degrade over time (Figure 1).

The loss of data through information entropy is not as great through broad-scale monitoring programs (e.g. USGS Breeding Bird Survey, Institute for Bird Populations MAPS, Audubon Christmas Bird Count, or Cornell Lab of Ornithology/Audubon eBird), and these projects provide one of the largest data resources for broad scale biodiversity data access initiatives. But the data gathered through directed surveys, which is the most commonly used data gathering technique in ecological studies, are being lost at an alarming rate. This is because most directed surveys are gathered by researchers working autonomously, which creates a network of heterogeneous data repositories with little opportunity for data integration or reuse, and eventual data degradation and loss.

The AKN is making a concerted effort to identify and archive all bird observation data. The AKN and its many partners curate data at 3 levels:

Level 1: All projects that gather bird observations are identified, a complete metadata description is created (and entered into the Natural Resource Monitoring Partnership), and the dataset is archived in its original format.

Level 2: All datasets are organized into the AKN's Primary Data Warehouse, which is a standardized data structure that enhances data interoperability.

Level 3: Depending on its access level, data from the AKN Primary Data Warehouse can be used for specific data visualizations, analyses, and access.

Analytical Tools: The AKN is developing new techniques to explore patterns of bird occurrence across broad ecological landscapes. This is done by modeling AKN data resources using highly automated, nonparametric data mining techniques that identifies patterns of habitat-selectivity in birds. One feature of these habitat-selectivity associations is that they accurately predict bird abundance in locations that have not been sampled. For example, Figure 2 shows a preliminary result from our work. We estimated the relative abundance of Yellow Warbler on three different days during its 2006 breeding season in the Eastern U.S. The map shows detailed spatial patterns of abundance before the spring migration (Figure 2, left). The dark contours indicate the absence of the Yellow Warbler across most of the Eastern U.S. The center map shows the relative abundance on May 8 during the peak of the migration when the overall abundance across the Eastern U.S. was at its highest. The right map (Figure 2, right) provides a snapshot during the return migration in late September.

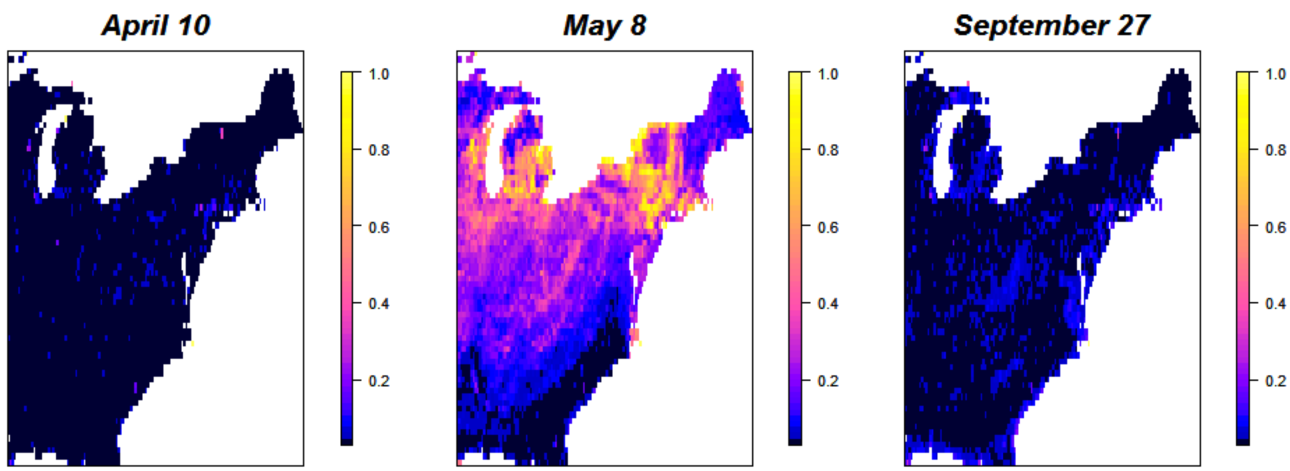

Figure 2. Surface estimates showing the relative abundance of Yellow Warbler in 2006. (Left) before the spring migration, April 10, (Center) during peak abundance, May 8, and (Right) during the fall migration, September 27.

In conclusion, the AKN provides a sufficiently robust information infrastructure to provide access to a diversity of data resources along with tools for data manipulation, exploration, analysis, and visualization. It does this by using proven bioinformatics techniques to provide a stable data organization structure that meets the needs for open, persistent, robust, and secure access to well-described and easily discovered bird observational data. Additionally, techniques in data intensive computing are providing new insights into the distribution and abundance of bird populations across broad geographic landscapes. These processes will provide a better understanding and increased ability to moderate the increasing anthropogenic pressures exerted on ecological systems (e.g. global warming, habitat destruction, infectious disease transmission).

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Indigo Bunting, /Dave Menke

Putting Strategic Habitat Conservation to Work for Birds: The Importance of Communications and Social Marketing

Rex R. Johnson, U.S. Fish and Wildlife Service and Charles K. Baxter, retired U.S. Fish and Wildlife Service employee

Basic concepts of strategic habitat conservation (SHC) are becoming deeply entrenched in the bird conservation community. In this paper, we present some ideas for fulfilling our mission of conserving abundant future bird populations via the growing body of SHC participants and outputs. A number of these ideas are already being promoted because they are a natural extension of the logic of SHC.

As a process, SHC consists of five elements: biological planning, conservation design, conservation delivery, outcome-based monitoring, and assumption-driven research. Each element yields products that are valuable in making our objectives and strategies more credible and visible. Through the application of SHC, we are seeking to affect bird populations, help habitat managers make more efficient decisions, and affect the awareness and attitudes of our investors (i.e., the public). Employing a strategic, science-based approach to population and habitat management has led to profound positive change for much of the conservation community. However it has not been enough to ensure mission success. Primarily this is because the awareness and attitudes of the public have not been adequately affected.

At the Fourth International Partners in Flight Conference in February 2008, participants were very good at communicating SHC techniques and products. These participants typically include a finite group that is mostly employed by state and federal agencies as well as non-governmental organizations having a significant interest in bird conservation. We will call this the bird conservation community. Most SHC products, such as population and habitat objectives, priority conservation areas, and the outcomes of monitoring and research on the effects of management and landscapes on bird populations, are discussed almost exclusively within this small community.

Thus, the concept of this group as a representative community of public interests deserves strong consideration. Communities are comprised of two groups called actors and effectors. Actors, such as the public, take an interest in an issue and express their will to effectors, such as elected officials or corporate leadership, who in response effect a change in the system typically by modifying objectives, operating practices, and the distribution of resources. However, we submit that the number of *motivated* actors that comprise the existing bird conservation community is too small to achieve change in the way we manage lands to conserve healthy ecosystem function, including abundant bird populations. We therefore need a new approach to bird conservation that encourages a broader community with many more motivated actors.

To understand the challenge of building a larger and more motivated community, we can consider a hierarchy of human concerns (in order of priority): preserving physical and emotional health, perceiving financial security, and investing in aesthetics. Each level in this simple hierarchy is founded on having achieved the one below it. Most of the world's population, even in the U.S., never perceive financial security and thus fail to reach the aesthetic level; yet, wildlife conservation and ecosystem health (at present, a very abstract concept for most people) are treated as aesthetic issues in American society. As an example, the FY2008 funding for NAWCA, the Neotropical Migratory Bird Conservation Act, and State Wildlife Grants totals $158 million, while the FY2008 National Endowment for the Arts is $128 million.

Wildlife and their habitat are only conserved with the concurrence and cooperation of the people. Aldo Leopold recognized this, but despite his profound effect on the existing bird conservation community, Leopold's writings have failed to resonate with the larger public. In fact, one might speculate that his premise of evolving a land ethic is fundamentally unattainable until we become more effective at connecting ecosystem health to the public's primary concerns – physical and perceived fiscal wellbeing.

One way to build this larger community of motivated actors is to increase awareness of the importance of healthy ecosystems, in part based on the products of SHC, using an aggressive marketing and communication

The North American Bird Conservation Initiative (NABCI) is a coalition of organizations and initiatives dedicated to advancing integrated bird conservation in North America.

The vision of NABCI is to see populations and habitats of North America's birds protected, restored, and enhanced through coordinated efforts at international, national, regional, state, and local levels, guided by sound science and effective management.

The goal of NABCI is to deliver the full spectrum of bird conservation through regionally based, biologically driven, landscape-oriented partnerships.

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campaign. Marketing professionals understand that a compelling message speaks to people's primary motivations using sticky messages that are simple and concise, full of visual images, not statistics, unexpected to the point of being sensational if not at least interesting, and emotional – people feel things for other people, pets, or individual animals, not abstract concepts like extinction rates (Heath and Heath 2007). In short, marketing is the antithesis of everything scientists are taught.

The recruitment of motivated actors paradoxically requires encouragement through restrictions and/or empowerment. We must either propose laws that limit how individuals use natural resources – including their own land – or we craft participatory conservation programs based on good science *and* an awareness of social and economic factors that affect landowners. This does not mean that every agency and organization needs to reprogram its budget to hire marketing specialists, rural economists, and sociologists; however, we contend that only by embedding the importance of healthy ecosystems in the public consciousness using concrete concepts of individual health and wealth, and with a sensitivity to socio-economic factors, can we achieve our objectives for bird populations.

When NABCI was established nearly ten years ago, the expectation was that it would function to "grow the pie" to accommodate all-bird conservation, not split the pie into smaller slices. The implicit promise in "growing the pie" was that each agency and organization at the table would bring its own constituencies to create the larger community of motivated actors. Unfortunately, we failed to consider how much our respective constituencies overlapped. We also failed to account for the degree to which agencies and organizations were functionally redundant. Each had its own vertically integrated capacity for planning, fund raising, communication, and often management. In other words, we did not enlarge our community or our capacity for conservation.

The conservation community's vertically-integrated, program-specific, agency-centric business models will not support a collective pursuit of conservation. To fulfill the promise of NABCI, we need to avail ourselves of transformational thinking occurring within the business world — specifically the concept of business ecosystems (Moore 1996, Iansiti and Levien 2004). Because conventional theories of markets and competition are falling by the wayside, unable to explain the complexities of horizontal integration, collaboration, and networking, the business world has turned to ecological systems as a metaphor to understand the increasingly complex relationships that a business needs if it is to sustain itself. Due to this ecological insight, companies are becoming increasingly functionally allied in order to accomplish basic business tasks such as research and development, supply chains, product distribution, marketing, and customer service. Hence, there is synergy to be gained by synthesizing the conceptual models of Business and Ecology, which could grow the conservation community.

Planning, implementation, biological and socio-economic monitoring and research, and communications and marketing are the functional elements of our conservation enterprise. We believe it is time for horizontal integration among private, state, and federal conservation agencies in performing these functional elements. The traditional paradigm of vertically-integrated businesses competing within the confines of their established industry is dead – replaced by the concept of business ecosystems. Is it not time to borrow the transformational thinking of business; embrace the concept and practice of horizontal-integration; and in so doing create "conservation partner ecosystems?"