I. **Title:** Designing Sustainable Landscapes for Bird Populations in the Eastern United States

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III. **Project Objective(s):** The overall objective of this proposal is to develop a consistent methodology and to enhance the capacity of states, joint ventures and other partners to assess and design sustainable landscape conservation for birds and other wildlife in the eastern United States. Specifically, this project would develop and implement a framework and tools to 1) assess the current capability of habitats in ecoregions in the eastern United States to support sustainable bird populations; 2) predict the impacts of landscape-level changes (e.g., from urban growth, conservation programs, climate change) on the future capability of these habitats to support bird populations; 3) target conservation programs to effectively and efficiently achieve objectives in State Wildlife Action Plans and bird conservation plans and evaluate progress under these plans; and 4) enhance coordination among partners during the planning, implementation and evaluation of habitat conservation through conservation design.

IV. **Proposed Length of Project:** Three years

V. **Funding Requested:** 2008: $119,741; 2009: $218,873; 2010: $183,798; Total: $522,412

VI. **Funding Source:** 100% Wildlife Restoration

VII. **States Benefited:** A majority of states in two U.S. Fish and Wildlife Service regions (7 of 11 states in Region 4 and all 14 states/D.C. in Region 5), all states in the Atlantic Flyway, all states in the Northeast Association of State Fish and Wildlife Agencies plus one state in the Midwest region.

VIII. **National Conservation Need (NCN) Addressed:** #2**:** Large-scale Habitat Conservation Design, Implementation, and Evaluation for the Conservation of Birds and Other Fish and Wildlife Species.

IX. **Summary Statement:** This project would directly address the statement of need and expected benefits of the NCN by providing a framework and methodology to conduct integrated conservation design at large spatial scales. The project would use the consistent habitat classification (Ecological Systems) and mapping being developed for the mapping regions in the eastern United States by the Regional Gap Analysis Program and Northeast Association of Fish and Wildlife Agencies as the basis for a consistent, model-based, spatially-explicit approach to conservation design for migratory birds using these habitats. This methodology would apply to seven bird conservation regions (BCRs), three existing or developing joint ventures (Atlantic Coast, East Gulf Coastal Plain, and Appalachian Mountains) and 22 states, with eventual application nationwide. Complete implementation of this approach would be piloted in the South Atlantic Migratory Bird Initiative (SAMBI) region (eastern part of the Southeastern Coastal Plain BCR in VA, NC, SC, GA and FL) and a modeling framework and approach would be applicable throughout the East allowing for implementation as mapping products and funding become available. The project would complement ongoing state, federal and NGO projects related to conservation design.

Title: Designing Sustainable Landscapes for Bird Populations in the Eastern United States

Objectives: The overall goal of this proposal is to develop a consistent methodology and to enhance the capacity of states, joint ventures and other partners to assess and design sustainable landscape conservation for birds and other wildlife in the eastern United States. Specifically, this project would develop and implement a framework and tools to:

1) Assess the current capability of habitats in ecoregions in the eastern United States to support sustainable bird populations. The project would develop and/or refine a set of bird-habitat models based on the Ecological Systems land cover and other habitat attribute data

developed by Regional Gap Analysis and others representing major habitat types in ecoregions of the eastern United States. The set of species modeled would be derived partially from priority species and species-habitat suites from State Wildlife Action Plans and bird conservation plans. Success under this objective would be the completion of a set of species-habitat models and maps representing a broad range of habitats in a pilot ecoregion in the eastern United States that allow for estimates of the capability of that ecoregion (and state portions of that ecoregion) to support populations and the development of a consistent methodology using Ecological Systems data. The results of this analysis would allow for refinement of population and habitat objectives in State Wildlife Action Plans and bird conservation plans at state, ecoregional and, ultimately, continental scales. Methods and models will be developed in cooperation with partners from multiple ecoregions and will be directly applicable to the entire set of ecoregions covered by Eastern Regional Gap Analysis (Figure 1) as those data become available.

Figure 1

2) Predict the impacts of landscape-level changes (e.g., from urban growth, succession, climate change and conservation programs) on the future capability of these habitats to support populations of migratory birds. The project would model predicted changes in land use and land cover patterns to predict changes in the capability of habitats to support priority populations. For example, one output of urban growth models is the pattern of habitat patches across the landscape showing loss, fragmentation and conversion of habitats due to urbanization and suburbanization. These outputs can be used in species-habitat models developed in this project to predict any reduction or change in capability of landscapes to support populations and, thus, be used to determine whether populations can be sustained at different levels of urban growth. We will be able to predict the benefits to populations from conservation programs such as the Farm Bill or North American Wetlands Conservation Act that protect, restore, enhance and manage habitats. When available, predicted impacts from climate change including changing vegetation patterns, hydrology and sea level also can be related to

bird populations. Success under this objective would be the completion of predicted habitat maps and data under future scenarios and associated habitat and population capabilities data. These results will allow states and other partners the ability to conduct long-term planning to prevent species falling below critical thresholds.

3) Target conservation programs to most effectively and efficiently achieve habitat objectives in State Wildlife Action Plans and bird conservation plans and evaluate progress under these plans. Decision support tools would be developed using habitat data layers from Regional Gap Analysis and bird-habitat models to determine where conservation should be targeted to optimally achieve population objectives for migratory birds. These tools will allow managers to determine how to target and optimize habitat conservation for a single bird species, multiple bird species using similar habitats or multiple species using multiple habitats in a diverse, dynamic landscape using limited resources. These tools will allow managers to compare and evaluate the expected outcomes from potentially conflicting management alternatives benefiting some species but having negative effects on others (e.g., decisions about whether to manage an area as a grassland or shrubland). These tools will be developed with input from decision-makers and managers from state and federal fish and wildlife and land management agencies as well as NGOs and large private landowners. Success under this objective would be the development of a broadly applicable framework for decision models, and the creation of maps and other decision support tools in the pilot ecoregion that are used by partners in an adaptive management framework to make informed decisions about where to focus limited conservation dollars, manage land or programs for species with conflicting habitat needs and evaluate progress of habitat conservation relative to the plans. These tools will be developed in cooperation with partners from multiple ecoregions and will be applicable across the entire eastern United States as data becomes available.

4) Enhance coordination among the many partners, initiatives and plans that have initiated efforts to be more effective with planning, implementation and evaluation of habitat conservation through conservation design. Although there are a number of state and federal agencies, NGOs and other partners working on various conservation design tools in the eastern United States, there has never been an effort to link these efforts together using a consistent set of habitat and species data layers, models, maps and decision support tools. The completion of Southeast Regional Gap Analysis and initiation of Northeast Regional Gap Analysis (jointly referred to as Eastern Regional Gap Analysis) provides the first opportunity for the development of seamless, consistent map data layers and a consistent approach for developing decision support tools using these data layers. A consistent system would result in more coordinated planning, implementation, and evaluation within and among the eastern states, three existing or developing joint ventures (Atlantic Coast, East Gulf Coastal Plain and Appalachian Mountains) and numerous BCR planning initiatives. Success under this objective would be measured by enhanced coordination in the development and long-term use of these decision support tools by all states in the pilot ecoregion and coordination on the development of the framework with other states and key partners throughout the eastern United States.

Problem Statement: Conservation planning for migratory birds has been occurring at the continental, national, regional and state scales for a number of years but, for the most part, conservation design tools that allow managers to determine how much, what and where specific habitats are needed on the landscape to sustain priority bird populations have not been developed consistently and are not widely available, especially in the eastern United States. With the completion of national and regional bird conservation plans and the completion of State Wildlife Action Plans in each state, there is an immediate need for a consistent conservation

design framework and set of tools at state and ecoregional scales that allow managers to make scientifically-based decisions about habitat conservation and evaluate progress relative to objectives stated in these plans. Current bird conservation planning does not allow for a quantitative assessment of the capability of landscapes to sustain populations at objective levels or the impact of net land use change. Current bird conservation planning also is hampered by the inability to assess holistically (i.e., for all species-habitat suites) the current or likely future landscape condition or its ability to support sustainable bird populations. In the eastern United States, bird conservation plans have been developed for several BCRs that have stepped down continental priorities and identified priority species and habitats, threats, limiting factors, population and habitat objectives and coarse focus areas for bird conservation. A Regional Gap Analysis project recently completed for Southeast states and underway in the Northeast states will result in up-to-date, uniform, habitat classification and maps. This proposed project would meet the need for consistent, widely-available conservation design tools, draw from the priorities in continental, BCR, and State Wildlife Action Plans and use the Regional Gap Analysis habitat data layers to build a framework and specific tools for conservation design that can be applied across the eastern United States and eventually across the country.

This project will address the NCN entitled: "Large-scale Habitat Conservation Design, Implementation, and Evaluation for the Conservation of Birds and Other Fish and Wildlife Species". The project will provide benefits to all the states in the Northeast Region and the Northeast Association of Fish and Wildlife Agencies (ME, NH, VT, MA, RI, CT, NY, NJ, PA, MD, DE, DC, VA, WV), and seven of the states in the Southeast Region (NC, SC, GA, FL, AL, TN, KY), as well as one state in the Midwest (OH). This NCN was originally recommended to the Bird Conservation Committee by the Atlantic Coast Joint Venture and this proposal is designed by Atlantic Coast Joint Venture partners and others to directly and completely meet the statement of need and provide the outcomes anticipated in that NCN. This project will result in enhanced conservation design capacity by state fish and wildlife agencies, federal agencies, NGOs and joint ventures across the entire eastern United States and will develop an approach and methodology that can be applied across the entire country. This project is being developed in cooperation with three joint ventures, state, federal and NGO partners and the approach is designed to integrate priority species and habitats and population and habitat objectives from bird plans and State Wildlife Action Plans into planning activities thus ensuring implementation through various delivery mechanisms and evaluation by partner organizations. This project is designed in part to use a model-based approach to monitor and evaluate the impact of changing habitat patterns across the landscape from conservation, development and other factors on the ability of ecoregions to support migratory and resident bird populations.

Experience: The partners involved in this project have extensive and varied experience in partnership coordination and in developing and implementing bird conservation planning, land cover mapping, wildlife habitat modeling and decision support tools in the eastern United States. Jaime A. Collazo is a Professor of Zoology and Forestry and Assistant Unit Leader at the Cooperative Fish & Wildlife Research Unit located at North Carolina State University and has been a principal investigator on state and regional Gap Analysis Projects since 1996. Alexa McKerrow and Steve Williams have led Eastern Regional Gap Analysis efforts to map land cover and develop vertebrate models. James Barry Grand is an Associate Professor and Unit Leader of the Alabama Cooperative Wildlife Research Unit located at Auburn University and a principal investigator for the Alabama Gap Analysis Project and is developing decision support tools for the East Gulf Coastal Plain Joint Venture. Tim Jones, Craig Watson and Andrew Milliken have extensive experience with the many partners involved in biological planning, conservation design, conservation delivery, research and evaluation in the Atlantic Coast Joint Venture and Appalachian Mountains Bird Conservation Region.

Approach: This project would be a collaboration between two universities, the Atlantic Coast Joint Venture and many state, federal and NGO partners involved in bird conservation in the eastern United States. The universities would be primarily responsible for the development of the models, maps and decision support tools as described below and the joint venture would primarily be responsible for collaborating with partners throughout the project.

The products developed though this project will build on several regional efforts that are currently developing or have recently completed spatial data, most notably the Gap Analysis Program (GAP), which will be delivering a Southeast land cover map based on Ecological Systems (www.natureserve.org/publications/usEcologicalsystems.jsp) -- the most detailed land cover map to date at this resolution. GAP also will deliver interim mapping products for the Northeast to cooperators by 2009 and will have a consistent, seamless land cover product by 2011 for the entire eastern United States. Ecological Systems has become a de facto standard for land cover classification for remote sensing specialists and a growing number of habitat modelers. This consistent approach is critical given the myriad habitat classification systems and descriptions across multiple states, NGO's and federal agencies. In addition to land cover, GAP products include terrestrial vertebrate species predicted habitat models that will provide a solid foundation for the development of abundance/population models through the supporting ancillary data sets and extensive habitat relationship database used in their development (www.basic.ncsu.edu/segap). This project also will draw on other relevant bird habitat modeling efforts from the eastern United States (e.g., Tirpak et al. In Press, Larson et al. 2004).

Several other regional spatial analysis efforts will be integral to the completion of this project. This project will build upon the single-habitat longleaf pine decision support tool (DST) being developed by the East Gulf Coastal Plain Joint Venture by integrating the needs of priority species across the suite of habitats they use, thereby incorporating the needs of species such as Northern Bobwhite that use a variety of habitats often occurring as mosaics in the landscape. This project will also build upon the NEAFWA Northeast Habitat Classification and Mapping project that is developing a habitat classification that crosswalking classifications from Northeast State Wildlife Action Plans with the Ecological Systems classification and developing a common basis for habitat-species models and decision support tools.

To track progress on this project, the major participating organizations (North Carolina State University, Auburn University and Atlantic Coast Joint Venture) will submit quarterly progress reports and an annual summary of accomplishments to AFWA. In addition, joint venture staff will report progress on this project twice annually to joint venture management boards (boards generally consist of state Directors and Wildlife Administrators, federal and NGO representatives). The project's effectiveness in achieving its objectives will be evaluated through 1) comparing the annual accomplishments with the expected annual outcomes and specific deliverables detailed in this proposal and 2) seeking an annual review of progress and feedback from SAMBI working groups and joint venture technical committees representing state fish and wildlife agency biologists and representatives of the major bird conservation initiatives.

Objective 1: Assess the current capability of habitats in ecoregions in the eastern United States to support sustainable bird populations. As a first step to ensure proper model development and application, focal species representing each habitat type occurring within the SAMBI area (about 15 habitat types) will be selected based, in part, on the list of priority species (http://www.acjv.org/documents/SAMBI_priority_species_by_habitat.doc) from the SAMBI plan (Watson and Malloy 2005) and State Wildlife Action Plans. In order to ensure the widest applicability to the bird conservation community, these focal species will be selected based on

their ecological representation of priority habitat types (i.e., umbrella species). Effort also will be made to include representative species from each of the major bird initiatives (landbirds, waterbirds, shorebirds, upland gamebirds and waterfowl) and develop models for both breeding and wintering species.

Once focal species are selected, model refinement and application will build on ongoing GAP, U.S. Fish and Wildlife Service and other efforts aimed at extending species-habitat models beyond presence/absence to include habitat suitability indices and population densities. These models are based on an existing database that documents vital rates, habitat choice and survey results in a format that can be queried and summarized to provide documented parameters for critical assumptions in models. The resulting datasets will allow for estimates of the ability of the current landscape to support populations; these estimates can then be compared to ecoregional and state population and habitat objectives and used by managers to set realistic objectives. For example, partners in North Carolina could use the models to evaluate the SAMBI objective of restoring and maintaining 2,835 hectares of pocosin/savannah to support 5,000 breeding pairs of Henslow's Sparrows and revise management strategies or objectives accordingly.

To fully engage the conservation community and build upon their biological expertise, modeling workshops will be held to review existing models and results of literature review and develop the initial habitat suitability models for focal species in each habitat type. Further refinement of habitat models to predict population numbers through relationships with mappable landscape characteristics will be conducted through an iterative process with engaged reviewers throughout the region. These predictions will be validated, when possible, using existing survey data of partners and regional projects such as the Breeding Bird Survey.

Objective 2: Predict the impacts of landscape-level changes (e.g., from urban growth, succession, climate change and conservation programs) on the future capability of these habitats to support populations of migratory birds. Another major component of this effort will be the implementation and/or development of landscape-level simulation models that can be used to evaluate future land cover composition and ability of future landscapes to support bird populations. For this study we are proposing to modify existing land use and succession models and apply them within the SAMBI region. Specifically we will evaluate the application of models such as LANDIS and Harvest to the Southeast Gap Analysis land cover data for modeling vegetation dynamics. Urban growth will be modeled using existing approaches (e.g., Clarke Urban Growth model). Input data available in the SAMBI region include the Census Block Data, National Land Cover Dataset (NLCD 2001; Homer et al. 2007), a coarse-level change analysis based on the NLCD, NOAA C-CAP change analysis products for the coast (NOAA-CSC 1995), and the Southeast Gap Analysis Land Cover.

Another potential major driver of landscape change is global warming. While the impacts of climate change on habitats is a rapidly developing area of research, given the complexity and understanding (or lack thereof) of interactions, full integration into this project at this time may not be realistic. However, the profound potential of climate change to radically alter the future condition of the landscape necessitates an exploratory approach with the idea that full integration would be more fruitful as additional information becomes available. For this project, we are proposing to use existing modeled scenarios to identify the potential impact of climate change on habitat suitability. The findings of the National Analysis Synthesis Team will be the primary source for information on the potential regional and national impacts of global climate change (NAST 2000). For example, the potential future forest types for the Northeast based on the Canadian and Hadley climate scenarios (Iverson and Prasad 1998) could be used to identify

shifts in habitat. We also will collaborate with partners who are assessing the impact of climate change on existing conserved lands including The Nature Conservancy in the Southeast.

Future landscape conditions also are affected by conservation actions taken by the partners to protect, restore, enhance and/or manage habitats. The effect of various levels of conservation actions by particular programs such as Farm Bill or the North American Wetlands Conservation Act can be evaluated, and comparisons of the future capability of landscapes to support populations with or without these programs can be made (e.g., the ability of agricultural landscapes to support early successional species with or without Farm Bill practices). This project can serve as a basis for collaboration with ongoing evaluation programs such as the Conservation Effects Assessment Program of the Natural Resource Conservation Service.

Combining the output of the landscape simulation and urban growth models will provide a set of spatially-explicit realizations of future landscape conditions. These results will serve as input to the previously developed species-habitat relationship models to predict community and population response to future landscape conditions and allow for evaluation of threats and objectives in State Wildlife Action Plans and bird conservation plans.

Objective 3: Target conservation programs to most effectively and efficiently achieve habitat objectives in State Wildlife Action Plans and bird conservation plans and evaluate progress under these plans. Using spatial models of focal species for each habitat type, decision support tools will be developed to guide decisions about where to most efficiently focus efforts on habitat conservation for each habitat type. For example, using quantitative species-habitat models for Bachman's Sparrow, a decision-support tool could be developed to determine where to protect longleaf pine and early successional habitats to achieve the greatest benefit for this and other species using this habitat type plus determining how much additional habitat would be needed to support the population objective for this species.

The integration of species-habitat and landscape change models (objectives 1 & 2) will result in predictions of future avian population levels and distribution across the landscape. These predictions will be evaluated under a variety of alternative management scenarios to examine the effects of each scenario across a suite of priority species. When integrated with the relative conservation concern and proximity to achieving population objectives, the results will allow managers to evaluate and prioritize the relative merits of conservation actions when faced with competing priority species requirements such as trade-offs between managing for brackish or freshwater wetlands. The spatially explicit maps and analyses will identify priority conservation areas for priority species, assess the capacity of current landscapes and conserved lands to support populations of priority species, help to resolve conflicts among competing management objectives for priority species and incorporate the influence of land cover changes due to management actions or other causes (e.g., succession, urbanization) on management priorities. These tools will conform to the adaptive resource management paradigm by presenting competing models of future condition based on explicitly stated hypotheses and testable assumptions that can serve as a basis for improving applied research and monitoring programs.

The decision tools resulting from this project would be further evaluated using results generated by the concurrent U.S. Fish and Wildlife Service Science Support project entitled "Development of Estimation Methods for Evaluation of Management Activities at the Landscape Scale Using Species Occurrence Modeling" (Royle and Sauer 2006). The goal of this effort is to develop a metric that can be used to select the most effective (i.e., most favorable for all species) landscape configuration.

Objective 4: Enhance coordination among the many partners, initiatives and plans that have initiated efforts to be more effective with planning, implementation and evaluation of habitat conservation through conservation design. Development of consistent data layers (maps) and decision support tools throughout the region will provide a common language for each organization to communicate its conservation priorities. Joint venture and BCR partnerships will work with the principal investigators to engage partners throughout the design, development and implementation of this project to ensure that the tools developed meet the needs of states and other partners and that this project is coordinated with ongoing or planned initiatives. The development of a common approach will provide a catalyst for collaborative efforts including those described below. The products of the first three objectives will be made available through a Web site and provided directly to state fish and wildlife agencies and other partners in the format most useful to those partners.

In the SAMBI pilot region, joint venture and project staff will meet with working groups in each state (VA, NC, SC, GA, FL) during the first year to guide the selection of focal species and to articulate the needs of partners in those states for conservation design decision support tools. Workshops also will be held during the final year of the project to fully inform users of the utility and application of the decision support tools developed and coordinate their long-term use.

In the Northeast Region, joint venture and GAP staff will work with NEAFWA, NatureServe, TNC and other partners involved in the Northeast Habitat Classification and Mapping project to coordinate completion of habitat mapping and development of a consistent framework for conservation design consistent with this project. The Regional Conservation Need process in the Northeast coordinated by NEAFWA and the Wildlife Management Institute has identified several priority projects including Creation of Regional Habitat Cover Maps, Identification of Regional Focus Areas and Corridors for Conservation of SGCN, Development of Habitat Conservation of Initiatives at a Landscape Scale and Development of Regional Indicators and Measures that would benefit from the conservation design products developed in this project.

The Northern Bobwhite Conservation Initiative (NBCI) is conducting joint venture-based conservation design workshops to facilitate better-informed planning, decisions and integration of bobwhite conservation with other grassland/early successional birds. NBCI will use their planned workshops in the East Gulf Coastal Plain as an opportunity to use Ecological Systems land cover to develop models and maps for bobwhite and later workshops in other BCRs in the bobwhite range as an opportunity for refinement of those tools. East Gulf Coastal Plain Joint Venture partners will integrate ongoing efforts to develop the single habitat, multi-species decision support tools for longleaf pine and grassland ecosystems with other habitat types.

Numerous other efforts will benefit from collaboration through this project. Project partners will work with AFWA and Atlantic Flyway states to collaborate between tools developed in this project and the development of an Atlantic Flyway database of information from State Wildlife Action Plans related to Bird Conservation. Project partners will work with the Southeast and Northeast Regions of the U.S. Fish and Wildlife Service to link this project to the implementation of the Service's Strategic Habitat Conservation initiative including a pilot project in coastal Carolina. Project partners will collaborate with the Natural Resources Conservation Service on their Conservation Effects Assessment Project on a science base to support technically defensible decisions with respect to directing what Farm Bill practices are needed where on the landscape. Project partners will work with The Nature Conservancy to incorporate the products of this project into their ecoregional planning, including refining habitat mapping in the Northeast and assessing the impact of climate change on portfolios of conservation sites in the Southeast.

Timeline and Deliverables:

Date	Obj.	Item
Project Year 1		
2008		Develop matrix of habitat relationships based on existing GAP and other data; develop framework and data requirements for mapping conservation landscape; develop spatial data necessary for mapping landscape potential
Feb. 2008	1	Framework for the selection of focal species representing each habitat type in SAMBI region
Jun. 2008	4	Coordinate with Northeast on Habitat Classification and Mapping on completed classification and future mapping
Jul. 2008	1	List of focal species representative of each habitat type based on state working group meetings
Sep. 2008	2	Develop methodology for landscape change (i.e. urban growth, succession, climate change) for the SAMBI region
Project Year 2		
2009		Complete development of spatial data layers; evaluate umbrella species based on current land cover/land use data; develop spatial models for conservation landscapes; develop spatial models/DSTs for avian conservation priorities
Jan. 2009	4	Develop Web site for distributing initial information
Mar. 2009	3,4	Relative conservation priorities for species established based on population objectives, conservation concern, and management plans
Apr. 2009	2	Future landscape conditions dataset for SAMBI region completed
Aug. 2009	2	Methodology for incorporating and modeling conservation actions
Nov. 2009	2	Conservation action spatial datasets for SAMBI region
Dec. 2009	1	Spatial models of habitat suitability and population densities for priority species with clearly stated assumptions and full documentation
Project Year 3		
2010		Implement spatial models for conservation landscapes and implement integrated models for avian conservation priorities
Jan. 2010	3	Completion of initial DSTs for focal species/habitat suites
Feb. 2010	2,3	Integration of species-habitat and landscape change models in spatially explicit decision support tools
Mar. 2010	1	Validation of habitat suitability and population density models with existing survey data (where available)
Aug. 2010	4	State SAMBI working group meetings to fully inform users of the utility and application of the decision support tools developed and apply to refinement of SAMBI objectives and focal areas.
Dec. 2010	All	Final report; all products available on Web site; outreach to partners

Expected Results or Benefits: The project addresses the NCN by developing a consistent conservation design framework and set of tools at state and ecoregional scales that allow managers to make decisions about where, what and how much habitat is needed and how they can evaluate progress relative to objectives in State Wildlife Action Plans and bird conservation plans. This project is designed to set up an organizing framework that will guide conservation for many years and to act as a catalyst for future refinement of biological planning, conservation design, efficient conservation delivery and evaluation/monitoring. It directly addresses the

desired outcomes in the NCN as described in the problem statement section above and described in more detail below.

1) Enhanced conservation design capacity across the entire U.S. including improved spatial analysis and modeling tools. This project will result in enhanced conservation design capacity by states, federal agencies, NGOs and joint ventures across the entire eastern United States and will develop an approach and methodology that can be applied across the entire country as Regional Gap Analysis data become available. The project will develop improved spatial analysis and modeling tools relating bird populations to habitats that will allow managers to make science-based decisions on habitat conservation and management alternatives.

Tools developed through this project, including species-habitat models, maps and landscape designs, will enhance the capacity of state fish and wildlife agencies and partners in all 22 states in the Eastern Gap Analysis Region to determine the capability of habitats to support wildlife populations consistent with the State Wildlife Action Plans and bird conservation plans and to deliver habitat conservation efficiently and effectively. This project represents the first opportunity to conduct conservation design across a large portion of the country using seamless, consistent and widely available base habitat data layers. The Ecological Systems land cover used in this project can be updated in the future as more recent imagery becomes available allowing this approach to remain current and useful for many years to come.

The first set of tools developed through this project will be used by partners in states in the South Atlantic Coastal Plain (VA, NC, SC, GA, FL) to determine how to best meet objectives in SAMBI and objectives for the coastal plain ecoregions of those five State Wildlife Action Plans using a conservation design framework and methodology. There are five state working groups under SAMBI that will assist with the development of these tools and these biologists and managers will apply these tools to decisions about where to target habitat conservation and how to measure success and design monitoring. In other ecoregions, joint venture partnerships, state and BCR working groups will apply these approaches to their areas.

2) Improved development, integration, and implementation of bird conservation plans and habitat objectives into joint ventures, state and federal agency planning and other delivery mechanisms such as the Farm Bill programs and NAWCA grants program. This project is being developed in cooperation with three existing or developing joint ventures (Atlantic Coast, East Gulf Coastal Plain and Appalachian Mountains), state and federal agency partners and NGOs. The approach of this project is designed to integrate priority species and habitats, population and habitat objectives from continental, regional and BCR bird plans and State Wildlife Action Plans into planning, implementation and evaluation by these partner agencies and organizations. The tools developed through this process in the pilot area will initially be used by SAMBI partners and then by partners in other BCRs and joint ventures in the Eastern Regional Gap Analysis region. These joint venture and BCR partnerships are designed to integrate among the many partners addressing bird conservation in a specific region and deliver habitat efficiently through sound science. This project will provide these partners a set of tools that can provide more detailed information on where habitat conservation is needed, how much habitat conservation is needed and how to manage habitats to meet the needs of multiple species. We also are planning on collaborating with the Conservation Effects Assessment Program of NRCS to coordinate assessment and delivery of Farm Bill programs to meet wildlife habitat objectives.

3) Development and implementation of comprehensive bird evaluation and monitoring systems and for migratory and resident bird species. This project is designed in part to use a model-

based approach to evaluate the impact of changing habitat patterns across the landscape from conservation, development and other factors on the ability of ecoregions in the eastern United States to support migratory and resident bird populations. This project will complement various initiatives to coordinate bird monitoring in the Northeast, Southeast and Atlantic Flyway and be designed to both use monitoring information from existing initiatives and design effective monitoring approaches that allow for the evaluation of the effectiveness of conservation. The tools developed through this project will allow for the design of specific monitoring approaches for priority species based on species-habitat models and the Ecological Systems habitat classification and mapping. Partners will be able to use the models developed through this project to develop metrics to evaluate progress of habitat and species conservation relative to goals in State Wildlife Action Plans, For example, they will be able to relate the conservation of blocks of habitat to the benefit to Species of Greatest Conservation Need in their plans.

The project would set up a long-term framework for conservation design for ecoregions in the eastern United States and act as a catalyst for additional conservation design for birds and for other wildlife species. The products produced through this project would be the starting point of a long-term, iterative process for evaluating and refining population and habitat objectives and implementation strategies. The existing joint venture administrative structures would ensure that the framework and tools developed through this project continue to be easily available, used consistently, updated to reflect new information and expanded to address additional species and areas as resources become available. In addition, the Eastern Regional Gap Analysis project would be able to apply the results of this project to other ecoregions and other wildlife species as resources allow. In the Northeast, the NEAFWA Regional Conservation Needs process would utilize this conservation design framework for several regional priorities. Finally, the U.S. Fish and Wildlife Service Strategic Habitat Conservation initiative would use these conservation design tools for all fish and wildlife in both the Southeast and Northeast.

Certification regarding fishing/hunting: By submitting this proposal, the organization's primary contact and/or authorized representative identified in this grant application certifies that North Carolina State University (1) will not use the grant funds to fund, in whole or in part, any activity of the organization that promotes or encourages opposition to the regulated hunting or trapping of wildlife or the regulated taking of fish; and (2) that the grant funds will not be used, in whole or in part, for an activity, project or program that promotes or encourages opposition to the regulated hunting and trapping of wildlife or the regulated taking of fish.

Certification regarding partnership funds: By submitting this proposal, the organization's primary contact and/or authorized representative identified in this grant application certifies that North Carolina State University: 1) understands that partnership fund contributions are assessed in the Association's review and selection of its priority list of MSCGP projects, but are not considered by the USFWS to be an official non-federal match/cost-share; 2) will provide the partnership funds identified in order to complete the proposed project; 3) will report the expenditure of partnership funds to the USFWS and the Association as required, which will not be more frequently than quarterly; 4) understands that if the promised partnership funds are not provided, and there is not a sufficient explanation, potential consequences could include a poor "quality assurance" evaluation by the National Grants Committee for the organization's future MSCGP applications; the imposition of "special award conditions" on this proposed grant and/or future grants (pursuant to 43 CFR 12); and if the failure to provide partnership funds affects the scope/objective or deliverables or other terms and conditions of the grant, then the USFWS could take necessary enforcement and termination actions (pursuant to 43 CFR 12).

Budget:

Expenses	2008		2009		2010		Total Funding Requested	Total Partner Funds
	Funding Requested	P.F.	Funding Requested	P.F.	Funding Requested	P.F.		
Objective 1:								
Personnel	$3,473	$201,198	$26,652	$164,843	$27,985	$172,975	**$58,110**	$539,016
Fringe	$868	$43,145	$4,534	$38,357	$4,760	$40,274	**$10,162**	$121,776
Travel	$1,334	$5,300	$22,000	$3,425	$2,000	$5,300	**$25,334**	$14,025
Supplies	$1,666	$1,845	$1,667	$4,561	$0	$2,094	**$3,333**	$8,501
Equipment	$0	$0	$0	$1,650	$0	$0	**$0**	$1,650
Subcontract (Auburn)	$0	$0	$0	$0	$0	$0	**$0**	$0
Current Services	$0	$0	$5,000	$0	$0	$0	**$5,000**	$0
Other (Tuition)	$0	$5,647	$5,302	$6,014	$5,647	$6,405	**$10,949**	$18,065
Subtotal	$7,341	$257,135	$65,155	$218,849	$40,392	$227,048	**$112,888**	$703,032
Objective 2:				0				
Personnel	$22,832	$93,658	$27,620	$77,903	$7,657	$81,688	**$58,109**	$253,249
Fringe	$3,578	$20,735	$4,669	$18,926	$1,916	$19,872	**$10,163**	$59,533
Travel	$1,333	$5,300	$2,000	$8,525	$2,000	$5,300	**$5,333**	$19,125
Supplies	$1,667	$1,845	$1,667	$4,561	$0	$2,094	**$3,334**	$8,501
Equipment	$0	$0	$0	$1,650	$0	$0	**$0**	$1,650
Subcontract (Auburn)	$0	$0	$0	$0	$0	$0	**$0**	$0
Current Services	$0	$0	$0	$0	$0	$0	**$0**	$0
Other (Tuition)	$5,302	$5,647	$5,647	$0	$0	$0	**$10,949**	$5,647
Subtotal	$34,712	$127,185	$41,603	$111,565	$11,573	$108,954	**$87,888**	$347,704
Objective 3:				0				
Personnel	$0	$84,200	$0	$89,700	$0	$2,200	**$0**	$176,100
Fringe	$0	$0	$0	$0	$0	$0	**$0**	$0
Travel	$0	$5,300	$0	$3,425	$0	$5,300	**$0**	$14,025
Supplies	$0	$7,845	$0	$5,442	$0	$2,094	**$0**	$15,382
Equipment	$0	$0	$0	$1,650	$0	$0	**$0**	$1,650
Subcontract (Auburn)	$37,793	$0	$47,141	$0	$48,474	$0	**$133,407**	$0
Current Services	$0	$0	$0	$0	$0	$0	**$0**	$0
Other (Tuition)	$0	$20,647	$0	$21,014	$0	$0	**$0**	$41,660
Subtotal	$37,793	$117,992	$47,141	$121,231	$48,474	$9,594	**$133,407**	$248,817

Budget Continued

Expenses	2008		2009		2010		Total Funding Requested	Total Partner Funds
	Funding Requested	P.F.	Funding Requested	P.F.	Funding Requested	P.F.		
Objective 1:								
Subtotal	$7,341	$257,135	$65,155	$218,849	$40,392	$227,048	**$112,888**	$703,032
Objective 2:				0				
Subtotal	$34,712	$127,185	$41,603	$111,565	$11,573	$108,954	**$87,888**	$347,704
Objective 3:				0				
Subtotal	$37,793	$117,992	$47,141	$121,231	$48,474	$9,594	**$133,407**	$248,817
Objective 4:				0				
Personnel	$3,473	$24,350	$7,293	$25,348	$7,657	$4,400	**$18,423**	$54,098
Fringe	$868	$2,793	$1,823	$2,933	$1,912	$0	**$4,603**	$5,726
Travel	$1,333	$6,100	$2,000	$4,225	$22,000	$6,100	**$25,333**	$16,425
Supplies	$1,667	$1,845	$1,666	$4,561	$0	$2,094	**$3,333**	$8,501
Equipment	$0	$0	$0	$1,650	$0	$0	**$0**	$1,650
Subcontract (Auburn)	$12,598	$0	$15,714	$0	$16,158	$0	**$44,469**	$0
Current Services	$0	$0	$0	$0	$5,000	$0	**$5,000**	$0
Other (Tuition)	$0	$0	$0	$0	$0	$0	**$0**	$0
Subtotal	$19,939	$35,088	$28,496	$38,716	$52,727	$12,594	**$101,161**	$86,399
All Objectives:				$0				
Personnel	$29,778	$403,406	$61,565	$0	$43,299	$261,263	**$134,642**	$664,669
Fringe	$5,314	$66,673	$11,026	$0	$8,588	$60,146	**$24,928**	$126,819
Travel	$4,000	$22,000	$26,000	$0	$26,000	$22,000	**$56,000**	$44,000
Supplies	$5,000	$13,380	$5,000	$0	$0	$8,377	**$10,000**	$21,757
Equipment	$0	$0	$0	$0	$0	$0	**$0**	$0
Subcontract (Auburn)	$50,390	$0	$62,854	$0	$64,632	$0	**$177,876**	$0
Current Services	$0	$0	$5,000	$0	$5,000	$0	**$10,000**	$0
Other (Tuition)	$5,302	$31,940	$10,949	$0	$5,647	$6,405	**$21,897**	$38,344
Total Direct Costs	$99,784	$537,399	$182,394	$490,361	$153,165	$358,191	**$435,344**	$1,385,951
P.F. Indirect Costs	--	$54,900	--	$52,288	--	$17,160	**--**	$124,348
NCSU Indirect Costs (20% total direct costs)	$19,957	--	$36,479	--	$30,633	--	**$87,069**	
Total Expenses	$119,741	$592,299	$218,873	$542,649	$183,798	$375,351	**$522,412**	$1,510,299

*Forfeited indirect costs of 28.5% of MTDC (total direct excluding tuition) (48.5%-20%), $26,927 in 2008, $48,862 in 2009, $42,043 in 2010, and $117,832 total.

Total Expenses for the 3-year project is $522,412; Total partnership funds for the 3-year project are $1,510,299.

NCSU Detailed Budget

Category	2008	2009	2010	TOTAL
Personnel				
Master Student - Species Habitat Modeling, Obj.1	$0	$19,361	$20,329	$39,690
Benefits - Full Student Support Program (14%)	$0	$2,710	$2,845	$5,555
Population based habitat modeling for priority species.				
Master Student - Landscape Change Analysis, Obj. 2	$19,360	$20,328	$0	$39,688
Benefits - Full Student Support Program (14%)	$2,710	$2,846	$0	$5,556
Integrating Landscape Change models and Population-based Habitat models to assess future conservation states.				
Project Staff (25% FTE 2008, 50% FTE 2009-2010), 33.4% Obj.1,2,&4	$10,418	$21,876	$22,970	$55,264
Fringe Benefits (25% FTE 2008, 50% FTE 2009-2010)	$2,604	$5,470	$5,743	$13,817
Provides biological, GIS, RS, and database support to students and researchers. Develop and facilitate outreach materials and workshops.				
Total Salary	**$29,778**	**$61,565**	**$43,299**	**$134,642**
Total Fringe	**$5,314**	**$11,026**	**$8,588**	**$24,928**
Total Personnel	**$35,092**	**$72,591**	**$51,887**	**$159,570**
Travel				
Partner Agency Meetings, 33.4% Obj.1,2,&4 Travel to Federal and State Agency meetings to present and discuss research and develop projects. FY08: 4 trips/year * $1,000/trip, FY09&FY10: 6 trips/year * $1,000/trip.	$4,000	$6,000	$6,000	$16,000
Spp-Hab Workshops, Obj.1	$0	$20,000	$0	$20,000
DST Workshops, Obj.4	$0	$0	$20,000	$20,000
Total Travel	**$4,000**	**$26,000**	**$26,000**	**$56,000**
Supplies, 50% Obj.1&2 2 Workstations, Monitors Workstations for model development. Project work requires the use of dedicated workstations for developing and executing models.	$5,000	$5,000	$0	$10,000
Total Supplies	**$5,000**	**$5,000**	**$0**	**$10,000**
Contractual				
SUBCONTRACT - Auburn University, 75% Obj.3 / 25% Obj.4	$50,390	$62,854	$64,632	$177,876
Computer rentals for Spp-Hab workshops, Obj.1	$0	$5,000	$0	$5,000
Computer rentals for DST workshops, Obj.4	$0	$0	$5,000	$5,000
Total Contractual	**$50,390**	**$67,854**	**$69,632**	**$187,876**
Student Aid				
Master student - Species Habitat Modeling Obj.1	$0	$5,302	$5,647	$10,949
Master student - Landscape Change Analysis, Obj.2	$5,302	$5,647	$0	$10,949
Tuition - 10% annual inflation factered in with current cost at $2651/semester				
Total Student Aid	**$5,302**	**$10,949**	**$5,647**	**$21,897**
Total Direct Costs	**$99,784**	**$182,394**	**$153,165**	**$435,344**
NCSU Indirect Cost (20% Total Direct Costs)	**$19,957**	**$36,479**	**$30,633**	**$87,069**
Total NCSU Expenses	**$119,741**	**$218,873**	**$183,798**	**$522,412**

Auburn Detailed Budget

Category	2008	2009	2010	TOTAL
Salaries				
Graduate Research Assistant (Ph.D.)	$ 18,690	$19,625	$20,606	$ 58,920
Hourly wage (temporaries)	$ 11,752	$23,504	$23,504	$ 58,760
Travel				
M & IE	$ 3,000	$ 3,000	$ 3,000	$ 9,000
Fuel costs, & airfares	$ 4,400	$ 4,400	$ 4,400	$ 13,200
Equipment				
Desktop computer	$ 3,300	$ -	$ -	$ 3,300
Supplies				
Disks, plotter paper, inks	$ 350	$ 350	$ 350	$ 1,050
Software licensing	$ 500	$ 1,500	$ 500	$ 2,500
Publication costs				
Page charges, reprints	$ -	$ -	$ 1,500	$ 1,500
Subtotal for Indirect Costs	$ 41,992	$52,379	$53,860	$148,230
Indirect Costs (FWS cap 20%)	$ 8,398	$10,476	$10,772	$ 29,646
Total to NCSU	$ 50,390	$62,854	$64,632	$177,876

All costs are split among Obj. 3 (75%) and Obj. 4 (25%).

Indirect Costs forfeited by AU (45%-20%)	$ 10,498	$13,095	$13,465	$ 37,058

Contract funding supplied to Auburn University will support Objectives 3 and 4, which require the development of methodology and decision support models that integrate avian conservation needs with landscape information to derive priority areas for actions that will result in the optimal returns for avian conservation in the SAMBI region. These objectives are not supported under any of the identified partner funds. They will however build upon similar efforts by the East Gulf Coastal Plain and the Mississippi Alluvial Valley Joint Ventures. These funds will be used to support a graduate student (Ph.D.) and travel for coordination with co-investigators at NC State, the Atlantic Coast Joint Venture, and Joint Venture partners. This student will be dedicated to the development of the methodological framework for the selection and evaluation of priority species, ensuring the adequacy and assisting with the development of spatial data for decision modeling, establishing methods for prioritizing species and habitats in the decision models, and ultimately implementing the models themselves. To ensure their defensibility these efforts will be supervised not only by the co-investigators, but the student's graduate advisory committee, and be published in the peer-reviewed literature.

Partner Funds
The following organizations have provided written confirmation to North Carolina State University documenting their willingness to contribute partner funds: U.S. Geological Survey - Northeastern Gap Analysis Project; U.S. Geological Survey – Science Support Project on Development of Inference Methods; U.S. Fish and Wildlife Service - Atlantic Coast Joint Venture staff time in support of this project.

Qualifications of Key Personnel:

Jaime A. Collazo is a Professor of Zoology and Forestry and Assistant Unit Leader at the North Carolina State University. He has worked as a wildlife research biologist with the Puerto Rico Department of Natural Resources, the US Fish and Wildlife Service and the US Geological Survey since 1980. His research interests are in avian ecology and habitat conservation in temperate and tropical systems. His research is conducted at multi-scales and is multi-disciplinary, reflecting the complexity of conservation challenges and interest in collaborative and team research. He has authored more than 50 publications in peer-reviewed journals of national and international scope, served as primary advisory for over 30 graduate students and postdoctoral researchers. He co-directs the Southeastern Regional Gap Analysis Project, soon to become the Eastern Regional Gap Analysis.

James Barry Grand is a Research Wildlife Biologist for U.S. Geological Survey, the Leader of the Alabama Cooperative Wildlife Research Unit, and an Associate Professor in the School of Forestry and Wildlife Sciences at Auburn University. Since completing his B.S. in Forestry and Wildlife at Louisiana State University, his M.S. in Wildlife Management at Auburn, and his Ph.D. in Wildlife Science at Texas A&M University, his 19-year research career with the Department of Interior has been devoted to the study of bird population dynamics and habitat requirements. His research experience spans from the tundra in the far northern and western reaches of Alaska to the coastal marshes of Texas. He has authored more than 30 publications in peer-reviewed journals of national and international scope, participated in over 20 graduate student committees, and been the primary advisory for 7 graduate students and postdoctoral researchers. He currently is the principal investigator for the Alabama Gap Analysis Project, a partner to the Southeastern Regional Gap Analysis Project. He also participates in technical committees working towards the development of decision support tools for the East Gulf Coastal Plain Joint Venture. He recently received the U.S. Geological Survey Cooperative Research Unit Leadership Award and the U.S. Fish and Wildlife Service Region 4 Director's Conservation Award.

Alexa McKerrow is a Regional Land Cover Mapping Coordinator for the USGS Gap Analysis Program. Over the past 15 years she has integrating remote sensing and Geographic Information Systems analysis and plant community ecology. Most recently she has been involved in coordinating mapping of Ecological Systems of the Southeastern United States, investigating the use of Light Detection and Ranging for modeling forest structure, and land cover change detection.

Steve Williams is a Regional Vertebrate Mapping Coordinator for the USGS Gap Analysis Program. Since obtaining a Masters degree from North Carolina State University in 1996, he has worked on both state and regional Gap Analysis Projects. In that capacity he has primary been responsible for developing spatial habitat models of vertebrate species. He has extensive experience with database design, Geographical Information Systems, remote sensing and their use in conservation applications.

Malcolm "Tim" Jones is the Science Coordinator of the Atlantic Coast Joint Venture. Dr. Jones has a B.Sc. in Biology from East Tennessee State University, an M.Sc. in Wildlife Science from Auburn University and a Ph.D. in Wildlife Ecology from the University of Maine. Before joining the USFWS, Dr. Jones worked as a Research Associate at the University of Minnesota Duluth where he was a co-investigator on a project modeling the potential future effects of timber

management on bird populations. Earlier research focused his interest on the interface of avian population dynamics with landscape ecology and computer modeling. Over the last 15 years he has been involved in numerous research projects that have used his experience in statistics, database design, Geographical Information Systems and modeling to further bird conservation.

Craig Watson is the South Atlantic Coordinator of the Atlantic Coast Joint Venture (ACJV). Craig's primary responsibilities are within the Joint Venture's South Atlantic Working Group, coordinating activities for "All Bird" conservation from North Carolina to Puerto Rico and the U.S. Virgin Islands. Craig has been with the ACJV since late 1997, and he began planning in the ACJV for "All Bird" conservation under the framework of the North American Bird Conservation Initiative in 1999, resulting in an implementation plan for the conservation of all birds in the southeast United States called the South Atlantic Migratory Bird Initiative. This regional planning effort, with partners from Virginia to Florida, has been very successful, receiving over 24 million dollars in grant funds, conserving over 136,000 acres, and with partners contributing over $100 million in matching dollars. Additionally, Craig used this planning experience to facilitate other BCR planning efforts both within and outside of the ACJV. Prior to working with the ACJV, Craig worked with the USDA Forest Service as Wildlife Program Manager on the Francis Marion National Forest for 9 years, leaving a position with the Tennessee Wildlife Resource Agency where he coordinated non-game and endangered species work for the eastern portion of the state.

Andrew Milliken is the Coordinator of the Atlantic Coast Joint Venture. He coordinates among the many partners conducting Biological Planning, Conservation Design, Conservation Delivery and Evaluation in the Atlantic Flyway. He is on the steering committee for the Northeast Habitat Classification and Mapping project and is the Technical Coordinator for the Regional Conservation Need on that topic. He is the chair of the Regional Implementation Team for Strategic Habitat conservation (SHC) in the Northeast Region of the U.S. Fish and Wildlife Service (Service) and a member of the National SHC Advisory Team. He has extensive experience in research, development and implementation of science-based approaches to prioritizing conservation in the eastern United States through the Service, U.S. Environmental Protection Agency, State of New York and University of Rhode Island.

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