Setting Population and Habitat Objectives for Forest-associated Birds in the Central Hardwoods Bird Conservation Region

Executive Summary

This document describes the process that evolved in the Central Hardwoods Joint Venture for setting ***initial population and habitat objectives*** for priority forest-associated landbirds. This process represents a science-based and transparent approach to answering the fundamental question of conservation, "How much is enough?"

In brief, we determined our priority species based on priority species lists contained in the North American Landbird Conservation Plan (Rich et al. 2004; hereafter, the Landbird Plan) and the Partners in Flight Species Assessment Database (Panjabi et al. 2001, Panjabi et al. 2005). We set population objectives for our priority species following the categories used in the Landbird Plan (Rich et al. 2004), but based our objectives on data specifically for the Central Hardwoods Bird Conservation Region (BCR) where possible. Species-specific habitat objectives were then calculated by estimating the extent of natural community restoration efforts necessary to provide enough habitat for the total population objective (i.e. existing birds and additional birds) of each priority species (21 of 38) for which we currently have a validated habitat model and are included in the CHJV's Spreadsheet Simulation Decision Support Tool (SSimDST; a.k.a. the spreadsheet tool). This calculation was structured to balance the relative suitability of each natural community used by the species against the relative potential to restore each natural community.

Species-specific habitat objectives were allocated geographically (state portions of the BCR) based on the relative restoration potential of each natural community in each State. Two sets of BCR-level habitat objectives were derived from the species-specific objectives. The Minimum BCR Objective was calculated as the maximum natural community areas needed by a species in a state for a suite of 10 Continental Priority (i.e. Watch List) species. The Maximum BCR Objective was calculated in the same way but for the full suite of 21 species.

Geographically allocated habitat objectives were further allocated to conservation "agencies" (e.g., state lands, refuges, national forests) within each state portion of the BCR. Agency allocations were calculated in 2 ways in order to place lower and upper bounds on each agency's restoration responsibility. The Proportional Agency Allocation scenario provided the lower bound and calculated the responsibility of each agency based on a straight proportion of the restorable area contained within the ownership class. Because public lands encompass <8% of the BCR, this scenario relies heavily on private lands to meet the restoration objectives. The Total Agency Allocation scenario provided the upper bound and focused allocation to agency lands first, with private lands responsible for any unmet portion of a restoration objective. It is

important to note the habitat targets presented here represent total area restored and do not account for restorations already complete or in progress.

Each step in this process had its own set of decisions and critical assumptions. We try to make these explicit here so that assumptions can be tested and decisions can be re-evaluated as new information becomes available. Therefore the population and habitat targets presented in this document represent our current best estimate for how many birds we want and how much it will take to get there. These targets should be revisited regularly and revised as appropriate.

Rationale

The Central Hardwoods Joint Venture (CHJV) is a partnership of state and federal government agencies and non-governmental organizations who work together to ensure the long-term viability of native bird populations. The CHJV pursues this mission by striving towards 2 primary goals: (1) implement conservation actions based on sound science and principals of adaptive management, and (2) target landscapes with the greatest ecological and socioeconomic potential to support viable populations of priority birds. Whereas these goals serve as guiding principles for CHJV planning and research efforts, they do not address the fundamental question that faces all conservation organizations. Namely, how much is enough?

Objective-setting is a necessary component of conservation practice (Conservation Measures Partnership 2007) because it promotes strategic and efficient conservation strategies (U.S. Fish and Wildlife Service 2008). Much debate exists within the conservation community about the proper process for setting conservation targets (Soulé and Sanjayan 1998, Bart et al. 2005, Tear et al. 2005). Thus, with no consensus on standards, a number of different approaches have arisen within Joint Venture partnerships. This document describes the approach that evolved in the CHJV.

Priority Species

In 2001, Partners in Flight published their Species Assessment Database (Panjabi et al. 2001), an attempt to identify the relative conservation priority of non-waterfowl species based on criteria related to population size, population trend, and distribution and threats in the breeding and non-breeding seasons. In 2004, the CHJV partnered with the Lower Mississippi Valley Joint Venture to develop ecoregional-scale Habitat Suitability Index (HSI) models (Tirpak et al. 2009a) for a suite of priority forest-associated species. Species selection was based on the Species Assessment Database, and included 43 species with total breeding season scores of 20 or higher in either the Central Hardwoods or West Gulf Coastal Plain/Ouachitas (WGCP/O) Bird Conservation Regions (BCR). Three species (Black-billed Cuckoo, Ivory-billed Woodpecker, and Ruby-throated Hummingbird) were subsequently removed from the list of modeled species due to lack of available information to produce models.

Partners in Flight published an update to the Species Assessment Database in 2005 (Panjabi et al. 2005). The update included several changes to reflect the information used in the North American Landbird Conservation Plan (Rich et al. 2004; hereafter, the Landbird Plan), including changes to how the total breeding season scores were calculated (e.g., potential maximum score was reduced from 29 to 25), changes to the structure of the database (e.g., additional fields identifying continental and regional priority status), and updates to the various component scores for each species (e.g. changes in population trend). These changes meant that the original criteria for selecting species to model would no longer produce the same list of species (i.e., some species would be added and some dropped).

In March 2010, the CHJV Technical Committee (hereafter, Tech Committee) gathered in St. Louis, MO to discuss the issue of setting population objectives for forest and shrubland birds in the Central Hardwoods Bird Conservation Region (CHBCR). To facilitate the discussion, CHJV staff developed a potential list of priority species based on data in Tables 1 and 8 of the Landbird Plan, as well as the 2005 Species Assessment Database. The list included 35 of the 40 species that were included in the aforementioned HSI modeling project. Black-and-White Warbler, Northern Parula, and Pileated Woodpecker were not included in this exercise because they were originally modeled as priorities for the WGCP/O BCR. Great-crested Flycatcher was not included because it was abundant in the CHBCR and American Woodcock was not included because it is primarily a migratory species in this region. Three species (Chuck-will's-widow, Hooded Warbler, and Mississippi Kite) were retained on the list despite not being categorized as BCR priorities in the 2005 Species Assessment Database because they were listed in the Landbird Plan as continental stewardship species. The list of 35 modeled species was presented in table format (Table 1) along with 15 additional species listed as BCR priorities. Species were categorized in terms of their status as continental priority (i.e. Watch List) species, continental stewardship species, or BCR priority (concern and/or stewardship status within the BCR), and included information on the source of the information, the proportion of the global population thought to breed in the CHBCR, the management action category identified by each source, and the status of the HSI models (validated, not validated, or not modeled). The Tech Committee was reminded that it was up to them as a group to determine the priorities of the partnership (contingent on the approval of the CHJV Management Board).

> "Users must decide for themselves what balance to give to concern vs. responsibility [scores], and the answers are likely to be affected by interests of each agency, joint venture, or other planning group, as well as financial, political, and logistic considerations" (Panjabi et al. 2005, 2012).

Ultimately the Tech Committee decided to retain the 35 modeled species list as CHJV priorities, with a couple notable additions (Table 1). Summer Tanager and Loggerhead Shrike were among the 15 species identified as BCR priorities in the 2005 Species Assessment Database that were not included in the HSI model project. The Tech Committee felt their populations warranted management attention and thus were important to include in our conservation planning efforts (i.e., develop models, population objectives and habitat objectives). The Tech Committee also decided to add Wild Turkey to the list. Although this species is not a priority Landbird species, it is the focus of a substantial amount of private land management and the Tech Committee recognized that including it in the planning process would help us identify the benefits of turkey management for our priority forest-associated Landbirds.

Partners in Flight published another update to the Species Assessment Database in May 2012 (Panjabi et al. 2012). This update resulted in some significant changes to relative priority of species the Central Hardwoods has been focusing on. For example, Blue-winged Warbler is no longer a Watch List species, though it remains a continental stewardship species. These changes ***have not been incorporated*** into the CHJV population & habitat objectives at this time.

Setting Population Objectives

At the March 2010 meeting, setting population objectives for the CHBCR was presented as the best way to answer the question of how much (habitat) is enough. Further, basing conservation actions on population objectives provided the additional benefits of:

1. Providing a metric of success that keeps efforts focused on biological outcomes (as opposed to dollars and acres),
2. Providing a common currency across geographies (within the CHBCR as well as in relation to other BCRs), and
3. Increasing scientific credibility, transparency, and accountability.

Three approaches to setting population objectives were presented. First, the CHJV could simply adopt the continental-scale population objectives stated in the Landbird Plan. Continental-scale population objectives in the Plan were set categorically in relation to declines in relative abundance of birds on Breeding Bird Survey (BBS) routes from 1966 to 2002. This approach was dismissed because it did not recognize the uniqueness of the CHBCR (i.e. population declines within the CHBCR are sometimes significantly different from range-wide trends), and because the Landbird Plan did not consider current habitat capacity. Second, the CHJV could use its assessment of current habitat capacity (Tirpak et al. 2009a) to estimate current population size for each priority species and set population objectives as a proportional increase over the current size based on the habitat modifications/improvements that the partners thought was achievable. Although generally viewed as a way to generate more readily achievable objectives, this approach was dismissed because the choice of what proportional increase to use was arbitrary and indefensible, and because it was perceived as relying too heavily on public lands which constitute <8% of the CHBCR (i.e. not enough & too fragmented to ensure long-term viability of populations).

Ultimately, the Tech Committee selected a third option of setting tentative population objectives based on CHBCR-specific changes in relative abundance, using similar categorical assignments as the Landbird Plan (i.e. Maintain, Increase 50%, Increase 100%) (Table 1). To implement this approach, the Tech Committee compared graphs of BBS relative abundance (average count per route each year from 1966 to 2008) range-wide against relative abundance within the CHBCR for each priority species. For most species, the population objective was set based on changes in relative abundance on routes within the CHBCR (Maintain = relatively stable or increasing; Increase 50% = declines of up to one third; Increase 100% = declines greater than one third).

For species where BBS data was lacking within the CHBCR (e.g. Brown-headed Nuthatch), the Tech Committee defaulted to the continental-scale objective stated in the Landbird Plan. For species covered by other planning documents (i.e. Red-cockaded Woodpecker and Northern Bobwhite), the Tech Committee defaulted to that plan. This approach was recognized as imperfect but possessed several advantageous attributes in that the resulting objectives:

1. Were stated in terms compatible with the Landbird Plan (i.e. changes in abundance),
2. Were based on an objective, defensible target (i.e. beginning of the BBS),
3. Recognized the unique history and landscapes of the CHBCR,
4. Were regional (i.e. top-down) and therefore could be used to inspire strategic efforts on private and public lands within the CHBCR, and
5. Could be assessed and revised based on CHBCR decision support tools (e.g. current habitat assessment).

This process resulted in CHJV population objectives for 18 of the 38 priority species that differed from continental objectives in the Plan (Table 1). For one species, Bewick's Wren, the Tech Committee believed more information was needed to set a population objective. No objectives were set for Swallow-tailed Kite because it is currently extirpated from the CHBCR. The Tech Committee left it on the priority list for the time being however, because implementation plans for other species may provide conditions for its return.

Setting Habitat Objectives

At a minimum, the process of setting habitat objectives requires a population objective (i.e. how many birds do you want), a population estimate (i.e. how many birds you have), and a population-habitat linkage (e.g. an average density estimate) that informs the decision of how much more habitat will be needed to achieve the objective. To set habitat objectives for the CHBCR the Tech Committee had access to the following decision support tools:

1. Population objectives for 38 forest & shrubland species (Table 1),
2. Habitat Suitability Index (HSI) models validated for 24 species (Tirpak et al. 2009a, b),
3. Subsection-level population estimates based on BBS and HSI model outputs for 24 species (Jones-Farrand, unpublished data),
4. An Ecological Potential Vegetation (EPV) model that provides spatially explicit estimates of the restoration potential of 11 natural communities,
5. An Urbanization model that provides spatially explicit estimates of the potential change in land use (i.e. habitat quantity & quality) by 2030, and
6. A spreadsheet-based simulation tool (Jones-Farrand et al. 2009) that allows estimates of population change for 21 species simultaneously due to user-defined changes in habitat quantity & quality.

BCR-level habitat objectives could be quickly calculated by summarizing information from the tools 1 and 3. For example, the Upper Mississippi River/Great Lakes Region Joint Venture (Potter et al. 2007) subtracted population estimates from population objectives to calculate population deficits. They then set habitat objectives for protection efforts (i.e. population estimate divided by density in quality habitat as defined in the literature) and for restoration efforts (i.e. population deficit divided by density in quality habitat as defined in the literature). The CHJV could have taken a similar approach using the HSI models and population estimates to determine the density for each species. However, this simple approach has only limited utility because it produces a vague habitat objective (e.g., additional 1 million acres of Prairie Warbler habitat) and ignores other information at our disposal that the Upper Mississippi River/Great Lakes Region Joint Venture doesn't have (e.g., a model that describes the site and landscape constituents of Prairie Warbler Habitat). Thus, the CHJV devised a framework for setting habitat objectives that is:

1. Able to take advantage of our existing decision support tools (e.g. estimates of restoration potential),
2. Scales density estimates based on habitat quality (i.e. not just a single density estimate such as a maximum density),
3. Estimates tradeoffs among species (i.e. land is finite and can't support early-successional & mature forest birds on the same acre), and
4. Appropriately allocates habitat objectives across natural communities within nested geographies (e.g. subsection*state, state*BCR, subsection, or BCR).

Habitat objectives for the CHBCR were calculated using a 7 step process. Those steps are listed below for quick reference. Below the list, the thought process behind each step is described to give a clearer understanding of how the step was executed.

The CHJV's 7-step process for calculating habitat objectives:

1. Calculate desired population size
    a. Desired Pop. = Current Pop. Est. * Pop. Obj. Factor
        i. Pop. Obj. Factor = 1 (maintain), 1.5 (increase 50%), or 2 (increase 100%)
2. Allocate desired populations (i.e. calculate %Pop) to EPV communities
    a. Allocate based on relative suitability of EPV (%Pop_HSI)
    b. Allocate based on relative restoration potential of EPV (%Pop_EPVarea)
    c. Balance allocation objectives
        i. %Pop_EPV = (%Pop_HSI + %Pop_EPVarea)/2
3. Allocate populations to State*BCR subregions
    a. %Pop_State = %Pop_EPV * %EPV in State
4. Estimate density of each species in each EPV
    a. For each Species in each Subsection
        i. Maximum Average Density = (Current Pop. Est. / Current Habitat Area) / Average HSI value

        ii. Adjust Maximum Average Density based on published densities or territory sizes
    b. EPV_Density = Max. Avg. Density * relative suitability of EPV
5. Calculate Habitat Objective
    a. For each Species in each State
        i. Hab. Obj. = EPV Density * %Pop_State
6. Allocate habitat objectives to conservation partners within State*BCR subregions
    a. For each organization in each State*BCR subregion
        i. Hab. Obj. 2 = Hab. Obj. * %EPV owned
7. Check validity of calculations using the Spreadsheet Tool
    a. Checks "back of the napkin" approach detailed here against the (albeit limited) ability of the spreadsheet tool to account for patch size.

In Step 1, we calculated our desired population size for each of the 21 species in the spreadsheet simulation tool by multiplying its population estimate by its population objective (Table 2). These species include all those with validated HSI models except Chimney Swift, Chuck-wills-widow and Whip-poor-will. These 3 species were excluded from this analysis because habitat quality is defined by landscape configuration that could not be assessed with the spreadsheet tool. The 3 new priority species (Summer Tanager, Loggerhead Shrike, and Wild Turkey), as well priority species whose HSI models are not currently validated (e.g. Red-headed Woodpecker), will be added into this framework once their models are validated.

In Step 2, we allocated populations across the natural community types in the Ecological Potential Vegetation model based on the relative suitability (i.e. HSI value; Table 3) and the relative restoration potential (i.e. areal extent) of each natural community (Table 4). HSI values were estimated for each species in each community based "reduced" versions of the HSI models developed by Tirpak et al. (2009a) that included defined parameters for each community (i.e. landform, forest type, seral stage, canopy cover) but excluded landscape (e.g. distance to edge) and structural (e.g. basal area) parameters that have yet to be defined for a community. Using these "reduced" HSI models allowed us to estimate quality of restored areas based on our partial knowledge of the system rather than on expert opinion alone. Restoration potential was calculated by overlaying the Ecological Potential Vegetation model with the distribution of currently forested lands from the 2001 National Land Cover Database. By restricting our definition of restorable areas to currently forested lands, we recognized the irretrievable losses of habitat to development (e.g., urban areas, reservoirs) and the low likelihood and high costs of taking agricultural lands out of production.

For each species, we allocated total populations (i.e. current plus desired) across natural community types based on relative suitability and relative potential separately. This resulted in 2 possible allocation proportions for each community type. We averaged those 2 proportions for each community and then scaled the results across communities such that they summed to 100%. The resulting allocation (Table 5) thereby attempts to balance managing for the highest densities

(i.e. best habitats for the birds & most birds for least cost) against our restoration opportunities. For example, Glade Complexes are considered superior habitats to Oak Open Woodlands for Prairie Warbler (Table 3) suggesting they could support higher densities. However, opportunities to restore Glade Complexes are relatively rare across the CHBCR (Table 4) because of the soil and topographic conditions necessary to support a glade community. Therefore, we have to allocate a much larger proportion of the total population to Oak Open Woodlands where restoration opportunities are much more abundant.

In Step 3, we applied the allocation proportions from Step 2 to the desired population size for each species and the proportion of each community in each State*BCR sub-region. This step assumed that sustaining the desired population size indefinitely would require the CHJV to provide enough managed habitat (i.e. restoration or enhancement of public or private lands) for each species. Occurrence of any species on other lands (e.g. agricultural, private unmanaged, timbered) is assumed an unsustainable buffer population because the suitability of those lands over the long term is less certain. This step also allocated a proportion of the desired population to each State based on its mix of potentially restorable habitats. For example, Arkansas harbors 9.5% of Glade Complex restoration opportunities, so 9.5% of the Prairie Warbler allocation to glade habitats is allocated to Arkansas. Alternatively, Arkansas does not have Barrens habitats so no Prairie Warblers are allocated to Arkansas on that basis.

In Step 4, we estimated a density for each species in each natural community by assigning a maximum density (i.e. the density expected when HSI = 1) and assuming a linear relationship between density and HSI values. To assign maximum densities, we examined several possibilities including using density values from the literature, using density values calculated from the CHJV's Forest Bird Assessment Project (a.k.a. the Cerulean project) where available, or calculating densities in each State*BCR sub-region based on CHBCR Population Estimates (Jones-Farrand, unpublished data) and the extent of habitat area and average habitat quality from the HSI models (i.e. maximum density = average density divided by average quality, where average density = population estimate divided by habitat area). Table 6 lists the maximum density estimates we obtained from each option as well as the value we ultimately chose for calculating habitat objectives. In general we chose to use the highest maximum average density calculated for any State*BCR subregion as the density assigned to communities where HSI = 1. We departed from this rule for 5 species (Painted Bunting, Acadian Flycatcher, Louisiana Waterthrush, Field Sparrow, and Yellow-breasted Chat) where concerns about the habitat area estimates from the HSI models existed. The selected densities were generally lower than high density estimates found in the literature. This is viewed as a positive attribute because it helps account for (unknown) occupancy rates, which may vary with habitat suitability. Well-restored sites may remain unoccupied due to circumstances not captured in the habitat models (e.g. competition, conspecific attraction, food availability), but this may occur less frequently than in habitat of moderate or marginal quality.

In Step 5, we multiplied our density estimates from Step 4 by the population allocation from Step 3 to calculate the number of acres of each restored community type in each State*BCR subregion needed to support each species. This yielded the habitat objectives for each species. The Maximum BCR Objectives (Table 7) were calculated as the maximum area estimated for any natural community in any state across all 21 species. Because this resulted in a large habitat area (approximately 10.5 million acres or 27.1% of currently forested lands) due to the requirements of a couple of lower-priority species (e.g. Field Sparrow), we recalculated the habitat objectives for Watch List species only (the Minimum BCR Objectives; Table 8). This resulted in a substantial reduction in habitat acres needed to approximately 4.8 million acres or 12.4% of currently forested land in the CHBCR while still meeting the Population Objective for 14 of 21 species (Table 9).

In Step 6, we developed both Minimum and Maximum BCR Objective habitat targets for conservation organizations (i.e. current and potential partners) within the CHBCR under 2 scenarios as a way of putting bounds on the restoration efforts each organization would need to pursue in order to meet the CHJV population objectives. As a preliminary step, we identified conservation organizations as those groups listed in the "Agency" attribute field of the USGS Protected Areas Database (CITATION). This definition allowed us to quickly and easily categorize public land units by organization, but lacks resolution on State lands where different departments may have different land use missions (e.g. wildlife agency vs. state parks vs. transportation). The first scenario, the Proportional Agency Allocation scenario, calculated the responsibility of each agency based on a straight proportion of the restorable area contained within the ownership class. Because public lands encompass <8% of the BCR, this scenario relies heavily on private lands to meet the restoration objectives and serves as a minimum bound on restoration effort for each organization. The Total Agency Allocation scenario focused allocation to agency (i.e. public and NGO) lands first, with private lands responsible for any unmet portion of a restoration objective. This scenario rests on the expectation that agency land is more likely to provide stable, long-term reliability for conservation. However, we recognized that most agencies are unlikely to be able to restore 100% of their owned parcels. Thus, this scenario serves as an upper bound on restoration effort for each organization. ***Tables containing the agency allocations for each State*BCR subregion are in the spreadsheet file accompanying this document***. It is important to note the habitat targets presented here represent total area restored and do not account for restorations already complete or in progress.

Finally in Step 7, we entered the Minimum BCR Objectives (i.e. the proposed habitat objectives for Watchlist species; Table 8) into the spreadsheet-based decision support tool. The purpose of this step is to serve as a reality check to the Habitat Objectives presented here by testing whether the proposed objectives would produce the expected population gains given the patch structure of CHBCR landscapes (i.e. is a patch large enough to harbor a bird given our density estimates),

and the inherent tradeoffs among species (e.g. a patch being converted to woodland reduces suitability for Cerulean Warblers). This approach to examining the impact of our restoration targets approximates the impact of restoration under the Proportional Agency Allocation scenario (i.e. a proportional allocation across State*BCR subregions and agencies). It has the advantage of giving us a quick assessment of the success of these restoration goals given the current context of the BCR, but is limited by the spreadsheet tool's inability to capture some landscape patterns.

Predicted population increases from the spreadsheet tool (Table 10) were sufficient to meet population objectives of 16 of 21 species (Table 11), though in most of these cases the proportion of the population objective achieved was lower than expected under the Minimum BCR Objectives. Similarly, 3 species that were expected to achieve goal (Blue-winged Warbler, Cerulean Warbler, and Yellow-breasted Chat) would not according to the spreadsheet tool. There are at least 3 possible reasons for this. First, many acres are improved habitat rather than created habitat (i.e. density doesn't always go up from 0 to X, but from some smaller number to some larger number). Second, within the spreadsheet tool patches have to be big enough to contain a bird once restored or improved. Thus, depending on density estimate for a given species, a patch selected for restoration in the spreadsheet tool may not contribute to the overall population. Finally, restoration efforts that benefit one species at a site may have negative effects on species inhabiting that site (e.g. restoring a glade from a closed woodland may attract Prairie Warblers but eliminate Acadian Flycatchers). Thus, such tradeoffs may have the effect of moving populations around, limiting the realized population change. This is evidenced by the data in Table 10 where 15 of 21 species declined in at least 1 subsection.

Other interesting interactions are evident in Table 11. Five species for which the Minimum BCR Objectives were not expected to be sufficient were predicted to achieve their population goal in the spreadsheet tool. Similarly, 4 species were predicted to reach even higher population sizes above goals than expected. These results are likely due to the availability of suitable habitat outside of restored areas.

This analysis points to the importance of landscape context and the spatial arrangement of habitats in determining the outcome of conservation actions. Thus we will need to plan and act strategically. As we develop more detailed implementation plans, we can execute more rigorous analyses with a GIS to determine likely results before we act.

Critical Assumptions

Underlying the CHJV population and habitat objectives are a number of critical assumptions that need to be tested to refine the objectives:

1. Population objectives stated in terms of abundance adequately capture sustainability of populations (i.e. sustainability is really about demographics but the goal of increasing abundance implies changes in key demographic rates),
2. Increasing available habitat will engender increases in population size (i.e. "if you build it they will come" & populations have the reproductive capacity to capitalize on the change),
3. Projected population increases due to restoration efforts reflect new birds added once restoration is achieved (i.e. years down the road when appropriate structure is achieved) and represent average conditions in years thereafter,
4. Restored sites (public or private) are more secure through time (i.e. sustainable) than unmanaged land & therefore should be relied on to provide habitat for the entire population objective for each species,
5. Relative suitability of sites calculated from reduced HSI models is proportionally constant to full HSI models (i.e., using different forms of the models lead to the same result),
6. Simple arithmetic averaging is the best way to balance relative suitability and relative restoration potential of natural communities,
7. Density (i.e. population response) is linearly related to suitability scores in current & restored sites,
8. Maximum density varies by subsection on unmanaged sites but is constant across restored sites (e.g. restored glades in TN will harbor the same densities of Prairie Warblers as sites in AR or MO),
9. Restored (i.e. managed) sites harbor higher densities than unmanaged sites,
10. Stated Habitat Objectives will be placed on appropriate sites of appropriate size and strategically within landscapes (i.e. complexes of restored sites).

Next Steps

In January 2011 the Tech Committee met to discuss setting and allocating habitat objectives. The CHJV Tech Committee determined that the density estimates used were probably the most critical assumption in the process. Relatively small changes in density values can have enormous consequences on the resulting habitat objectives at the BCR scale. Further, all agreed that the achievability of the stated objectives was dependent in large part on what partners had already done. Thus, an important next step would be to an assessment of the CHJV Conservation Estate, wherein we would build a GIS database of lands currently restored or being restored. This information could serve as a framework for testing the other critical assumptions of this process. CHJV staff are working on developing refined density estimates and density-HSI relationships for each species and devising a method to develop a Conservation Estate Assessment.

Presentations on this process were delivered to the CHJV Management Board at their Spring meetings in 2011 (State*BCR allocations) and 2012 (agency allocations). The Board found the information useful to their planning processes, but wanted more information on how much of these restoration goals have already been achieved across the BCR as well as more detailed information on the structural targets for each community (i.e. Desired Future Conditions). The Conservation Estate Assessment will address the former. CHJV staff are devising methods to develop Desired Future Conditions for each Natural Community.

In addition to these ongoing efforts, CHJV staff are working to package these objectives with other decision support tools (e.g. urbanization model) to help partners initiate conversations within their organizations as well as with others in their State*BCR subregion. Conservation planning is an iterative process (Will et al. 2005), and these discussions will no doubt lead to refinements to this process and its inputs. The framework presented here will be useful in focusing those discussions that will eventually lead to greater clarity in vision (how much is enough) as well as more strategic and efficient conservation action.

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Table 1. Priority status of forest & shrubland species modeled for the Central Hardwoods (BCR 24). Black font indicates species with validated models, red indicates unvalidated models, and blue indicates species without habitat models. CHJV Population Objectives that differ from Continental Objectives are highlighted.

Priority Class	Species name	Species code	% Global Pop in BCR	Continental[a] Objective	Continental[a] Action category	E. Region[b] Action category	Assessment Database Action category	CHJV Objectives
Continental Priorities (Watch List)	Bachman's Sparrow	BACS	0.0%	Increase 100%	IA	IA	CR	Increase 100%
	Bell's Vireo	BEVI	0.7%	Increase 100%	IA		MA	M/I
	Blue-winged Warbler	BWWA	16.8%	Increase 50%	MA	MA	MA	Increase 100%
	Brown-headed Nuthatch	BHNU	0.0%	Increase 50%	MA	MA	CR	Increase 50%
	Cerulean Warbler	CERW	11.6%	Increase 100%	MA	MA	IM	Increase 100%
	Kentucky Warbler	KEWA	27.8%	Increase 50%	MA	MA	MA	Maintain
	Painted Bunting	PABU	0.5%	Increase 100%	MA	MA	MA	Maintain
	Prairie Warbler	PRAW	14.9%	Increase 50%	MA	MA	MA	Increase 100%
	Prothonotary Warbler	PROW	4.0%	Increase 50%	MA	MA	P&R	Maintain
	Red-cockaded Woodpecker	RCWO	0.0%	Recovery Plan	IA	IA	CR	Recovery Plan
	Red-headed Woodpecker	RHWO	7.5%	Increase 100%	MA	MA	MA	Increase 100%
	Swainson's Warbler	SWWA	0.0%	Maintain	P&R	P&R	CR	Maintain
	Swallow-tailed Kite	STKI	0.0%	Increase 100%	IA	IA	CR	None
	Wood Thrush	WOTH	7.2%	Increase 50%	MA	MA	MA	Maintain
	Worm-eating Warbler	WEWA	21.4%	Maintain/Increase	MA	MA	MA	M/I
Stewardship Species	Acadian Flycatcher	ACFL	14.4%	Maintain	P&R	P&R	P&R	Maintain
	Brown Thrasher	BRTH	7.5%	Maintain	MA	MA	MA	Increase 50%
	Chuck-will's-widow	CWWI	10.4%	Maintain	MA	MA		M/I
	Hooded Warbler	HOWA	2.0%	Maintain	P&R	P&R		Maintain
	Louisiana Waterthrush	LOWA	19.6%	Maintain	P&R	P&R	P&R	Maintain

Table 1. (Continued)

Priority Class	Species name	Species code	% Global Pop in BCR	Continental[a] Objective	Continental[a] Action category	E. Region[b] Action category	Assessment Database[c] Action category	CHJV Objectives
Stewardship Species	Mississippi Kite	MIKI	0.3%	Maintain	P&R			Maintain
	White-eyed Vireo	WEVI	7.5%	Maintain	P&R	P&R	MA	M/I
	Yellow-throated Vireo	YTVI	10.9%	Maintain	P&R	P&R	P&R	Maintain
	Yellow-throated Warbler	YTWA	16.5%	Maintain	P&R	P&R	P&R	Maintain
BCR Priorities	Bewick's Wren	BEWR	1.1%				IM	Need Info
	Blue-gray Gnatcatcher	BGGN	13.1%				MA	M/I
	Carolina Chickadee	CACH	11.1%				P&R	Maintain
	Chimney Swift	CHSW	9.8%				MA	Maintain
	Eastern Wood-peewee	EAWP	19.0%				MA	Increase 100%
	Field Sparrow	FISP	21.6%				MA	Increase 100%
	Loggerhead Shrike	LOSH	1.5%				IM	Increase 100%
	Northern Bobwhite	NOBO	7.6%				MA	NBCI Plan
	Orchard Oriole	OROR	11.2%				MA	M/I
	Summer Tanager	SUTA	13.2%				P&R	Maintain
	Whip-poor-will	WPWI	26.6%				MA	Increase 100%
	Wild Turkey	WITU	5.0%					Maintain
	Yellow-billed Cuckoo	YBCU	13.1%				MA	Increase 100%
	Yellow-breasted Chat	YBCH	11.8%				MA	M/I

[a] Rich et al. 2004, Table 1. Action categories: IA = Immediate Action; MA = Management Attention; P&R = Planning & Responsibility.
[b] Rich et al. 2004, Table 8. Action categories: IA = Immediate Action; MA = Management Attention; P&R = Planning & Responsibility.
[c] Partners in Flight Species Assessment Database, version 2005 (http://www.rmbo.org/pif/pifdb.html). Action categories: IM = Immediate Management; MA = Management Attention; P&R = Planning & Responsibility.

Table 2. Estimates of current and desired population sizes for priority forest and shrubland birds in the Central Hardwoods Bird Conservation Region.

Priority Class	Species name	Species code	Population Objectives [a]	Population Estimate	Population Factor	Desired Population
Continental Priorities (Watch List)	Bachman's Sparrow	BACS	Increase 100%	1	2	2
	Blue-winged Warbler	BWWA	Increase 100%	49,853	2	99,706
	Brown-headed Nuthatch	BHNU	Increase 50%	5,261	1.5	7,892
	Cerulean Warbler	CERW	Increase 100%	35,107	2	70,214
	Kentucky Warbler	KEWA	Maintain	293,075	1	293,075
	Painted Bunting	PABU	Maintain	25,625	1	25,625
	Prairie Warbler	PRAW	Increase 100%	156,814	2	313,628
	Prothonotary Warbler	PROW	Maintain	75,918	1	75,918
	Wood Thrush	WOTH	Maintain	990,815	1	990,815
	Worm-eating Warbler	WEWA	M/I	174,657	1	174,657
Stewardship Species	Acadian Flycatcher	ACFL	Maintain	667,416	1	667,416
	Hooded Warbler	HOWA	Maintain	198,117	1	198,117
	Louisiana Waterthrush	LOWA	Maintain	38,306	1	38,306
	Yellow-throated Vireo	YTVI	Maintain	152,615	1	152,615
	Yellow-throated Warbler	YTWA	Maintain	261,943	1	261,943
BCR Priorities	Blue-gray Gnatcatcher	BGGN	M/I	5,162,018	1	5,162,018
	Carolina Chickadee	CACH	Maintain	1,854,224	1	1,854,224
	Eastern Wood-peewee	EAWP	Increase 100%	927,840	2	1,855,680
	Field Sparrow	FISP	Increase 100%	818,463	2	1,636,926
	Yellow-billed Cuckoo	YBCU	Increase 100%	909,527	2	1,819,054
	Yellow-breasted Chat	YBCH	M/I	1,195,810	1	1,195,810

[a] Population Objectives are categorical following Rich et al. 2004. M/I = Maintain/Increase.

Table 3. Suitability values assigned to each species for each natural community based on reduced HSI models.

	Species code	Prairie / Savanna	Barrens	Glade / Savanna Mosaic (< 20% canopy)	Oak Open Woodland (20-50% canopy)	Oak Closed Woodland (50-80% canopy)	Pine / Bluestem Open Woodland (20-50% canopy)	Pine / Oak Closed Woodland (50-80% canopy)	Forest (> 80% canopy)	Floodplain Forests
Continental Priorities (Watch List)	BACS	0.7	0.7	1	0.5	0	1	0	0	0
	BWWA	0.75	0.75	1	0.6	0	0	0	0	0
	BHNU	0	0	0	0	0	1	0.7	0	0
	CERW	0	0	0	0	0.5	0	0	1	1
	KEWA	0	0	0	0	0.85	0	0.7	1	1
	PABU	0.75	0	1	0.9	0	0	0	0	0
	PRAW	0.85	0.85	1	0.7	0	0.6	0	0	0
	PROW	0	0	0	0	0	0	0	0	1
	WOTH	0	0	0	0	0.55	0	0.5	1	0.667
	WEWA	0	0	0	0	0.7	0	0.55	1	0
Stewardship Species	ACFL	0	0	0	0	0.4	0	0.25	0.9	1
	HOWA	0	0	0	0	1	0	0.8	0.75	0.75
	LOWA	0	0	0	0	0.4	0	0.3	1	1
	YTVI	0	0	0	0.1	0.8	0	0.6	0.85	1
	YTWA	0	0	0	0	0.2	0	0.3	0.5	1
BCR Priorities	BGGN	0	0	0	0.25	0.75	0	0.4	1	0.9
	CACH	0	0	0	0.2	0.7	0.3	0.9	1	1
	EAWP	0.2	0.2	0	0.9	0.9	1	0.9	0.3	0.2
	FISP	0.75	0.75	1	0.6	0	0.6	0	0	0
	YBCU	0	0	0	0.2	0.667	0	0.4	1	0.9
	YBCH	0.4	0.4	1	0.7	0	0.6	0	0	0

Table 4. Distribution of restorable acres (i.e. currently forested) of each natural community by State subregions of the Central Hardwoods Bird Conservation Region.

State	Prairie / Savanna	Barrens	Glade / Savanna Mosaic (< 20% canopy)	Oak Open Woodland (20-50% canopy)	Oak Closed Woodland (50-80% canopy)	Pine / Bluestem Open Woodland (20-50% canopy)	Pine / Oak Closed Woodland (50-80% canopy)	Forest (> 80% canopy)	Floodplain Forests	Total
Alabama	-	60,779.7	4,621.8	115,770.5	220,241.5	13,491.6	15,111.5	115,358.6	218,128.5	763,503.8
Arkansas	61,885.0	-	63,684.3	496,344.8	1,946,047.8	15,660.4	975,738.9	1,793,321.9	114,408.5	5,467,091.5
Illinois	1.3	66,215.2	-	131,790.8	357,168.3	31,257.2	-	361,774.6	537,286.0	1,485,493.3
Indiana	-	42,748.7	-	43,744.0	393,376.3	-	7,304.1	2,659,648.8	779,006.1	3,925,828.0
Kansas	608.4	-	-	3,349.4	4,807.5	-	-	-	12.2	8,777.5
Kentucky	-	339,629.9	-	64,102.0	955,328.7	-	0.4	4,988,319.1	1,406,274.9	7,753,655.1
Missouri	232,192.8	-	537,808.4	3,157,688.1	3,782,613.2	485,950.0	1,567,198.1	2,064,030.8	620,139.0	12,447,620.5
Ohio	-	-	-	-	-	-	-	219,174.7	27,178.0	246,352.6
Oklahoma	28,549.5	-	-	309,368.9	408,454.5	-	14,661.8	174,890.3	20,659.0	956,584.0
Tennessee	-	215,327.1	64,395.0	626,083.5	2,088,145.5	-	-	1,928,844.6	631,825.7	5,554,621.4
Total	323,237.1	724,700.7	670,509.5	4,948,241.9	10,156,183.2	546,359.2	2,580,014.9	14,305,363.3	4,354,917.9	38,609,527.7

Table 5. Allocation of desired population size across Ecological Potential Vegetation (EPV) communities based on relative habitat suitability value for the species and relative restoration potential within the BCR.

		Allocation Weights (%Pop in each EPV Community)								
	Species code	Prairie / Savanna	Barrens	Glade / Savanna Mosaic (< 20% canopy)	Oak Open Woodland (20-50% canopy)	Oak Closed Woodland (50-80% canopy)	Pine / Bluestem Open Woodland (20-50% canopy)	Pine / Oak Closed Woodland (50-80% canopy)	Forest (> 80% canopy)	Floodplain Forests
Continental Priorities (Watch List)	BACS	6.47%	9.45%	24.38%	35.82%		23.88%			
	BWWA	10.94%	13.93%	34.33%	40.80%					
	BHNU						49.50%	50.50%		
	CERW					19.50%			49.00%	31.50%
	KEWA					25.00%		8.00%	41.50%	25.50%
	PABU	10.05%		32.16%	57.79%					
	PRAW	12.44%	15.42%	25.87%	39.30%		6.97%			
	PROW									100.00%
	WOTH					19.90%		6.97%	59.20%	13.93%
	WEWA					27.36%		8.96%	63.68%	
Stewardship Species	ACFL					17.50%		4.50%	41.00%	37.00%
	HOWA					41.79%		13.43%	30.35%	14.43%
	LOWA					17.09%		4.51%	47.24%	31.16%
	YTVI				7.46%	23.38%		6.97%	31.34%	30.85%
	YTWA					17.00%		5.50%	26.50%	51.00%
BCR Priorities	BGGN				7.46%	21.39%		4.98%	44.78%	21.39%
	CACH				6.97%	17.91%	0.99%	13.93%	36.82%	23.38%
	EAWP	1.00%	1.49%		16.92%	23.88%	17.41%	13.93%	19.40%	5.97%
	FISP	10.00%	13.00%	31.50%	38.00%		7.50%			
	YBCU				7.46%	18.91%		4.97%	46.27%	22.39%
	YBCH	3.52%	6.53%	39.20%	42.21%		8.54%			

Table 6. Potential maximum density estimates (acres/bird) for each species from habitat models (Maximum Average Density), the Forest Bird Assessment Project (CHJV Data), and Birds of North America accounts (BNA Density). Densities used in the production of habitat objectives are shown in the last column.

	Species code	Max. Avg. Density [a]		CHJV Data			BNA Density [d]		Selected
		Max [b]	Min [c]	Max	Min	Avg	Max	Min	
Continental Priorities (Watch List)	BACS	157.5	86747.0	---	---	---	5.1	164.7	157.5
	BWWA	13.7	205.8	---	---	---	6.3	6.3	13.7
	BHNU	3.3	38.3	---	---	---	---	---	3.3
	CERW	32.7	494.0	16.5	40.7	28.0	0.4	5.2	32.7
	KEWA	6.4	32.1	6.0	29.3	19.7	13.6	26.9	6.4
	PABU	48.2	229.2	---	---	---	16.5	16.5	32.4
	PRAW	2.8	31.7	---	---	---	2.3	2.7	2.8
	PROW	5.4	15.2	---	---	---	2.3	32.9	5.4
	WOTH	3.0	17.0	2.8	83.4	31.4	0.1*	3.5*	3.0
	WEWA	13.5	74.8	2.9	50.2	21.7	11.1	16.5	13.5
Stewardship Species	ACFL	2.8	35.3	2.5	15.0	8.5	4.0	20.5	8.5
	CACH	1.7	26.3	---	---	---	4.0*	5.9*	1.7
	HOWA	17.9	109.8	---	---	---	1.2*	1.9*	17.9
	LOWA	14.6	164.7	4.1	239.0	88.0	1.4*	4.4*	88.0
	YTVI	13.4	617.5	---	---	---			13.4
	YTWA	6.5	102.9	---	---	---	3.2	3.2	6.5
BCR Priorities	BGGN	0.9	8.1	---	---	---			0.9
	CACH	1.7	26.3	---	---	---	4.0*	5.9*	1.7
	EAWP	2.7	58.8	---	---	---	3.2	15.4	2.7
	FISP	3.2	12.9	---	---	---	0.4*	2.0*	2
	YBCU	0.2	3.5	---	---	---	2.3	2.3	0.2
	YBCH	2.4	58.8	---	---	---	3.2	328.5	2.0

[a] Maximum average density calculated from average density (population estimate divided by habitat area) divided by mean Habitat Suitability Index value.

[b] Highest maximum average density value for any State*BCR subregion.

[c] Lowest maximum average density value for any State*BCR subregion.

[d] Values noted with a "*" indicate territory sizes.

Table 7. The Maximum BCR Objectives needed to support desired populations of 21 priority forest and shrubland bird species. Habitat estimates (acres) are allocated geographically by natural community and state portion of the Bird Conservation Region.

State	Prairie / Savanna	Barrens	Glade / Savanna Mosaic (< 20% canopy)	Oak Open Woodland (20-50% canopy)	Oak Closed Woodland (50-80% canopy)	Pine / Bluestem Open Woodland (20-50% canopy)	Pine / Oak Closed Woodland (50-80% canopy)	Forest (> 80% canopy)	Floodplain Forests
Alabama	0.0	35,694.6	7,108.5	29,106.5	32,097.0	21,449.2	4,070.7	18,723.2	104,949.4
Arkansas	62,679.2	0.0	97,948.3	124,788.7	283,607.8	24,897.2	262,839.3	291,064.3	55,046.0
Illinois	1.4	38,886.7	0.0	33,134.2	52,052.0	49,693.3	0.0	58,717.7	258,507.4
Indiana	0.0	25,105.4	0.0	10,997.9	57,328.8	0.0	1,967.5	431,673.1	374,807.5
Kansas	616.2	0.0	0.0	842.1	700.6	0.0	0.0	0.0	5.9
Kentucky	0.0	199,457.2	0.0	16,116.2	139,225.1	0.0	0.1	809,626.8	676,608.9
Missouri	235,172.5	0.0	827,165.2	793,891.1	551,260.2	772,573.6	422,163.4	335,001.6	298,370.9
Ohio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35,573.0	13,076.3
Oklahoma	28,915.9	0.0	0.0	77,780.1	59,526.2	0.0	3,949.5	28,385.5	9,939.8
Tennessee	0.0	126,456.9	99,041.4	157,407.0	304,316.5	0.0	0.0	313,060.2	303,993.8
Total	327,385.2	425,600.8	1,031,263.4	1,244,063.8	1,480,114.2	868,613.4	694,990.5	2,321,825.4	2,095,305.9
Proportion[a]	101%	59%	154%	25%	15%	159%	27%	16%	48%

[a] Proportion of restoration opportunities on currently forested land. Values greater than 100% indicate that currently non-forested land would need to be restored to meet the objective.

Table 8. The Minimum BCR Objectives needed to support desired populations of 10 priority forest and shrubland bird species (Continental Priorities only). Habitat estimates (acres) are allocated geographically by natural community and state portion of the Bird Conservation Region.

State	Prairie / Savanna	Barrens	Glade / Savanna Mosaic (< 20% canopy)	Oak Open Woodland (20-50% canopy)	Oak Closed Woodland (50-80% canopy)	Pine / Bluestem Open Woodland (20-50% canopy)	Pine / Oak Closed Woodland (50-80% canopy)	Forest (> 80% canopy)	Floodplain Forests
Alabama	0.0	15,984.5	3,237.7	13,060.3	14,007.5	1,532.5	1,239.0	14,350.0	36,252.7
Arkansas	28,656.9	0.0	44,611.7	59,959.7	123,770.0	1,778.9	80,001.1	223,079.9	19,014.6
Illinois	0.6	17,414.0	0.0	14,867.6	22,716.2	3,550.6	0.0	45,002.9	89,296.3
Indiana	0.0	11,242.5	0.0	4,934.9	25,019.0	0.0	598.9	330,846.4	129,469.9
Kansas	281.7	0.0	0.0	404.6	305.8	0.0	0.0	0.0	2.0
Kentucky	0.0	89,319.5	0.0	7,231.5	60,759.6	0.0	0.0	620,520.8	233,721.2
Missouri	107,520.8	0.0	376,742.0	381,456.6	240,576.9	55,200.2	128,494.9	256,754.6	103,066.4
Ohio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27,264.2	4,516.9
Oklahoma	13,220.3	0.0	0.0	37,372.5	25,978.0	0.0	1,202.1	21,755.4	3,433.5
Tennessee	0.0	56,629.0	45,109.5	70,630.0	132,807.5	0.0	0.0	239,938.2	105,008.7
Total	149,680.4	190,589.4	469,700.9	589,917.8	645,940.4	62,062.2	211,536.0	1,779,512.4	723,782.2
Proportion[a]	46%	26%	70%	12%	6%	11%	8%	12%	17%

[a] Proportion of restoration opportunities on currently forested land.

Table 9. Estimates of current and desired population sizes for priority forest and shrubland birds in the Central Hardwoods Bird Conservation Region expected under the Minimum BCR Objectives.

Priority Class	Species code	Population Estimate	Objective Factor	Desired Population	Habitat Objective Impact	% Desired Population Achieved
Continental Priorities (Watch List)	BACS	1	2	2	9,283	464150%
	BWWA	49,853	2	99,706	102,014	102%
	BHNU	5,261	1.5	7,892	82,263	1042%
	CERW	35,107	2	70,214	96,236	137%
	KEWA	293,075	1	293,075	525,676	179%
	PABU	25,625	1	25,625	37,374	146%
	PRAW	156,814	2	313,628	514,939	164%
	PROW	75,918	1	75,918	135,126	178%
	WOTH	990,815	1	990,815	1,107,779	112%
	WEWA	174,657	1	174,657	195,083	112%
Stewardship Species	ACFL	667,416	1	667,416	396,087	59%
	HOWA	198,117	1	198,117	187,991	95%
	LOWA	38,306	1	38,306	38,178	100%
	YTVI	152,615	1	152,615	295,340	194%
	YTWA	261,943	1	261,943	251,241	96%
BCR Priorities	BGGN	5,162,018	1	5,162,018	4,569,329	89%
	CACH	1,854,224	1	1,854,224	2,417,961	130%
	EAWP	927,840	2	1,855,680	1,619,075	87%
	FISP	818,463	2	1,636,926	730,972	45%
	YBCU	909,527	2	1,819,054	730,972	61%
	YBCH	1,195,810	1	1,195,810	24,052,980	1322%

Table 10. Population impacts estimated by the spreadsheet simulation tool (SSimDST_v4.xlsx) of implementing the Minimum BCR Objectives listed in Table 8.

	Species code	Continental Population Objective	CHJV Population Objective	Baseline Population Estimate	Scenario Population Estimate	Population Change	Percent Change (*100)	Sub %Change [a]	
								Min	Max
Continental Priorities	BACS	Increase 100%	Increase 100%	1	1,789	1,788	178800.00	-100.0	348.0
	BWWA	Increase 50%	Increase 100%	49,853	81,995	32,142	64.47	-14.9	564.2
	BHNU	Increase 50%	Increase 50%	5,261	24,718	19,457	369.83	-26.9	4574.6
	CERW	Increase 100%	Increase 100%	35,107	60,580	25,473	72.56	1.8	386.0
	KEWA	Increase 50%	Maintain	293,075	445,169	152,094	51.90	1.2	116.5
	PABU	Increase 100%	Maintain	25,625	26,261	636	2.48	-33.3	512.4
	PRAW	Increase 50%	Increase 100%	156,814	325,298	168,484	107.44	-14.1	1152.0
	PROW	Increase 50%	Maintain	75,918	119,805	43,887	57.81	-8.7	232.3
	WOTH	Increase 50%	Maintain	990,815	1,252,119	261,304	26.37	-0.5	56.8
	WEWA	Maintain/Increase	Maintain/Increase	174,657	220,434	45,777	26.21	-6.1	102.9
Stewardship Species	ACFL	Maintain	Maintain	667,416	721,854	54,438	8.16	-10.5	42.2
	HOWA	Maintain	Maintain	198,117	224,234	26,117	13.18	-16.4	91.5
	LOWA	Maintain	Maintain	38,306	44,093	5,787	15.11	-11.3	82.9
	YTVI	Maintain	Maintain	152,615	227,551	74,936	49.10	1.8	94.0
	YTWA	Maintain	Maintain	261,943	286,752	24,809	9.47	-11.4	51.5
BCR Priorities	BGGN		Maintain/Increase	5,162,018	5,929,202	767,184	14.86	-2.3	37.3
	CACH		Maintain	1,854,224	2,569,935	715,711	38.60	6.1	72.3
	EAWP		Increase 100%	927,840	1,208,698	280,858	30.27	1.1	64.1
	FISP		Increase 100%	818,463	965,585	147,122	17.98	-13.4	342.4
	YBCU		Increase 100%	909,527	1,364,525	454,998	50.03	7.7	118.7
	YBCH		Maintain/Increase	1,195,810	1,364,885	169,075	14.14	-14.0	215.8

[a] Range of percent population change (*100) values across subsections of the Bird Conservation Region. Negative values indicate population declines.

Table 11. The proportion of Population Objectives achieved by implementing the Minimum BCR Objectives listed in Table 8 calculated from density estimates alone (Acreage Estimate) or calculated within the CHJV spreadsheet-based simulation decision support tool (SSimDST). Factor denotes the relative size of the Acreage Estimate approach compared to the SSimDST approach.

	Species code	Acreage Estimate	SSimDST Estimate	Factor [a]
Continental Priorities (Watch List)	BACS	464150%	89450%	5.2
	BWWA	102%	82%	1.2
	BHNU	1042%	313%	3.3
	CERW	137%	86%	1.6
	KEWA	179%	152%	1.2
	PABU	146%	102%	1.4
	PRAW	164%	104%	1.6
	PROW	178%	158%	1.1
	WOTH	112%	126%	0.9
	WEWA	112%	126%	0.9
Stewardship Species	ACFL	59%	108%	0.5
	CACH	130%	139%	0.9
	HOWA	95%	113%	0.8
	LOWA	100%	115%	0.9
	YTVI	194%	149%	1.3
	YTWA	96%	109%	0.9
BCR Priorities	BGGN	89%	115%	0.8
	EAWP	87%	65%	1.3
	FISP	45%	59%	0.8
	YBCU	61%	114%	0.5
	YBCH	1322%	75%	17.6

[a] Factor is calculated as the Acreage Estimate value divided by SSimDST value.