



Partners in Flight Caribbean/Eastern Upland Hardwoods Avian Conservation Business Plan

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SUMMARY

We all envision a world where birds thrive. To achieve that vision, Partners in Flight is developing this living document as a framework for linking conservation activities in the Caribbean with those in the upland forests of the eastern U.S. and Canada. The document identifies 8 species as focal points for illuminating the threats facing all birds in this region, and to serve as catalysts for actions to reduce those threats. We need your help to identify and think through potential actions or projects that can reduce threats to habitats and/or species or increase conservation capacity, and then to prioritize them so that we focus on those that are the most feasible and impactful.

INTRODUCTION

This Conservation Business Plan (CBP) is being developed by a team of conservationists with the assistance of many practitioners and researchers, primarily through workshops held as part of the 19th *Regional Meeting of the Society for the Conservation and Study of Caribbean Birds* (www.scscb.org) and the 5th *International Partners in Flight Conference and Conservation Workshop* (www.pifv.org). The purpose of developing this business plan is to build upon existing scientific information and conservation plans by

1. Identifying conservation actions/projects that are well defined and able to be implemented,
2. Defining the measurable impacts and costs of implementing those actions/projects,
3. Identifying the general risks underlying the strategic approach of each action/project, and then
4. Prioritizing the set of identified actions/projects.

The Caribbean/Eastern Upland Hardwoods CBP is a “living document” that highlights the current state of our knowledge about a suite of migratory and resident birds representative of major habitat types in these regions, as well as what we think are the most fruitful approaches to addressing threats and limiting factors shared by migratory and endemic birds. As such, it will be continually updated to reflect new information and understanding.

The projects identified here will be those the broad conservation community (e.g. researchers, managers, planners, policy makers) thinks are both feasible and impactful at this time. It is the intent of the development team that these projects will serve as the basis of funding proposals, which will serve to strengthen the science underlying conservation actions and help develop coordinated conservation actions throughout the full annual cycle (breeding, migration and wintering). Given the focus on fundable projects, this CBP is not intended to detail all possible threats or actions or the finer elements of species biology. Rather, it is intended to focus on the most critical actions in a language appropriate for a broad set of audiences, particularly those agencies and organizations that fund or implement conservation actions throughout the geography.

DESCRIPTION OF LINKED GEOGRAPHIC AREAS

This business plan focuses on the Caribbean and the Upland Forests of the Eastern United States and Canada, geographies that are linked by migratory forest birds. The avian

conservation community recognizes that successful conservation of these birds requires that efforts be coordinated throughout their full annual life cycle. Further, because migrants spend most of the year on their wintering grounds, their fates are inextricably linked to those of resident endemics.

The Caribbean region covered by this CBP includes Bermuda and all the islands of The Bahamas, Greater Antilles (Puerto Rico, Jamaica, Cuba and Hispaniola [comprising the countries of the Dominican Republic and Haiti]), Virgin Islands, Cayman Islands, Lesser Antilles, the Netherlands Antilles, and Trinidad and Tobago. The Caribbean represents a complex geopolitical region of 13 independent nations (Antigua and Barbuda, The Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Trinidad and Tobago,) and six British (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos Islands) and three U.S. overseas territories (Puerto Rico, US Virgin Islands and Navassa), two French overseas départements (Guadeloupe and Martinique), two French overseas collectivités (St Barthélemy and St Martin), three special municipalities of the Netherlands (Bonaire, Saba and St Eustatius), and three constituent countries within the Kingdom of the Netherlands (Aruba, Curaçao and St Maarten). The Caribbean encompasses more than four million km² of ocean as well as approximately 230,000 km² of land area, with the four islands of Cuba, Hispaniola, Jamaica and Puerto Rico making up about 90% of this. The elevational range spans from over 3,000 m above sea level to 40 m below sea level and encompasses a diverse array of habitats and ecosystems.

The Eastern Forests breeding grounds covered by this CBP includes forested areas east of the Great Plains of the United States and Canada. This area has been divided into Bird Conservation Regions (BCR; ecological regions for bird conservation planning) by the U.S. North American Bird Conservation Initiative Committee (U.S. North American Bird Conservation Initiative Committee 2000). Using this geographic framework, this business plan specifically covers the Boreal Hardwoods Transition (BCR 12), Atlantic Northern Forest (BCR 14), Central Hardwoods (BCR 24), West Gulf Coastal Plain (BCR 25), Mississippi Alluvial Valley (BCR 26), Southeastern Coastal Plain (BCR 27), Appalachian Mountains (BCR 28), Piedmont (BCR 29), and Peninsular Florida (BCR 31). Each BCR is administered by one or more non-regulatory public-private partnerships called Joint Ventures. The Joint Ventures included in this plan include: Eastern Habitat (Canadian portion of BCR 12), Upper Mississippi River/Great Lakes Region (U.S. portion of BCR 12), Atlantic Coast (BCRs 14, 29, 31 and portions of 27), Central Hardwoods (BCR 24), Lower Mississippi Valley (BCRs 25 & 26), Appalachian Mountains (BCR 28), and East Gulf Coastal Plain (portions of BCR 27). These regions are dominated by deciduous and/or pine forests and woodlands, ranging from lowland types (bottomland hardwoods, longleaf pine) to high elevation types (e.g. spruce) of the Appalachian Mountains. Other habitats of importance include coastal marsh and scrub along the Atlantic Ocean and Gulf of Mexico, mangrove forests in Florida, temperate and subtropical grasslands, and freshwater wetlands.

CONSERVATION TARGETS

The Steering Committee for the 5th International Partners in Flight Conference and Workshop (PIF V) suggested a list of 8 bird species to serve as conservation targets for this plan: Bicknell's Thrush, Kirtland's Warbler, Mangrove Cuckoo, Prairie Warbler, Swainson's Warbler, Black-throated Blue Warbler, Cape May Warbler and Painted Bunting. These species were selected because their wintering grounds are concentrated in the Caribbean region (as defined by this plan), and because they represent a variety of habitat types in the Caribbean and Eastern Forest regions. Whereas this list of conservation targets is provisional, these species do provide explicit linkages between the Caribbean and Eastern Forest regions and the writing team considered them useful for the primary purpose of this plan (i.e. identifying conservation actions/projects that are well defined and able to be implemented). Of course, resident endemic species are of great concern in the Caribbean. Appendix 1 links the 8 target species to globally threatened endemic species within Important Bird Areas of the Caribbean (BirdLife International 2013). Future editions of this plan will attempt to set population goals for at least some of the globally threatened endemic species listed in Appendix 1 as has been done for the 8 target species.

Following Wege et al. (2009), we grouped Caribbean region habitat types used by the target species into 6 broad types: Moist forest, Dry forest, Coniferous forest, Shrub/Scrub, Mangrove/Coastal and Agricultural (e.g., shade-grown coffee plantations). Similarly, we grouped Eastern Forest habitats into 7 broad types: Boreal forest, Moist forest, Dry woodland, Coniferous forest, Shrubland (includes scrub and early-successional forest), Mangrove and Wetland. This plan will explicitly tie migrant and resident birds to the habitat classification so that habitat objectives (i.e. the number of acres needed to support populations at goal) can be calculated.

Current Situation and Conservation Need

The areas covered by this plan have experienced significant changes in land use, primarily conversion of native habitat types to agricultural uses or urban development. With these changes have come other stressors, including changes in vegetation structure, invasion of exotic species (plant and animal), changes in predator communities, and range expansion of the parasitic Brown-headed Cowbird (*Molothrus ater*). Although habitat restoration efforts exist throughout the plan area, urban expansion is expected to progress at an increasing rate (Ramalho and Hobbs 2012) that is already much faster than our ability to create or restore habitat. Further, the expected impacts of climate change such as warmer temperatures, altered precipitation regimes, increased risk of extreme storms and droughts, and sea level rise, will add further stress on bird populations and the habitats on which they depend.

Perhaps the greatest impediment to conservation planning in these regions is a lack of knowledge about the birds themselves. Whereas the need for conservation is obvious in light of decreasing bird populations and increasing stressors, little information exists to guide decisions on what the most efficient and effective management or conservation actions might be. There is limited information on the basic abundance, habitat use, and range of migratory birds or their response to stressors on their wintering grounds in the Caribbean, leaving conservationists

unsure of the most limiting factors impacting their populations. Similarly, information is sparse for these birds during migration periods.

Whereas addressing information gaps will be key to the success of this plan, we must simultaneously address broader, more immediate threats as well. These include direct impacts to birds and their habitats such as advancing urbanization and pressures from a rapidly changing climate, but also underlying systemic issues such as heavy reliance natural resource by poorer communities and the tourism industry, limited capacity of government to develop and enforce environmental policy, and institutional barriers to protected area management (Wege et al. 2009).

Species Status and Population Goal

Mangrove Cuckoo

The Mangrove Cuckoo (*Coccyzus minor*) is a resident bird that breeds in a variety of lowland habitat types of extreme southern Florida, the Bahamas, Cuba, Cayman Islands, Jamaica, Hispaniola, Puerto Rico, Virgin Islands and most of the Lesser Antilles (Hughes 2012). Winter habitats are similar to breeding sites, though birds may switch between types or move to higher elevations in winter. The Caribbean habitat usually includes dry scrub, mangroves, shade-grown coffee plantations and areas with substantial forests or thickets except for high mountains (Raffaele et al 1998). The global population of the Mangrove Cuckoo is estimated at 200,000 birds, with 5% breeding in the U.S. (Panjabi et al. 2012). Although the Florida population was thought to be migratory, recent evidence suggests this is not the case. However, post-breeding birds may wander outside of breeding areas. Conservationists suffer from a general lack of knowledge about the population status and ecology of this species. It is known to be area sensitive in Florida and is negatively impacted by habitat loss to development, but populations appear stable where habitat is protected (see citations in Hughes 2012).

The population goal developed by Partners in Flight for the Mangrove Cuckoo is to increase populations by 50% to 300,000 birds by 2030. Accomplishing this objective will require short-term efforts to identify and preserve current high quality breeding habitat to stabilize the population, and longer-term efforts (research and management) to mitigate lost breeding and wintering areas.

Painted Bunting (eastern population)

The eastern population of the Painted Bunting (*Passerina ciris*) is a neotropical migrant songbird that breeds in shrubby and interspersed open and woody habitats of the coastal southeastern U.S. from North Carolina to Florida (Lowther et al. 1999). It winters primarily in extreme southern Florida, the Bahamas, Cuba, Jamaica and Cayman Islands primarily from mid-October to April (Raffaele et al 1998). Winter habitat use is not well-understood, but it is known to use thickets, brush and grassy areas, particularly in semi-arid areas, often not far from water (Raffaele et al 1998). For migration, it likely uses habitats similar in structure to breeding areas and appears to migrate directly in both spring and fall. Painted Bunting populations in the Eastern U.S. have declined 1.6%/year from 1966 to 2011 (Sauer et al. 2012). These declines have been attributed to habitat loss on the breeding grounds due to development, though they

are still trapped and sold as cage birds in large numbers, especially in Mexico, Central America, the Caribbean, and to a lesser extent in Florida. Although Painted Buntings are known to suffer fatal collisions during migration, these amount to <1% of the current estimated population size annually (Lowther et al. 1999, Longcore et al. 2013).

The population goal developed by Partners in Flight for the Painted Bunting is to double the current range-wide population by 2030. Accomplishing this objective will require continued efforts to identify and preserve current high quality breeding and wintering habitat to stabilize the population, and longer-term efforts (research and management) to mitigate lost breeding and wintering areas.

Prairie Warbler

The Prairie Warbler (*Setophaga discolor*) is a neotropical migrant songbird that breeds in shrubby and early successional habitats of the east-central and southeastern U.S. (Nolan et al. 1999). One of six migrant warblers whose entire populations occur almost exclusively in the Caribbean during the non-breeding season (Raffaele et al. 1998), it is among the most common winter residents in the Caribbean - common in the Bahamas, Greater Antilles and Cayman Islands, fairly common in the Virgin Islands but rare to vagrant south through Lesser Antilles to Grenada (Raffaele et al. 1998; Keith et al. 2003). The Prairie Warbler occurs from the lowlands to the mountains where it uses a broad range of habitat types including dry coastal forest, thickets, pastures with scattered trees, mangroves and gardens. Most birds have been found at elevations of 300 m or below. It is generally less numerous at higher elevations where it uses pine forest with thick scrubby understory (Keith et al 2003). For migration, it likely uses habitats similar in structure to breeding areas and appears to migrate directly in both spring (March – April) and fall (mid-September-October) (Keith et al 2003), though variations do exist that may be attributable to sex and/or age differences. Prairie Warbler populations are currently estimated at 3,500,000 birds (Panjabi et al. 2012), and have declined 2.1%/year since 1966 (Sauer et al. 2012). These declines have been attributed to habitat loss on the breeding grounds due to succession or conversion. However, little data exists to help explain changes in detection rates at wintering sites (Faaborg et al. 2012) and more information on winter ecology is needed. Winter site fidelity has been recorded for the species (Latta and Faaborg 2001) and birds can be very concentrated in their winter range making them particularly vulnerable to habitat losses from agriculture, woodcutting, and development occurring there. In addition, mortality due to hurricanes and hunting by children with slingshots in the winter range may also account for population declines (NatureServe 2001 in Southwell 2001). Although Prairie Warblers are known to suffer fatal collisions during migration (Nolan et al. 1999), Longcore et al. (2013) estimated the annual mortality loss at approximately 1% of the estimated global population size. Bonnot et al. (2013) used a population model to show that small changes in this loss rate could improve population trends.

The population goal developed by Partners in Flight for the Prairie Warbler is to increase the range-wide population by 50% to 5.2 million birds by 2030. Accomplishing this objective will require continued efforts to identify and preserve current high quality breeding and wintering habitat to stabilize the population, as well as reducing collision mortalities during migration.

Longer-term efforts (research and management) to mitigate lost breeding and wintering areas and to educate communities about the value of these birds are also needed.

Swainson's Warbler

The Swainson's Warbler (*Limnothlypis swainsonii*) is a neotropical migrant songbird that breeds in heavily forested landscapes of mature moist bottomland forests of the southeastern U.S. or mixed mesophytic montane forests of the southern Appalachian Mountains (Anich et al. 2010). In both cases, this species prefers sites with shaded, dense understory and abundant leaf litter. It winters regularly from September to April (Raffaele et al. 1998) in the Bahamas, Cuba, Jamaica, Hispaniola, Puerto Rico, and as far east (rarely) as Anguilla where it uses a range of habitat types with dense vegetation including Moist Forest, shrub/scrub, mangroves, and coffee plantations. For migration, it likely uses habitats similar in structure to breeding areas and appears to migrate directly in both spring and fall. Swainson's Warbler populations are estimated at 90,000 birds (Panjabi et al. 2012). Data from the Breeding Bird Survey indicate that the species has been stable since 1966, but increasing 3.7%/year from 2001-2011 (Sauer et al. 2012). However, the BBS is not well-suited to this species. The species is threatened by habitat loss on the breeding grounds related to anthropogenic ecosystem modifications especially the loss of canebreaks and altered hydrologic regimes. Loss of habitat on the wintering grounds could also be a problem (Anich et al. 2010). However, little data exists to help explain changes in detection rates at wintering sites (Faaborg et al. 2012). Swainson's Warblers are known to suffer fatal collisions during migration (Anich et al. 2010) and Longcore et al. (2013) estimated annual losses at about 1% of the current estimated population. In general terms little is known about this species in any part of its annual cycle.

The population goal developed by Partners in Flight for the Swainson's Warbler is to maintain the current populations. Accomplishing this objective will require continuing to preserve and re-create breeding habitats to keep pace with losses to development.

Bicknell's Thrush

The Bicknell's Thrush (*Catharus bicknelli*) is a neotropical migrant songbird that has a very limited distribution on both its breeding and wintering grounds. It breeds only in coastal and mountainous areas of the northeastern U.S. (50%) and Canada (50%), in fragmented boreal forest dominated by balsam fir. Its known winter range includes only mountainous forests of the Greater Antilles, with the majority of the population found in the Dominican Republic, and, to a lesser extent, Haiti, Jamaica, Puerto Rico and eastern Cuba (IBTCG 2010). Little is known about its migration path, however it is assumed to fly along or near the eastern coast of North America. The population of Bicknell's Thrush is estimated at 110,500 individuals (Panjabi et al. 2012). Population declines are attributed to restricted habitat preferences and threats related to habitat loss, pollution and climate change on both the breeding and nonbreeding grounds. The primary threats to breeding habitat include forest thinning and clear-cutting; commercial development (wind power, telecommunications facilities, and recreational ski development) may be further fragmenting and reducing breeding habitat. On the wintering grounds subsistence farming, logging, charcoal production, and human-caused fires have reduced available habitat for the Bicknell's Thrush. In particular, female thrushes tend to concentrate in areas most

heavily affected by habitat loss and alteration in the Greater Antilles. Little is known about this species or risks during migration.

The goal for the Bicknell's Thrush is to increase the current global population by 25% over the next 50 years (2011-2060) and to ensure no further net loss of distribution for the Bicknell's Thrush (IBTCG 2010). Accomplishing this objective will require a 'no net habitat loss' policy and long-term forest management on the breeding ground. On the wintering grounds, there is a strong need to increase capacity for conservation on Hispaniola by strengthening current relationships and providing outreach and opportunities to local biologists, students, government officials, non-governmental organizations and community members for implementing conservation activities. To implement the goal, the Bicknell's Thrush Habitat Protection Fund needs to be funded at \$50,000 in North America, as well as an additional \$50,000 in Hispaniola.

Cape May Warbler

The Cape May Warbler (*Setophaga tigrina*) is a neotropical migrant songbird that has an extremely large range and a fairly stable population (BirdLife International 2012b). It breeds in boreal forest across Canada (98%) and the northeastern U.S. (2%), specializing on spruce budworms. On its wintering grounds, it primarily forages on nectar in a variety of habitats using its unique semitubular tongue. It is most commonly found in settled areas and around ornamental plantings (Baltz and Latta 1998), however in Puerto Rico and Cuba it is common in xeric coastal vegetation and secondary forest. In the Dominican Republic, it can be found in pine and broadleaf forests, dry scrub, pasture, and shade-grown coffee plantations (Arendt 1992, Wunderle and Waide 1993). The population of Cape May Warbler is estimated at 7,000,000 individuals (Panjabi et al. 2012) and is estimated to have declined 3.4% between 1966-2011 (Sauer et al. 2012). In winter, the Cape May Warbler can be found primarily across the Caribbean, with uncommon occurrences in southern Central America, and northern South America. In fall, Cape May Warblers primarily migrate down the Appalachian Mountains, and occasionally along the Atlantic Coast. In spring, most migrate north through the Midwest before spreading across Canada (Baltz and Latta 1998).

The population goal developed by Partners in Flight for the Cape May Warbler is to maintain the current population (Rich 2004). The primary threat to Cape May Warblers is loss of habitat and the associated population instability of its primary prey, spruce budworms (*Choristoneura sp.*), which are threatened by the use of certain combinations of insecticides and the need for mature to old-growth spruce forests to maintain the budworm population.

Kirtland's Warbler

The Kirtland's Warbler (*Setophaga kirtlandii*) is a neotropical migrant songbird that is listed as federally endangered in the U.S. Until recently Kirtland's Warblers were known only to breed in the northern part of southern peninsular Michigan, however the species' range has recently expanded to Michigan's Upper Peninsula, Wisconsin and Canada. The Kirtland's Warbler has very specialized habitat requirements, nesting only in fire-maintained homogeneous stands of 1-5 m tall young jack pine (*Pinus banksiana*) forests on sandy soil. The global population of Kirtland's Warbler is estimated at 3,600 individuals (Panjabi et al. 2012). Its known winter range

includes early-successional disturbed habitat (Wunderle et al. 2010) in the northern islands of The Bahamas (New Providence, Eleuthera, Abaco, San Salvador), and The Turks and Caicos Islands. The winter habitat includes stands of Caribbean pine (*Pinus caribbaea*; Haney et al. 1998), or natural and secondary scrub, and saline/upland ecotone (Sykes and Clench 1998, Wunderle et al. 2010). The species is threatened by habitat loss, fire suppression, nest parasitism by Brown-headed Cowbirds (*Moluthrus ater*), and a need for constant conservation management of fire-dependent habitats.

The population goal developed by the USFWS for the Kirtland's Warbler is 1,000 breeding pairs and to maintain 38,000 acres of nesting habitat. This goal has been met, so the primary need for this highly managed species is funding to maintain continual forest and cowbird management. A key need is to identify and protect the Kirtland Warbler's preferred wintering habitat (Probst et al. 2003, BirdLife International 2012a).

Black-throated Blue Warbler

The Black-throated Blue Warbler (*Setophaga caerulescens*) is a neotropical migratory songbird that breeds in large tracts of relatively undisturbed hardwood and mixed deciduous-coniferous forests with a thick understory across the northeastern United States (25%), southeastern Canada (65%), and in the higher elevations of the Appalachian Mountains (10%). It winters primarily in the Caribbean, and less frequently in Central America, where it can be found in dense tropical forests, primarily at higher elevations, but also in rich lowland forests. On migration it can be found in various habitats, including forests, forest edges, parks and gardens. The population of Black-throated Blue Warblers is estimated at 2,100,000 individuals (Panjabi et al. 2012) and is estimated to have increased 2.3 % between 1966-2011 (Sauer et al. 2012).

The population goal developed by Partners in Flight for the Black-throated Blue Warbler is to maintain current populations. Forest fragmentation and associated increased nest parasitism on the breeding grounds and habitat loss on the wintering grounds are the primary threats to this species.

THREATS TO BIRDS AND THEIR HABITATS

Birds face many threats throughout the annual cycle. Threat information from various conservation planning documents were compiled and organized for the breeding grounds (Table 1) according to the classification system of Salafsky et al. (2008). Threats were then ranked by the proportion of plan documents identifying the threat. Wintering ground threats had already been assessed and prioritized using a similar approach of ranking threats for each island based on stakeholder input, then averaging across islands to produce a Caribbean score (Wege et al. 2009). Here we highlight and discuss those threats which both systems indicated were most important. Whereas all these threats may negatively impact birds during migration, we presume that efforts to mitigate threats during the breeding and wintering seasons will provide benefits to birds in migration.

It is extremely important to note, however, that there are threats to the conservation of birds which are not covered by this classification system. In particular, a lack of conservation

capacity and a limited knowledge of ecology of some species, particularly for the Caribbean, are hindrances that must be addressed for any conservation strategy to be successful. While some training programs exist in Caribbean communities (e.g. banding, radio tracking), strategies need to be developed to maintain employment in this field. This could include training in the business side of conservation (e.g. writing grant proposals and project management). Similarly, few monitoring or research programs exist in the wintering grounds to elucidate the causes of population changes in areas being studied (Faaborg et al. 2010). Certainly these problems exist in the US and Canada as well, though to a lesser degree. Knowledge of migration ecology (routes, timing) also is very poor.

Socio-economic issues can be both a direct threat and an underlying cause of the threats described here. Poverty across the regions covered in this plan results in communities relying heavily and unsustainably on natural resources for food, energy and income. This reliance makes these populations more vulnerable to environmental degradation and reduces their ability to make conservation a priority. Additionally, large variation exists across these regions in terms of political and institutional structures for developing and enforcing environmental policies or supporting conservation and management. Conservation actions developed under this plan will need to be innovative to work within these realities to improve conditions for people as well as for birds.

Common Threats

The primary threats to birds and habitats in the Caribbean and eastern U.S. and Canada are generally anthropomorphic in nature. Human population growth and its subsequent demand on resources directly causes habitat loss, fragmentation and degradation, and is antecedent to other problems such as pollution and invasive species.

Habitat Loss and Fragmentation

A wealth of research over the last 30 years has demonstrated the nuanced impacts of land use changes on birds. This threat was well-summarized by Rich et al. (2004) when they wrote: “The causes of population declines in birds are numerous, but the loss, modification, degradation, and fragmentation of habitat almost always play a major role. Threats to habitats come primarily from intensified land-use practices in agricultural and forested regions and from other impacts associated with human population growth.” The underlying causes of this threat are tightly interwoven with the other threats we discuss here. For example, clearing and filling of mangroves for tourism development can cause both loss of existing habitat as well as fragmentation of remaining habitat. Further, habitat loss is not restricted to conversion of land types from natural to developed, but also includes degradation and changes due to invasive species, exploitation, and land management (e.g. fire).

Invasive and Other Problematic Species and Infectious Diseases

This was the top ranked threat overall in the Caribbean assessment and also ranked near the top of breeding ground threats. Feral goats, donkeys, horses and pigs have negatively impacted native vegetation by trampling and selective grazing leading to alteration of native plant community dynamics. Both Caribbean and breeding ground habitats have suffered from a major

invasive plant species which has suppressed and replaced native vegetation. However, quantitative data are lacking on invasive species in the Caribbean (Kairo *et al.* 2003) and the mainland. This limits the ability to design effective responses. There is also a low level of awareness from public to policy-makers of the threats posed by invasive aliens and their environmental and economic impacts. A particular challenge to addressing invasive aliens arises from the fact that many of the major pathways for species introductions (those related to trade and tourism, for example) are critical to national economies (Wege *et al.* 2009).

Residential, Commercial, Industrial and Tourism Development

This threat ranked second overall in the Caribbean assessment and was the most cited threat to forest area and integrity on the breeding grounds. Extensive development and a lack of conservation input in the planning process leads to destruction, fragmentation and degradation of natural habitats of all types. Development frequently leads to other impacts including: pollution from untreated sewage from residential and tourism developments and contamination from industrial sites; clearance of natural coastal vegetation for construction; clearance, dredging, channelization or in-filling of coastal wetlands and mangroves for marinas and ports; sand mining and beach and dune erosion; and increased consumption of water from surface and ground water sources leading to salt intrusion and changes in ecosystem function, and decreased availability of water supplies. In addition, housing and commercial/industrial initiatives are being sited on agricultural lands, displacing farmers to more marginal lands (Wege *et al.* 2009). Commercial and residential development, communications towers and wind power development are known to affect the migration habitat of other neotropical migrants using the same eastern flyway (e.g. Longcore *et al.* 2013).

Severe Weather and Climate Change

Climate change is of high concern for many in this geography, especially with reference to sea level rise and storms impacting islands and mainland coasts. The loss, fragmentation and degradation of natural habitats compound the problem by reducing the resilience of the region's remaining biodiversity to survive hurricanes and tropical storms. These impacts are particularly severe on mangrove habitats which can take 10 years to regenerate and have limited space to move landward due to seawalls and other types of coastal development. More frequent storms and erratic weather could limit foraging opportunities, reduce roosting cover, destroy lower-altitude habitats, cause direct mortality, or lower breeding fitness (i.e. cross-seasonal effects).

Rainfall levels are also predicted to change, with increased rainfall in the east of the Caribbean and less in the western part, with longer dry seasons on Jamaica for instance which could increase the risk of damage to forests from the fires and thus impact native biodiversity.

Human-related Disturbance

Wege *et al.* (2009) used this category to capture impacts from recreation, wars, or other direct impacts (Salafsky *et al.* 2008, category 6), as well as indirect effects of human activity such as fire suppression, water management, and ecosystem modifications (Salafsky *et al.* 2008, category 7). On the breeding grounds, these categories ranked 8th and 2nd, respectively.

The Caribbean and coastal areas are hotbeds of tourism development, replacing and fragmenting habitats. The growth in the numbers of visitors even within protected areas in recent years has led to degradation of vegetation and disturbance of fauna, due to exceeding carrying capacities.

Fire is commonly used to clear land for agriculture and settlements, prepare sugar-cane fields for cutting, to "clean" undergrowth in forests and to encourage new growth in grassland and lightly wooded areas in the dry season for pasturage (FAO 2006b). Fire suppression is more of an issue on the breeding ground forests leading to structural changes and elimination of ground flora and fauna. Additionally, dam building has eliminated habitat (upstream and downstream) and altered natural hydrographic regimes.

Agricultural Expansion and Intensification

This threat ranks moderately for the Caribbean and the breeding grounds. However, most of the Caribbean forests have been lost to agricultural development, and today no more than an estimated 23,000 km² or approximately 10 percent of the original vegetation remains in a pristine state (CI 2009). Clearance for agriculture has been one of the greatest threats to native forests in the Caribbean. A survey of 220 Eastern Caribbean coastal wetlands (predominantly mangroves) between 1989 and 1991 revealed that virtually every site visited in the 16 islands showed evidence of damage, and more than 50 percent showed severe damage (Bacon 1993).

Over-exploitation

Human resource use is a high ranking threat in the U.S. and Canada and a moderate concern in the Caribbean. This primarily relates to concerns over unsustainable timber practices, ownership fragmentation of formerly large private industrial forests, and illegal logging that threatens commercial forest concessions and critical protected areas and buffer zones. Poorly developed energy infrastructure in rural areas of the poorer Caribbean countries causes communities in these areas to rely heavily on fuel wood and charcoal from neighboring forested areas, including mangroves. Similarly, collection of some non-timber forest products (e.g. fruits, fibers, resins, tannins, essential oils, tree seeds, honey, fodder, yam and bean poles, ornamental plants, tree fern trunks [for cultivation of orchids], bamboo, medicinal plants, spices, edible oils, dyestuffs, gums and mushrooms) is known to be taking place at unsustainable levels or using destructive practices.

In addition to exploitation of habitats, birds themselves may be exploited. Painted Bunting are still trapped and sold in large numbers in Mexico, Central America, the Caribbean, and to a lesser extent in Florida, harming wild populations

(http://www.allaboutbirds.org/guide/Painted_Bunting/lifehistory).

Other Threats

A variety of other threats ranked low in both regions likely due to their localized impacts. These include mining, energy extraction/production, pollution, transportation corridors, and geologic events (e.g. earthquakes, volcanos). Most of these are related to human population growth and the need for more resources to support them. Of particular interest to avian conservation are

mining activities that destroy habitat (e.g. strip mining, mountaintop removal) through clearance of vegetation for surface facilities and dumping of tailings, with a risk of pollution from poorly constructed or managed effluents and tailings ponds (Wege et al 2009). Similarly, energy production may clear forests for shale gas extraction, or cause direct injury or mortality (e.g. collisions with wind turbines). Pollution can result from mining and energy production, but primarily results from urban or agricultural sources. Waste management and disposal capability (both solid and liquid) is very limited in the Caribbean countries, and as a result, pollution of coastal areas especially from land-based sources is a major threat to coastal biodiversity (including mangroves, beaches, and coastal lagoons).

Table 1: Prioritized threats

Threat Category*	THREATS**	Caribbean: Average prioritization score **	Breeding Ground: Rank***
8	Invasive Species	3.7	4
1	Residential/Commercial Development	3.5	1
11	Severe Weather/Climate Change	3.3	4
6 and 7	Human Disturbance	2.8	8, 2
2	Agricultural Expansion/Intensification	2.7	4
5	Over-exploitation	2.7	3
3	Mining/Energy Production	2.6	9
9	Pollution	2.4	7
4	Transportation	2.3	9
10	Geological Events	1.2	11

* World Conservation Union-Conservation Measures Partnership (IUCN-CMP) classification of direct threats (Salafsky et al. 2008).

** Threat descriptions used in Wege et al. (2009) for all islands included in this CBP, except Trinidad and Tobago, and Bermuda; however threats are assumed to be similar on these islands. Threats were scored from 1 (insignificant threat or impact) to 4 (highly significant national threat/ impact), for each of a broad cross-section of the Caribbean countries. The average of these scores is presented as a “Caribbean” score.

***Rank of threats developed for this document by calculating the proportion of Joint Venture or Bird Conservation Region plans that identified the threat as an issue in their area (1 highest; 11 lowest).

STRATEGIES TO ADDRESS THREATS

The primary purpose of this CBP is to identify, describe, and prioritize projects that are feasible and have a strong positive impact on avian populations. Table 2 provides a framework for describing potential projects or actions in a consistent manner to facilitate comparison and prioritization. Examples are listed to stimulate thinking, but it is the project ideas that reviewers and workshop participants generate that will ultimately be prioritized for further development, including the pursuit of funding. Thus, it is important that project ideas be explicitly and quantitatively linked (to the extent possible) with population viability or habitat sustainability because these outcomes will drive the prioritization process.

Suitable projects could include (but are not limited to) the following themes:

- Species-specific projects: how can we meet the overall population goal? The overall habitat goal? The desired habitat conditions and BMPs to get there? Management actions prescribed for what areas? Conservation and protections identified for what areas? Ongoing guard presence needed for what areas?
- Habitat projects: Is it being diminished or degraded in a way that makes it unable to support target species? Is it affecting overall carrying capacity, or a key vital rate, or both?
- Direct land protection projects: What lands are identified for protection? Public decree? Where is critical increased onsite protection or management needed?
- Working landscape/Community engagement projects: how do we influence local communities? Promote bird-friendly uses of the land? In what specific areas? What industries are impacting habitat and target species where engagement could lead to more sustainable practices?
- Policy/Regulatory projects: To what extent are existing or potential future laws, regulations, policies, or judicial decisions detrimental?
- Socio – Economic/Community engagement projects: To what extent are social factors and considerations detrimental? To what extent are current or anticipated economic factors and conditions detrimental? How do we influence and engage local communities to meet their needs and the needs of the conservation targets?
- Knowledge and Evaluation projects: To what extent is our scientific understanding of the threats and/or necessary conservation actions insufficient?

Table 2: Project Matrix

Threat	Season (B,M,W)	Project Name	Target	Objective & Target	Strategy	Partners	Time Frame	Benchmarks	Evaluation	Cost	Comments
Habitat Loss	W	Caribbean Pine Conservation	Kirtland's Warbler	10,000 Ac	ID key wintering sites	TNC, BNT, USFS, USFWS	5 years	2,000 per yr	# Acres protected	\$400,000 total	Based on KIWA Action Plan 2010-2012

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