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CONSERVATION PLANNING AND ACCOMPLISHMENTS FOR PROTECTION OF CERULEAN WARBLER (*SETOPHAGA CERULEA*) NONBREEDING HABITAT

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Resumen. – Planificación y Logros de Conservación para la Protección del Hábitat durante la Temporada No Reproductiva de la Reinita Cerúlea. – La colaboración entre miembros del Grupo Técnico de la Reinita Cerúlea ha sido muy importante para la evaluación del estatus de la población, coordinar la planificación de actividades futuras, y principalmente implementar acciones de conservación. Logros al presente incluyen una estrategia general para la conservación y manejo de la especie a través de su rango, un plan para la conservación de poblaciones no reproductivas incluyendo hábitats a nivel de paisaje, y un análisis sobre la economía de las comunidades locales. Desde entonces se han logrado implementar acciones de conservación en 355.701 ha que representa hasta 2% del rango no-reproductivo y beneficiando 35.570 individuos en la zona invernal en Sudamérica. Recomendamos mayor coordinación entre stakeholders para facilitar replicación e incremento de acciones de conservación en 4,4 millones ha adicionales para lograr la meta de doblar la población hasta 1.000.000 individuos. También, pedimos que la comunidad científica realice investigación en los mismos sitios que los proyectos de conservación para contribuir información sobre el monitoreo y la biología que serviría para adaptar las estrategias de conservación.

Abstract. – Vital to the work of the Cerulean Warbler Technical Group has been the collaboration among members to evaluate population status and coordinate planning for future activities, principally in conservation implementation. Two plans have been produced, one a general strategy for the conservation and management of the species over its entire range, and a more restricted plan for conservation of non-breeding populations, their landscapes, and the economic vitality of the local communities. In the process several notable conservation implementation successes have been achieved affecting nearly 355,701 ha affecting as much as 2% of the species non-breeding range and benefiting an estimated 35,570 Cerulean Warblers on their non-breeding range in South America. We recommend increased coordination among stakeholders to enable the replication and scaling up of conservation actions on an additional 4.4 million ha, which will help achieve the stated goal of doubling the population to 1,000,000 individuals. Also, we urge the scientific community to engage in research at conservation project sites to contribute vital monitoring and biological information to adapt conservation strategies.

Key words: Conservation partnerships, Cerulean Warbler, wintering ground

INTRODUCTION

The dramatic decline of the Cerulean Warbler (*Setophaga cerulea*) places the species among North America's most rapidly declining Neotropical migrant songbirds. Numbers have decreased by almost 70% since 1966, and the species is listed as Vulnerable by IUCN (Birdlife International 2008). Cerulean Warblers have experienced the steepest declines of any wood warbler in the United States, 3.2% per year for 40 years, 1966-2005 (Sauer *et al.* 2011). In recognition that a continuous, concerted, and collaborative multi-national effort was necessary to determine the cause of population declines and to coordinate an effective response over a large area, the Cerulean Warbler Technical Group (CWTG) formed in 2001. Concentrated field surveys from 2003-2008 on the non-breeding grounds in Central and South America contributed to improved knowledge of the species distribution. A petition to list the species by the United States Fish and Wildlife Service (USFWS) as a threatened species was found not warranted in 2006; however the compilation and analysis of existing information informed the creation of the USFWS Conservation Action Plan (USFWS 2007). In 2010, a Conservation Plan for the Cerulean Warbler on its non-breeding range, hereafter called the "Non-breeding Plan," was written by Paula Caycedo for Fundación Proaves (Colombia) with input from members of Grupo Cerúleo, a subcommittee of the CWTG (Fundación ProAves *et al.* 2010). Respectively, the plans produced a general strategy for the conservation and management of the species over its entire range and a more detailed plan for conservation of non-breeding populations. The Non-breeding Plan addresses actions to increase the habitat value to Cerulean Warblers of the landscapes in which the birds occur, as well as to maintain and improve the economic vitality of the local communities in these areas so as to increase local awareness and participation in conservation.

Loss of suitable habitat along migratory pathways and in South America are clear threats (Hamel 2000), although low reproduction rates in fragmented landscapes on the breeding grounds may not be adequate to increase populations (Buehler *et al.* 2008). The two plans broadly detailed threats and limiting factors to the species across its entire range, highlighting a list of ten and five priorities, respectively. Although considerable gaps exist in knowledge of the Cerulean Warbler's life history and threats, the information in the Plans has been sufficient to engage in preliminary conservation actions. The CWTG established a conservation objective of restoring Cerulean Warbler populations to their levels in the 1980s, by doubling the current population. This paper documents on-the-ground efforts to deliver protection to the Cerulean Warbler with particular emphasis on the non-breeding range a decade after the formation of CWTG. We suggest that although considerable investment has been made in a variety of projects in northern South America, more emphasis needs to be given to coordinating current projects, to improved evaluation of conservation projects as well as to careful scientific monitoring of effects on Cerulean Warblers, and to replicating and expanding the scale of projects.

METHODS

Pilot Cerulean Warbler wintering ground conservation projects were undertaken in Colombia, Peru and Ecuador based on hotspots within the distribution of the species in its non-breeding range (Barker *et al.* 2006). The map and geographic descriptions presented in the Non-breeding Plan highlight these potential hotspots by modelling natural forest remnants of the Northern Andes at the warbler's preferred elevation (Josse *et al.*

2008) with localities of over five hundred historic and recent observations of Cerulean Warblers. To restore degraded landscapes and create habitat, trees were planted in a variety of treatments including reforestation plots of mixed native species, silvopastures, living fences, and agroforestry systems where shade coffee and other crops are produced. Nurseries were established on community and private lands to produce the necessary saplings. Trees were planted on community and private lands in Peru, on farms and private forested areas in Peru and Colombia, and on degraded areas within protected areas owned by Fundación Jocotoco, ECOAN and Fundación ProAves in Ecuador, Peru and Colombia, respectively.

In these projects a variety of methods were used to encourage landowners and community members to participate in reforestation and promote long-term stewardship of trees, including regulation and incentives. Local institutions in Peru, *comunidades campesinas*, offered strict rules for participation and required beneficiaries to attend meetings, work in nurseries and group tasks (*faenas*), and pay penalties for violating signed agreements. Contracts were signed in Peru and Colombia with beneficiaries when saplings were delivered for planting that stipulated proper care and consequences for high plant mortality. Conservation easements were included in the deeds of landowners in Colombia for periods up to 15 years. Direct incentives given to beneficiaries included tree saplings (often fruiting or forestry species were desirable to landowners because of their commercial value), technical training, cement for irrigation systems, fencing, and signs for conservation easements. An outreach component allowed implementing partners to educate participants on the structure of these reforestation programs and the variety of benefits of reforestation and habitat protection.

Additional landscape level projects conducted by industry, e.g., Biodiversity and Coffee Growing Program, National Coffee Federation, Colombia; by governments, e.g., Socio Bosque, Ecuador; non-profit groups, e.g., Corredor de Conservación Guantiva-La Rusia- Iguaque, Fundación Natura, The Nature Conservancy and others, Colombia; or regional efforts spanning several countries, e.g., ecoregional strategy to conserve the Spectacled Bear (*Tremarctos ornatus*) in the northern Andes (Rodríguez *et al.* 2003) did not set out explicitly to benefit Cerulean Warblers but employed conservation strategies that likely benefit the species in its non-breeding range.

We also evaluated the extent of overlap between the modeled nonbreeding range of Cerulean Warbler from Barker *et al.* (2006) and two sources of information about conservation areas in the nonbreeding range, the Important Bird Areas (IBA) of the Andes (Birdlife International & Conservation International 2005), and the World Database on Protected Areas (WDPA) in the Andean countries (IUCN & UNEP-WCMC 2010). We intersected the modeled nonbreeding range with digital maps of the IBA and WDPA in ArcMAP 10 (ESRI 1999–2010). We estimated the area contained in IBAs projected as nonbreeding habitat by four or five models of Barker *et al.* (2006), and calculated the proportion of nonbreeding range included in IBAs, or in WDPAs, from these area values using SAS 9.2 (SAS Institute 2002–2008). The shapefile of IBAs was obtained from Amiro Perez-Leroux and Francisco Prieto in the Birdlife International Americas Regional Office in Quito, Ecuador. That of the WDPA was downloaded from (IUCN & UNEP-WCMC. 2010).

RESULTS

Of 455 IBAs listed in BirdLife International & Conservation International (2005), 433 were included in the modeled nonbreeding range of Cerulean Warbler. Slightly more than half of the IBAs, N = 226 IBAs, were predicted to

have habitat for Cerulean Warbler by at least four of the five models used by Barker *et al.* (2006), representing all the countries (Bolivia, N = 2; Colombia, N = 91; Ecuador, N = 52; Peru, N = 35; and Venezuela, N = 46). These IBAs include 26% of the 600,000 km^2 of Andean landscape predicted as habitat by at least four of the models used by Barker *et al.* (2006). A smaller number, N = 162 IBAs, include areas predicted by all five of the models as habitat for the species, and account for 22% of the 173,000 km^2 projected as habitat by all five of those models.

Of 836 areas in the WDPA listed in IUCN & UNEP-WCMC. (2010), N = 391 were predicted to have habitat for Cerulean Warbler by at least four of the five models used by Barker *et al.* (2006), representing all the countries (Bolivia, N = 4; Colombia, N = 143; Ecuador, N = 65; Peru, N = 30; and Venezuela, N = 149). These WDPAs include 59% of the 600,000 km^2 of Andean landscape predicted as habitat by at least four of the models used by Barker *et al.* (2006). A smaller number, N = 261 WDPAs, include areas predicted by all five of the models as habitat for the species, and account for 42% of the 173,000 km^2 projected as habitat by all five of those models.

Conservation actions were undertaken on 355,701 ha in various pilot and landscape level projects in areas with predicted presence and documented high densities of Cerulean Warbler in Colombia, Peru and Ecuador. This area represents just over 0.5% of the 60,257,000 hectare non-breeding range based upon the sum of the area predicted by at least four of the five models employed by Barker *et al.* (2006). However, wintering habitat may be occupied at only 17% capacity, 10,000,000 ha, and considering that projects focused on areas of relatively high abundances of Cerulean Warbler, perhaps as much as 3.6% of the occupied range was affected in the conservation projects reported here (Colorado *et al.* 2012). We treat the project areas by country.

Colombia. The Serranía de Yariguies, Santander Department, had the highest number of Cerulean Warblers reported in Colombia (Fundación ProAves *et al.* 2010). In 2005, Fundación ProAves established the 10 kilometer Cerulean Warbler Corridor linking the Yariguíes National Park to Cerro de la Paz. Habitat protection strategies in the Corridor include engaging landowners in reforestation and conservation easement programs as well as expanding three private protected areas, Pauxi Pauxi, Cerulean Warbler and Niceforo's Wren Reserves. Landowners included 13 tracts, totaling 130 ha, as conservation easements into the deeds (Fundación ProAves 2011a). These easements required a ban on timber harvesting and hunting and protection of existing forest in exchange for saplings for reforestation and other incentives (e.g. fencing to restrict cattle from forested areas). To date nearly 200,000 trees were planted on over 400 ha of shade coffee and cacao in two multi-year Neotropical Migratory Bird Conservation Act projects (Fundación ProAves 2011b). An alliance with local government and surrounding communities to support the corridor was established through the Yaré project, which contributes to reforestation and the restoration of the historic Lengerke stone path that will be promoted as an ecotourism route. Expansion of the corridor will take place in a three year project beginning in 2012 to reforest 150,000 trees on an additional 450 ha of agricultural lands. Forested lands and degraded lands targeted for restoration were acquired in the Corridor, resulting in over 3,000 ha of land under private protection since 2005. Land acquisition has also taken place in the northern Central Andes of Colombia, another area noted for high Cerulean Warbler concentrations, at Arrierito Anitqueño Reserve (1,500 ha in 2010). In

the Corredor de Conservación Guantiva- La Rusia- Iguaque, the oak conservation corridor in Colombia, Fundación Natura Colombia conducts activities designed to conserving oak (*Quercus humboldtii* and *Colombobalanus excelsa*); this project has protected and recuperated as well as promoted sustainable use on 52,122 ha of forests (Cardenas & Avella Muñoz 2007 & 2009).

The Colombian National Coffee Federation has conducted numerous initiatives restoring or protecting 75,500 ha of habitat within the Cerulean Warbler range. For instance, along the Magdalena river basin, 65,000 ha have been reforested in the last twenty years and plans include planting another 7,000 ha in 2012. Another initiative in Nariño, Quindío, and Valle de Cauca departments established 450 ha of biodiversity conservation corridors. Begun in 1991, the Ecological Coffee Fund has created 3,962 ha of protected areas as well as restored 1,600 ha and acquired 8,000 ha of forest in important watersheds. In addition to direct habitat creation or protection, the Federation certified 27,000 ha of coffee farms with environmentally friendly practices thus far in a four year project begun in 2010. Not all certified coffee has equal benefits for Cerulean Warbler, but environmental certifications have direct benefits to habitat because of reduced pollution, watershed protection, shade trees, and other factors (Fischersworring 2008, López López *et al.* 2012).

Ecuador. The area of greatest documented concentration of Cerulean Warblers in Ecuador lies along the eastern slope of the Andes. In 2006, the Jocotoco Foundation established the Narupa Reserve, Napo Province, which was subsequently expanded to 596 ha. Private reserves maintained by EcoMinga Foundation also have multiple records of Cerulean Warblers and provide habitat protection for the species. Efforts are underway to work in the areas surrounding these private reserves and engage communities in habitat protection in the buffer areas of several large national parks (Santander *et al.* 2012). Cerulean Warbler occurs between 900 and 1400 m on the eastern slope of the Andes in Zamora Chinchipe province in southern Ecuador (Andrade *et al.* 2006). This area includes the Tapichalaca Reserve owned by Fundación Jocotoco. The reserve comprises 3,252 ha; since 2009 85,100 trees of 17 species were planted on acquired properties there with degraded habitat (Fundación Jocotoco 2011). On the western slope, Fundación Jocotoco also manages the 1,947 hectare Río Canandé Reserve, where Cerulean Warblers have been observed as well (Lebbin pers. observ.).

The Socio Bosque program pays direct monetary incentives per hectare to private and community landowners to maintain forest cover; and through December, 2011 883,223 ha were protected through 1,563 contracts with 90,162 community and private landowners beneficiaries (Ministerio del Ambiente 2012). Of the total area affected, 25,154 ha are montane forest and constitute suitable Cerulean habitat.

Peru. Most Peruvian records of Cerulean Warbler are from the northern departments. Conservation efforts led by ECOAN in northern Peru include regional conservation planning, reforestation programs across the department of Amazonas, promotion of shade coffee and silvopasture, education of local communities about migratory birds, and establishment and improvement of management of private and public protected areas. ECOAN established the Abra Patricia-Alto Nieva Private Conservation Area and 40-year term Abra Patricia-Alto Nieva Conservation Concession which total over 9,800 ha (Angulo *et al.* 2008). ECOAN also works with various community, local, and national government agencies to improve management of natural resources and

the adjacent 182,000 hectare Bosque de Protección Alto Mayo, and establish future protected areas. The area has several records of Cerulean Warbler and is indicated as an area of high probability in the Non-breeding Plan. The species may arrive to the Mayo River Valley in the fall moving to higher elevation through the Bosque de Protección Alto Mayo and then on to the upslope habitat at the Abra Patricia-Alto Nieva reserve and concession (Aucca pers. observ.). Since 2004, a sustained reforestation campaign working with six community nurseries resulted in the planting of 736,785 native trees and shrubs of over 40 species and coffee bushes on roughly 300 ha. Most of these were planted in mixed forest, shade coffee, silvopasture and living fences systems on private or community-owned lands surrounding reserves managed by ECOAN. In 2010, Rainforest Alliance, Cenicafe, and El Grupo Cerúleo conducted workshops for Peruvian coffee growers as an outreach resulting from the Cerulean Warbler -Golden-winged Warbler Summit in Bogota in 2008 (Gabriel Colorado and Jorge Botero, unpubl. data). These activities were conducted in tandem with model validation work on the non-breeding season model (Colorado *et al.* 2008, 2012).

Venezuela. Although areas of importance were identified in Venezuela, particularly in the Mérida Cordillera (Jones *et al.* 2000, Bakermans *et al.* 2009, Colorado *et al.* 2012), and many areas were revealed through the analysis of IBAs and WDPA areas, we regret that no implementation actions were recorded specific to Cerulean Warbler conservation and we look forward to including this information in the future.

DISCUSSION

Conservation projects began to address the first objective of the Non-breeding Plan that calls for the improvement of the physiological condition and survival of the Cerulean Warbler by protecting and improving non-breeding habitat in South America. The overall goal is to restore Cerulean Warbler populations to 1980s levels and double population sizes from 560,000 estimated to exist in 1995 (Rich *et al.* 2004) to 1,000,000 individuals.

In areas of key habitat, densities as high as 0.83 Cerulean Warbler per ha has been documented (Jones *et al.* 2000). To get some idea as to the scale of number of hectares that would have to be affected by conservation measures, including both protection of already-existing habitat and restoration of habitat to make it suitable for wintering Cerulean Warblers, we can make an estimate using some assumptions of distribution and abundance. Assuming that the birds occur at a much lower density of 0.1 birds per ha average abundance in the areas affected by this conservation activity, approximately 10 million ha of wintering habitat would be required to meet the goal of 1 million individuals. The population of 560,000 (Rich *et al.* 2004) would likely occupy 5,600,000 ha (560,000 individuals / 0.1 individuals per ha) of existing habitat, of which only part is protected. To achieve the goal of 1 million birds would therefore require about 4,400,000 ha of new, restored or improved habitat, assuming that there are no further losses in existing habitat, plus efforts to protect much of previously-existing 5,600,000 ha against losses. However, if we consider that Cerulean Warblers are often more densely populated in key areas, then conservation on these lands would have a disproportionately larger effect on the overall population. The conservation efforts on 355,701 ha described in this paper are a significant first step towards this goal. Using the conservative figure of 0.1 birds per ha, conservation may have benefited up to 35,570 Cerulean Warblers on 2% of the winter range.

Cerulean Warblers may have a strong affinity to successional forests and agroforestry

systems, such as shade coffee; and proximity to large contiguous forests may be an important factor as well (Colorado *et al.* 2012). Given variations in habitat quality, future non-breeding ground conservation actions should continue to focus on areas of documented high abundance of Cerulean Warblers. Pilot projects focused on sites that support high densities of Cerulean Warblers employed two primary strategies: 1) maintenance of existing natural forest through easements and land acquisition, and 2) restoration of degraded areas through the promotion of shade-grown coffee, agro-forestry, silvopasture and reforestation. Additional programs were identified that have direct benefits on Cerulean Warbler habitat through acquisition or direct payments to landowners for forest protection as well as restoration through reforestation.

The variety of efforts conducted to date provides a rich base of experience to guide future actions and evaluate and adapt the planning documents. Initiatives in Colombia, Ecuador and Peru carried out by non-profit conservation groups began with acquisition, restoration and protection of private lands. These institutions later incorporated landscape approaches that integrated surrounding communities and public protected areas. A long-term institutional presence provided opportunities to engage communities and build trust as well as build expertise in the field of reforestation. Besides the lasting benefits of environmental services provided by reforestation, including erosion control, nutrient retention and watershed protection, beneficiaries also received direct incentives and the commercial value of fruiting tree species. Private reserves and reforestation programs, in particular, provided multiple benefits to residents. For instance, in the last decade, reforestation programs in three countries employed 55 individuals year-round and provided an additional 2,250 seasonal jobs (American Bird Conservancy 2011). Programs conducted by the Colombian coffee industry and Ecuadorian government will similarly bring long-term benefits from forest protection. These programs began as landscape scale, well-funded initiatives that impacted comparatively large areas. In contrast to the non-profit groups' projects, their primary focus was economic benefits that resulted in improved livelihoods to hundreds of thousands of people. One-fifth of the incentives paid to landowners ($1.2 million USD through Dec 2011) have been re-invested in conservation or territorial consolidation that helps limit land invasions (Koning *et al.* 2011). Given the urgency of habitat protection in the face of rapid deforestation, industry and government programs can provide a useful tool to affect change. Furthermore, these programs can provide a complement to site-specific projects because enrollment is open to private landowners. For example, coffee growers in the Cerulean Warbler Corridor can participate in the Colombian National Coffee Federation initiatives and the private landowners surrounding the Narupa Reserve in Ecuador can enroll their forests in the Socio Bosque program.

The success of conservation efforts depends on good communication, outreach, and education of appropriate audiences. These build public awareness and support for bird conservation necessary to accomplish our goals for improving the status of species like the Cerulean Warbler. Education programs such as the Migratory Bird Festivals hosted in the Cerulean Warbler Corridor in Colombia and educating farmers about the benefits of cultivating shade-grown coffee are two examples of efforts to address this issue.

Multi-national projects have provided a platform for the implementing partner groups to share best practices and replicate or adapt tactics to best fit realities in the field (American Bird Conservancy 2011). For instance, following a best-practices workshop

held by American Bird Conservancy in Peru, Fundación Jocotoco planned to implement a model agroforestry plot for teaching local landowners in Ecuador; and Fundación ProAves staff began implementing formal agreements with beneficiaries who received trees from Colombian nurseries because these agreements increased landowners' commitment to caring for the saplings. Migratory bird projects in multiple countries must manage for multiple species (Cerulean Warbler is not the only high priority species on most of these properties). Because of the diversity of ecosystems, implementation varied considerably in these projects given the need to adapt similar initial approaches to specific local circumstances.

Although the objectives in the Cerulean Warbler Non-breeding Plan are of necessity general in calling for conservation actions and protection of wintering areas, many sites identified in the Plan have yet to receive conservation action. For instance, no known conservation was noted in Venezuela, the upper Napo Province of Ecuador, or western slope of the eastern Andes or the southern region of the eastern slope of the central Andes in Colombia, all potentially important non-breeding destinations of Cerulean Warbler. Given the dispersed range of the Cerulean Warbler, a challenge of this study was to fully consider the impact of all projects. The growing portfolio or Reducing Emissions from Deforestation and Forest Degradation projects (Hübenthal *et al.* 2010), the contribution of national park systems, industry initiatives by foresters, cattle ranchers, fruit growers and cacao farmers need further analysis and consideration.

Unfortunately, none of these conservation projects conducted monitoring of Cerulean Warblers or other migratory songbirds to assess the status of the species. In the case of Socio Bosque, Koning *et al.* (2011) note that no monitoring of biological indicators has taken place. Cenicafé, the research center of the Colombian National Coffee Federation, has carried out research on Cerulean Warblers in coffee plantations (Sánchez-Clavijo *et al.* 2008, 2009, Botero *et al.* 2010) and maintains ornithologists on staff who could provide vital research on the warblers in the Biodiversity and Coffee Growing Program. Previously, monitoring has been limited to gauging the successful implementation of project activities such as survival of tree species, easements signed and ha acquired, and avian monitoring was not conducted in part because of limited project funding. Monitoring is planned for 2012-2013 in the Cerulean Warbler Corridor in Colombia. Wintering Cerulean Warblers are generally difficult to detect and never abundant, and thus considerable time and expertise is needed in the field to complete a thorough monitoring program. Members of the CWTG and the ornithological community could bolster the efficacy of conservation programs by conducting research at project sites. Research questions might ideally focus on the number of Cerulean Warblers supported by different habitat protection strategies, noting habitat type and proximity to contiguous forests, so that more broad questions can be answered regarding the amount and type of habitat required to restore population levels of the 1980s (Hamel *et al.* 2012). An example of this sort of collaboration already exists in the case of Cerulean Warbler records from reserves owned by Fundación ProAves contributing to baseline estimates of occupancy (Hamel pers. observ.). These synergies could feed Cerulean Warbler monitoring data back into conservation programs to assess and adapt strategies.

One success of the CWTG and Grupo Cerúleo is the collaborative spirit that these efforts have encouraged among stakeholders. Increasingly, interest is growing among individuals and institutions for migratory bird conservation. Pilot projects discussed here

have attracted new support, such as Fondo para la Acción Ambiental support for Cerulean Warbler Corridor in Colombia. New initiatives such as Southern Wings, a cooperative program coordinated by the Association for Fish and Wildlife Agencies that links state wildlife agencies with neotropical migratory bird projects in the tropics and the American Bird Conservancy's Migratory Bird Program will drive continued growth of larger-scale, multi-national projects. National programs like Socio Bosque in Ecuador are gaining interest in other countries, such as Peru. In coming years, emphasis should be given to coordination among non-governmental, government and industry stakeholders on the non-breeding grounds as our analysis suggests current conservation initiatives are complimentary and strong alliances can be formed to strengthen one another's programs. Efforts should be made to specifically expand conservation programs to the landscape scale to connect large forest blocks where Cerulean Warblers seem to be more densely populated (Colorado *et al*., 2012).

Next steps needed to continue improvement of Cerulean Warbler conservation planning and non-breeding ground conservation efforts include: (1) adapt implementation of the existing conservation plans, and apply occupancy-based modeling approaches to refine the identification of potential and demonstrated hotspots for conservation; (2) identify existing projects that can be expanded in scale and replicated in other locations; (3) identify and assess the protection status of stop-over sites and application of strategies to assure the continued existence of the sites as good habitat into the future; (4) continue high quality scientific research to address the important gaps in our knowledge identified in the research arena; (5) coordinate international, national, regional and local stakeholders in the adaptation of the conservation planning approaches to fit local conditions; and (6) develop mechanisms to recognize the important contributions of different entities, governmental, nongovernmental, commercial, and individual, to the conservation effort for the species.

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