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GOLDEN-WINGED WARBLER NON-BREEDING SEASON CONSERVATION PLAN

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The process of creating this conservation plan, spanning multiple national borders, would not have been possible without the dedicated involvement of multiple individuals. Listed below are individuals that have had a major roll in the development of this plan. A complete list of all individuals involved in the plan development is found in Appendix A.

- Ruth Bennett, Cornell Lab of Ornithology: Lead author on Winter Ground Conservation Plan; helped lead workshops and conducted field research in Honduras.
- Andrew Rothman, American Bird Conservancy and co-chair of the Alianza Alas Doradas: Identified Conservation Plan needs, organized and commissioned focal area identification and threats assessments, facilitate partner communication, organized and led workshops.
- Fabiola Rodriguez, Indiana University of Pennsylvania. Compiled threats assessments, organized logistics of Copan Ruinas workshop.
- Ken Rosenberg, Cornell Lab of Ornithology: Supervised data analyses, defined plan goals, and supervised the writing and organization of the Conservation Plan.
- Pablo Elizondo, Co-Chair of the Alianza Alas Doradas, Costa Rica Bird Observatory: assisted with organization of workshops in Costa Rica and supervised the Costa Rica survey effort.
- Fundación ProAves: Coordinated field survey effort.
- Liliana Chavarria and Georges Duriaux, El Jaguar, Nicaragua: identified plan needs, helped develop threats assessment, led Nicaragua survey effort.
- Maria Isabel Moreno, Fundación SELVA: Led effort to compile winter records, assisted with focal area development and distributional modeling.
- Nick Bayly, Fundación SELVA: Complied threats assessments and assisted with focal area development.
- Richard Chandler, University of Georgia: developed survey protocol, analyzed data, and modeled Golden-winged Warbler distribution.
- Sara Barker, Cornell Lab of Ornithology: Compiled and georeferenced historic records.
- Benjamin Skolnik, American Bird Conservancy: Identified plan needs, facilitated partner communication, organized Colombia workshop.
- Tom Will, USFWS: Advocated for plan funding and networked conservation partners.

CHAPTER 4: TABLE OF CONTENTS

Golden-winged Warbler Non-breeding Season Conservation Plan 1

Recommended Citation 1

Acknowledgements 2

Table of contents 3

Summary 5

Introduction 6

Section 1: Golden-winged Warbler Non-breeding Assessment 9
- Assessing non-breeding distribution 9
- Current winter distribution 10
- Distribution during migration 11
- Patterns of occupancy on winter grounds 12
- Historic winter distribution 13
- Migratory connectivity 13
- Winter territory establishment and maintenance 14
- Foraging behavior 15
- Mixed-species flock participation 16
- Overlap with Blue-winged Warbler 16

Winter grounds habitat requirements 18
- Habitat associations 18
- Use of Agriculture and Other Human Disturbance Systems 23
- Conservation implications of winter ecology 23

Section 2: Winter Range Conservation Plan 25

Focal Area Selection and Assessment 25
- A physical comparison of the focal areas 27
- Land cover and forest structure within focal areas 30

Prioritizing threats and developing a strategic conservation strategy 34

Range-wide Threats to Golden-winged Warbler Conservation 35
- Descriptions of Threats to Golden-winged Warbler Winter Habitat 36

Strategic Conservation Plan to Address Range-Wide Threats 43
- Regional Conservation Goals 43
- Regional Conservation Strategies 43
- Regional Conservation Actions 43
- Descriptions: Regional Conservation Actions 45
- Linking regional threats, conservation actions, and priority focal areas 53

Section 3: Country-Level Conservation Assessments and Plans 56

3.1 Guatemala Focal Area Assessment and Conservation Plan 58
- Threats Assessment 58
- Focal Areas 59
- Guatemala Conservation Plan (2015-2020) 60

3.2 Honduras Focal Area Assessment and Conservation Plan 62
Focal Areas 62
Threats Assessment 63
Honduras Conservation Plan (2015-2020) 64
3.3 Nicaragua Focal Area Assessment and Conservation Plan 67
Focal Areas 67
Threats Assessment 68
Conservation Strategy 69
Nicaragua Conservation Plan (2015-2020) 70
3.4 Costa Rica Focal Area Assessment and Conservation Plan 72
Focal Areas Selection 72
Conservation Strategy 74
Costa Rica Conservation Plan (2015-2020) 74
3.5 Panama Focal Area Assessment and Conservation Plan 77
Focal Areas Selection 77
Conservation Strategy 78
Panama Conservation Plan (2015-2020) 79
3.6 Colombia Focal Area Assessment and Conservation Plan 81
Focal Areas Selection 81
Colombia Conservation Plan (2015-2020) 83
3.7 Venezuela Focal Area Assessment and Conservation Plan 85
Focal Areas Selection 85
Counterpart organizations 86
Venezuela Conservation Plan (2015-2020) 87

Section 4: Focal Area Maps 89

Appendix A: Participants involved in the development of Chapter 4 90

CHAPTER 4: SUMMARY

The Golden-winged Warbler Non-breeding Season Conservation Plan (Chapter 4 of the Golden-winged Warbler Conservation Plan) describes the non-breeding ecology of the Golden-winged Warbler and proposes concrete actions to maintain habitat throughout its stationary non-breeding range (hereafter winter range). The plan is intended for use by conservation practitioners, land managers, and governmental agencies both in North America and Latin America. This plan provides guidance on where conservation investment in Latin America will have the greatest impact on Golden-winged Warbler habitat and recommends conservation actions to address the specific threats to habitat retention in the winter range. This plan is also intended for use at the country level for all Latin American countries within the Golden-winged Warbler winter range. For each country, this plan prioritizes areas where conservation action should begin immediately, defines five-year conservation goals, and proposes a conservation strategy to meet those goals by the year 2020.

The information contained in this chapter responds directly to Goal 2 of the Golden-winged Warbler Full Life Cycle Conservation Strategy as described in Chapter 2: "Increase Golden-winged Warbler survival through protection and enhancement of habitat during the non-breeding season and by addressing non-habitat limiting factors." Specifically, this chapter seeks to fulfill Objectives 2.1 and 2.2 under Goal 2 by defining the winter distribution and habitat requirements of the Golden-winged Warbler, identifying threats to habitat retention, identifying focal areas for conservation, and identifying conservation goals. The completion of this plan marks the completion of the final chapter in the Golden-winged Warbler Conservation Plan, which is the first conservation plan designed to address full-life cycle conservation of a declining Nearctic-Neotropical migratory passerine in this level of detail.

This chapter is divided into three sections. Section 1 describes the distribution and ecology of the Golden-winged Warbler during the non-breeding season. The section summarizes all scientific information currently available and informs all conservation recommendations. Section 2 outlines where and how Golden-winged Warbler conservation should occur in the stationary non-breeding range. This section responds directly to forces that threaten Golden-winged Warbler habitat and persistence at the scale of the stationary non-breeding range and proposes conservation actions to address those threats. Section 3 provides a conservation plan for each country that hosts high numbers of non-breeding Golden-winged Warblers.

INTRODUCTION

The Golden-winged Warbler, *Vermivora chrysoptera,* is one of the most threatened migratory species in the United States, and the focus of a multi-national effort to reverse its sharp declines. In 2010, the United States Fish & Wildlife Service (USFWS) was petitioned to list the GWWA under the Endangered Species Act, and the petition was recently determined to present substantial scientific or commercial information indicating that listing may be warranted. Without significant, immediate conservation action, the likelihood that this species will require listing and protection under the Endangered Species Act is high.

With strong leadership support from the collaborative Golden-winged Warbler Working Group (www.gwwa.org), conservation planning and restoration efforts are now well-advanced on the Golden-winged Warbler's breeding grounds in the United States and Canada. However, strong evidence for the importance of overwintering habitat as a limiting factor for Neotropical migrants suggests that even this massive effort on the breeding grounds may ultimately be unsuccessful without an equivalent strategy to conserve Golden-winged Warbler habitat during the non-breeding season. Fortunately, a renewed commitment from the Golden-winged Warbler winter-grounds working group, the *Alianza Alas Doradas,* to assemble the science, partners, and resources has resulted in the development of this conservation plan for Golden-winged Warbler during the non-breeding season.

The process of creating the Golden-winged Warbler Non-Breeding Season Conservation Plan began in 2005 with the formation of the *Alianza Alas Doradas*, a working group of biologists and conservationists focused on studying and conserving the non-breeding grounds of the Golden-winged Warbler. This group was created to explore the possibility that events during the non-breeding season might limit the populations of Golden-winged Warbler. Following the formation of the group in 2005, the Alianza Alas Doradas began the process of gathering Golden-winged Warbler specimen data, published information, and winter observation records from birders and biologists through northern South America, Central America, Mexico, and the Caribbean. That same year, the Alianza developed the first phase of a winter grounds conservation strategy by combing all known records of overwintering Golden-winged Warblers collected in eBird's project Priority Migrant (Barker Swarthout et al. 2008) and modeling them with program MaxEnt to create a preliminary distributional model (Will et al. 2010, Phillips et al. 2006).

In order to validate this initial distributional model, Cornell Lab of Ornithology, American Bird Conservancy, and Fundación ProAves initiated an extensive survey effort in 2008. Partners from Nicaragua, Costa Rica, Panama, Colombia, and Venezuela along with North American partners from the Golden-winged Warbler Working Group convened in San Vicente de Chucurrí, Colombia at a Golden-winged Warbler and Cerulean Warbler Conservation Summit. Latin American partners were trained in a survey protocol developed by Richard Chandler in which survey locations were selected within 100 km^2 grid cells that the MaxEnt model predicted to have ≥ 80% probability of Golden-winged Warbler occurrence. Between November and mid-March from 2008 to 2012, surveys were conducted at 1499 unique locations from Honduras through Colombia and Venezuela. Additional support from USWFS and Michigan Technological University led to an additional 120 points being surveyed in Honduras in 2013. Surveys were conducted up to three times at each location and were comprised of a 20-minute point count with 10 minutes of Golden-winged Warbler playback. Two independent analyses of the data

were conducted. An analysis of a subset of the data (historic records and surveys from 2008-2011) resulted in the creation a presence only, MaxEnt model (Yojanan Lobo-y-Henriques and Arega 2013), which estimated the distribution of Golden-winged Warblers throughout Central and South America. A more recent analysis of the full survey data (2008-2012) led to the creation of a male occupancy and abundance model that accounted for differences in detection probability between countries and incorporated the numerous points where Golden-winged Warbler were not detected (Rosenberg et al. in press). Male Golden-winged Warbler occurrence and abundance were modeled as a function of elevation, latitude, longitude, precipitation, and temperature using the model described in Chandler and King (2011). The Golden-winged Warbler male occupancy model, which is fully described in Rosenberg et al. (in press), was used by the Alianza Alas Doradas to select focal areas for Golden-winged Warbler winter grounds conservation.

The initiative to synthesize this information into a concrete conservation plan began at the 2012 meeting of the Alianza Alas Doradas at Patuxtant, MD hosted by Andrew Rothman of the American Bird Conservancy where the *Alianza Alas Doradas* restructured itself and identified the immediate goals and needs to developing the winter grounds conservation plan. In 2013, the American Bird Conservancy commissioned in-country experts in Honduras, Nicaragua, and Costa Rica to assess potential threats to Golden-winged Warblers and identify potential conservation actions within polygons drawn around the areas of highest Golden-winged Warbler male occupancy. These initial threat assessments were compiled into a document (American Bird Conservancy, 2013) and presented at the Partners in Flight Fifth International Conference in Snowbird, Utah in August, 2013. Following feedback at the conference, American Bird Conservancy and Cornell Lab of Ornithology worked together to refine the focal areas in Honduras, Nicaragua, and Costa Rica and to newly define focal areas in Guatemala, Panama, Colombia, Venezuela. The process was aided by a 2014 workshop in Colombia (Moreno and Bayly 2014), and study about the status of the Golden-winged Warbler in Guatemala (Eisermann 2014), and a 2014 workshop in Costa Rica hosted by the Costa Rica Bird Observatory. Funding for these workshops, reports, and threat assessments came from USFWS Regions 3 and 4, USDA Forest Service, Marybeth Sollins, and Starr Saphir. The ecological information used to create conservation recommendations are based on a body of research conducted under the Golden-winged Warbler Rangewide Conservation Initiative, funded by the National Fish and Wildlife Foundation and U.S. Fish and Wildlife Service, with more than $1 million in matching contributions by numerous partners.

While the initial threat assessments were compiled prior to October 2014, it became clear that additional work would be needed to prioritize the identified threats at multiple spatial scales and to develop a targeted conservation strategy. Funded by an award from US Fish and Wildlife Service, Region 3, the American Bird Conservancy and Cornell Lab of Ornithology were able host 22 *Alianza Alas Doradas* partners in a three-day workshop in Copan Ruinas, Honduras. This workshop resulted in strategic planning of the range-wide conservation strategies most likely to address the various threats to Golden-winged Warbler winter grounds habitat. A follow-up workshop was held in Wellington, Virginia in May of 2015 to continue the conservation planning process and define country-level conservation strategies. Eleven *Alianza Alas Doradas* members attended the follow-up workshop and defined conservation goals and projects for each represented country over a three-day period. The group also defined habitat conservation goals that the *Alianza Alas Doradas* should strive for over the next five, ten, and twenty year periods. In order to achieve these goals, each country group defined a series of conservation actions that

would allow their country to meet the five-year goals. With this information in hand, the authors worked to synthesize the conservation goals, the regional conservation strategies, the country-level conservation strategies, and information specific to each focal area into a single conservation document that forms the core of the Golden-winged Warbler Winter Grounds Conservation Plan.

The Golden-winged Warbler Non-breeding Season Conservation Plan also forms one of the core elements of the broader Central and South American Highlands Conservation Business Plan (CBP), initiated by a working group at the Partners in Flight Fifth International Workshop in Snowbird, Utah, in August 2013. The Highlands CBP (still in early stages of development as of this writing) seeks to address shared threats to the wintering habitats of Golden-winged, Cerulean, and Canada warblers, the Olive-sided Flycatcher, and the great diversity of endemic and other resident Neotropical bird species.

SECTION 1: GOLDEN-WINGED WARBLER NON-BREEDING ASSESSMENT

Nearctic-Neotropical migratory bird conservation has undergone a paradigm shift, whereby the once almost exclusive focus on breeding ground issues has expanded to include factors affecting populations throughout the full life-cycle. Full life-cycle conservation requires working across broad temporal and spatial horizons that can span continents. Conservation planning in particular needs to consider the ways that non-breeding habitat and events affect survival and carryover to impact reproductive success (Rappole and McDonald 1994, Marra et al. 1998, Rappole et al. 2003, Norris et al. 2004, Sherry et al. 2005). Despite the need for this information, scientists and conservation practitioners have been challenged to identify factors limiting populations during non-breeding periods, in part, because of poor understanding of the distribution and habitat preferences of most wintering migrants. To address this challenge, Section 1 of this chapter gives an overview of Golden-winged Warbler winter distribution and ecology, providing the foundational knowledge needed to develop an effective conservation strategy.

Assessing non-breeding distribution

Our assessment of Golden-winged Warbler distribution during the stationary non-breeding (hereafter "winter") and the migration season is adapted from Rosenberg et al. (in press), who relied on a combination of data sources, including a distribution model based on historic records, an occupancy model based on recent survey data from part of the winter range, historic specimen records and observational records in eBird. For a complete description of data sources, survey protocols, and modeling methods, see Rosenberg et al. (in press).

To estimate the complete winter distribution of the Golden-winged Warbler, we combined the results from the surveys and models described above with all additional eBird records from the regular wintering season (eBird.org 2015). We defined the stationary winter season as 1 November to 15 March based on observations of fixed territory maintenance between those dates in Costa Rica and Honduras (Chandler 2011, Bennett 2012). We complied observation and collection records from both published literature and personal observations for each country within the area inhabited during winter (eBird 2015, Vertnet 2015, Jones 2003, Stiles and Skutch 1989, Ridgely and Gwynne 1989, Thurber et al. 1987, Hilty 1986, Wetmore 1984, Monroe 1968, Slud 1964, Land 1962). Records were vetted for location accuracy. In total, we compiled and mapped 3,569 unique geo-referenced occurrence records of Golden-winged Warblers during the non-breeding season south of the U.S. These records were used to create a MaxEnt model, which informed survey locations that led to an occupancy and abundance model (Rosenberg et al. in press), which provide the assessment of relative abundance and concentration of Golden-winged Warblers within their entire winter range. We reviewed specimen records and eBird records from the spring and fall migration seasons to provide a qualitative assessment of migration timing, routes, and potential stopover areas for Golden-winged Warblers. In total, we compiled and mapped 1,201 unique geo-referenced occurrence records of Golden-winged Warblers during migration in areas south of the United States (15 September to 30 October and 16 March to 1 May).

Current winter distribution

The main winter distribution of the Golden-winged Warbler extends from southern Mexico through the northern Andes of Colombia and Venezuela. Golden-winged Warblers occur from sea level to 2800 meters above sea level. The distribution is positively correlated with elevations greater than 600 meters, and large lowland areas separate the population into three major distributional regions as shown in Figure 4-1.1: The highlands of northern Central America, the highlands of Costa Rica and Panama, and the Andes of Colombia and Venezuela. Abundance and occupancy of Golden-winged Warblers is highest at middle elevations in Central America, between 700-1400m, while records and models show the species winters at higher elevations in the Andes of South America, principally between 1200-2200m. Additionally, small numbers of Golden-winged Warblers winter outside of these areas in eastern Mexico, including the mountains of southern Veracruz and the Yucatan Peninsula, in the Perijá and Santa Marta Mountains of northern Colombia, and in the western Andes south to Ecuador. Rare, scattered winter records outside these core regions from the Pacific lowlands of Central America, the West Indies, the Virgin Islands, and Trinidad, and may represent occasional winter occurrence in these areas.

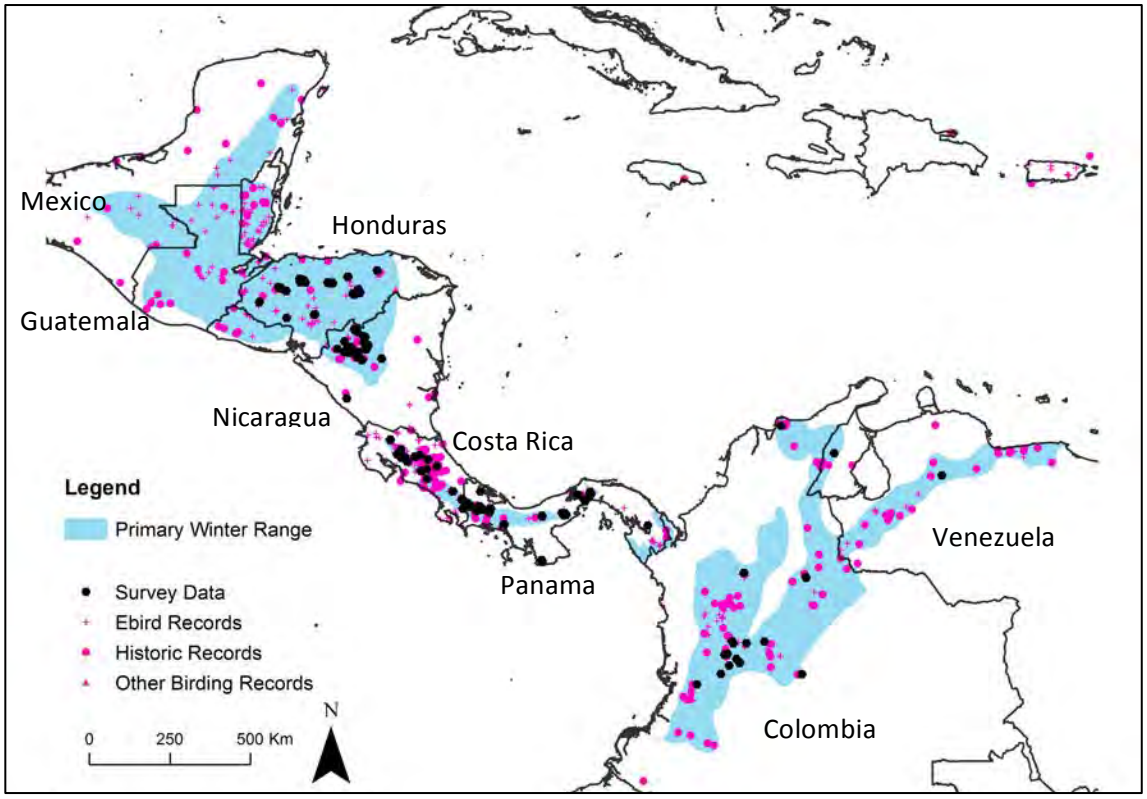


Figure 4-1.1. Winter Distribution of Golden-winged Warblers, based on all available information to date. All points on map represent specific localities where Golden-winged Warblers have been recorded from specimens, published records, standardized surveys conducted from 2008-2011, and observational records in eBird. Polygons represent the regions of continuous and regular winter occurrence of Golden-winged Warblers. Adapted from Fig. 1.8 of Rosenberg et al. (in press).

Distribution during migration

Little is known about the migration of Golden-winged Warbler, especially south of the United States. During the southward migration (August through October), Golden-winged Warblers likely to cross the Gulf of Mexico, with consistent records along the entire United States boarder with the Gulf of Mexico, especially Southern Florida. A portion of the population regularly makes landfall on the Caribbean coast between Veracruz, Mexico and Trujillo, Honduras, it is currently unknown what proportion of the population makes landfall in southern Central America or the Caribbean coast of South America. During spring migration (late March through April), Golden-winged Warblers also cross the Gulf of Mexico, with U.S landfall records concentrated in southern Texas. Ebird records show a strong difference in fall and spring migration routes, with Golden-winged Warblers migrating south through the eastern US and migrating north along a more westerly route associated with the Mississippi River (Rosenberg et al. *in press*). Within Central and northern South America, Golden-winged Warbler records are more likely to occur in lowlands and along the Caribbean coastline than during the winter season, which suggests that lowlands may provide important habitat to the species during migration (Figure 4-1.2). Ongoing work with geolocators should provide more concise information about migratory pathways and stop-over sites within Central and South America (Streby et al. *in progress* and Larkin and Bennett *in progress*).

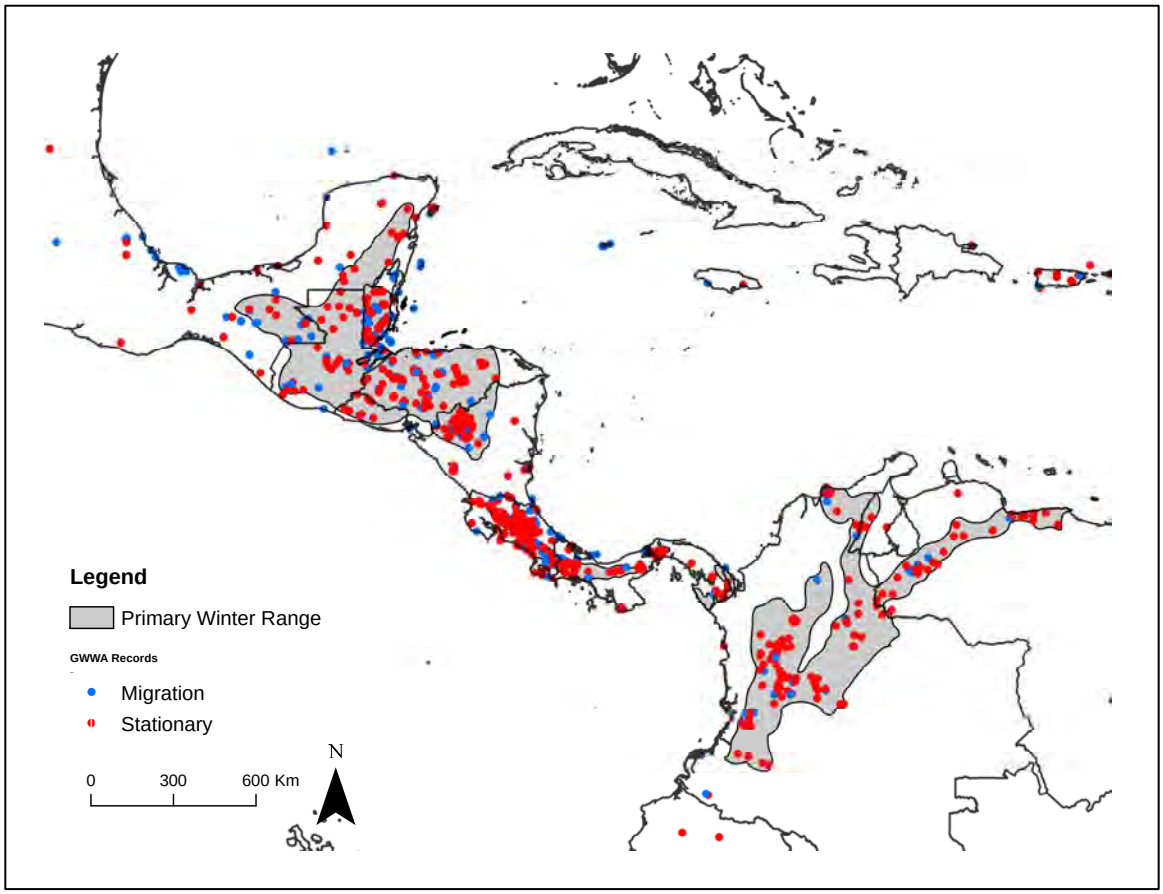


Figure 4-1.2. Comparison of the distribution of Golden-winged Warblers during the stationary and migratory periods within Middle and northern South America. All points on map represent specific localities where Golden-winged Warblers have been recorded from specimens, published records, standardized surveys conducted from 2008-2011, and observational records in eBird. Polygons represent the regions of continuous and regular winter occurrence of Golden-winged Warblers.

Patterns of occupancy on winter grounds

In order to better define the distribution and habitat associations of Golden-winged Warblers in the winter, repeated point-count surveys were conducted at 1,500 locations throughout the winter range. Survey and modeling methods are described in Rosenberg et al. (in press) Survey results were analyzed to create occupancy models, which describe the probability of encountering this species at any given point in the occupied range. Results of the analysis show that Golden-winged Warblers do not occupy all areas of their winter range at equal rates. Rather, Golden-winged Warbler males occur most frequently in the central highlands of Honduras and Nicaragua, followed by the foothills and highlands of Costa Rica and Panama, while Colombia and Venezuela have comparatively low rates of occupancy (Figure 4-1.3). Rates of female detection were too low to construct an accurate model of their distribution on the winter grounds, though the evidence from the standardized point counts suggests that females occupy hotter and lower elevation sites than males. Females occurred in equal proportion to males throughout geographic portions of the range, with no evidence for latitudinal segregation as occurs in some migratory species (Komar 2005). More recent survey data (Bennett, unpublished) further suggests that female Golden-winged Warblers occur in low densities in lowlands characterized by lower humidity and precipitation in areas adjacent to areas of high male occupancy.

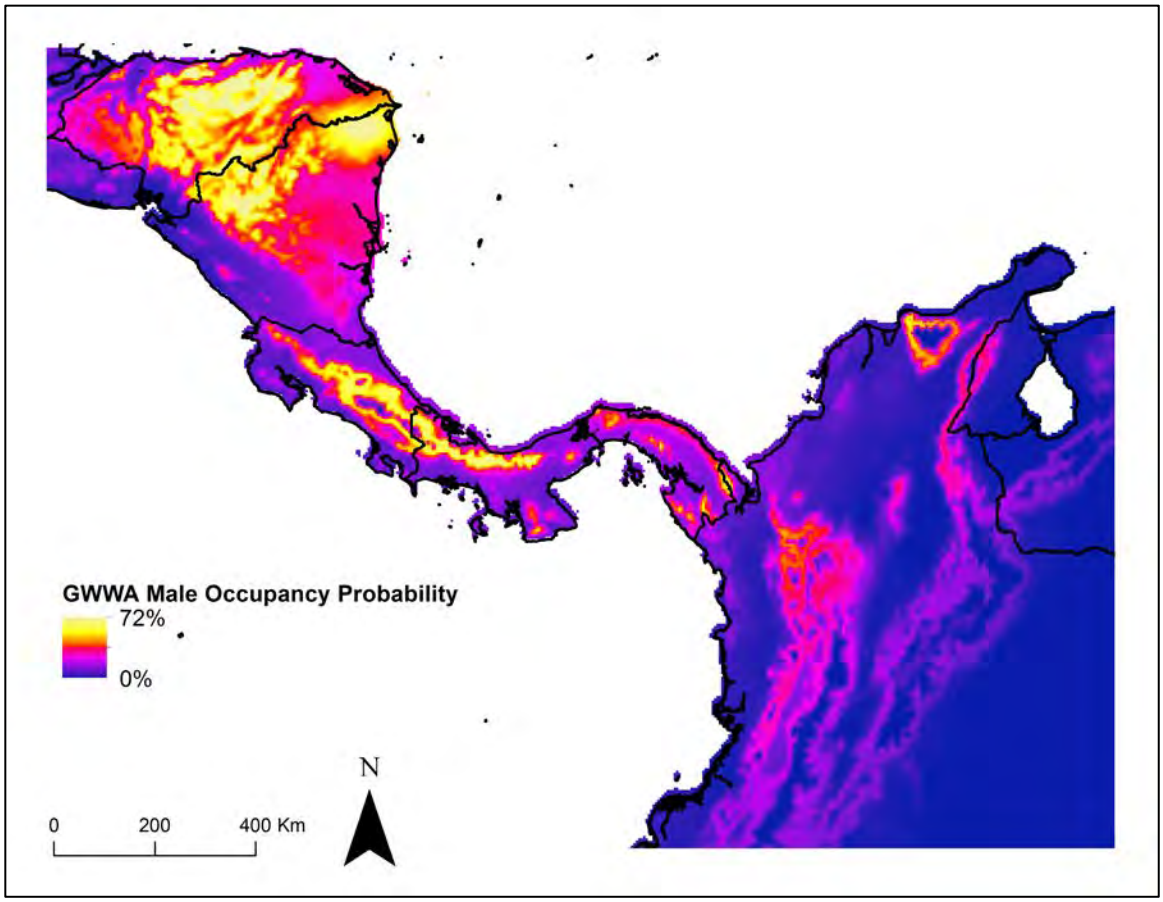


Figure 4-1.3. Occupancy model for male Golden-winged Warbler during the non-breeding season, based on survey data from December to mid-March, 2008-2012. Adapted from Fig. 1.7 of Rosenberg et al. (in press).

Historic winter distribution

While Golden-winged Warblers currently occur in highest numbers in Central America, historic records suggest that the winter distribution may have shifted during the past century. Golden-winged Warblers specimens are well represented in collections from Colombia and Venezuela between 1890 (when regular collections began) and 1920. From 1930 onwards, however, Golden-winged Warbler representation declines despite active collecting through the 1980s (Figure 4-1.4). This suggests that Golden-winged Warblers no longer winter in the Andes in the same densities as the early 1900s. Unfortunately, collections from the northern portion of the winter range are not consistent enough through time to detect potential changes in the proportion of Golden-winged Warblers overwintering there. However, it has been suggested that the overall range of the Golden-winged Warbler has shifted to the northwest corresponding to the shift in the breeding grounds (Rosenberg et al. *in press*).

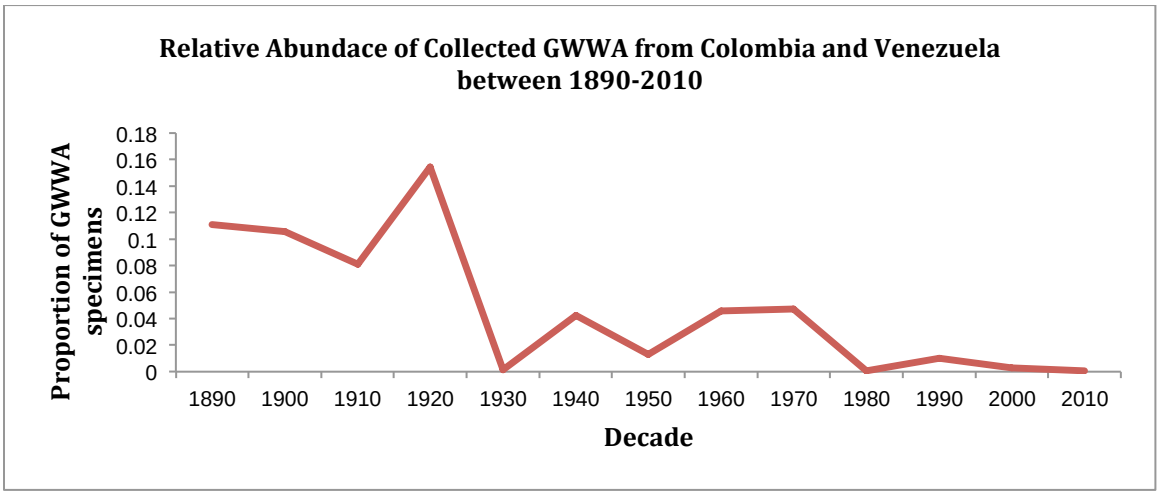


Figure 4-1.4. Proportion of Golden-winged Warbler specimens represented in museum collections compared to other migratory warblers that winter in similar habitat (Black-and-white Warbler, Blackburnian Warbler, Canada Warbler, Cerulean Warbler, and Tennessee Warbler). Based on a sample size of 36 Golden-winged Warblers and 685 other migratory warblers.

Migratory connectivity

Information linking breeding and wintering populations of Neotropical-Nearctic migratory passerines has been difficult to obtain, due to the difficulty of tracking small birds over large spatial scales. Recently, stable-isotope technology has been used successfully to link wintering populations to breeding grounds regions of North America where they completed a full molt. Hobson et al. (in press) obtained feathers from 171 Golden-winged Warblers (Honduras, *N* = 68; Nicaragua, *N* = 19; Costa Rica, *N* = 65; Colombia, *N* = 16; Venezuela, *N* = 3) at 74 locations spanning much of the wintering range and assigned them an inferred breeding range based on comparisons of their isotopic signatures with a known North American stable-isotope isoscale.

Golden-winged Warblers showed structure in their migratory connectivity, with breeding ground location differing significantly between the various locations on the winter grounds where feathers were collected. In general, there was a trend toward birds being more enriched

in ^{2}H the father south they were sampled on the winter grounds. On the breeding grounds, the isoscape followed a similar pattern, with birds being having higher proportions of ^{2}H in the Appalachians than in the Great Lakes population. Despite the existence of this general trend, specific origin of wintering populations was difficult to determine. Results show that birds wintering in Nicaragua and Costa Rica came from the northern and western portion of the Golden-winged Warbler breeding range (Manitoba, and the Great Lakes region). Birds from Honduras came from more southern origins and showed an east-west divide, with individuals sampled in eastern Honduras (east of 87° W) having a greater likelihood of being from the northern portion of the breeding range as compared to individuals sampled in western Honduras, which pertained more to southerly breeding origins. Birds from Colombia and Venezuela were linked to the southern and eastern breeding grounds of the Appalachians. The stable isotope results also suggests that the observed decline of Golden-winged Warblers in Colombia and Venezuela, described above (Figure 4-1.4) is linked to the decline of the Appalachian breeding population and the disappearance of historic breeding populations in New England (Rosenberg et al., in press). However, it remains unclear whether metrics associated with the breeding season or non-breeding season are driving the population decline.

While resolution of the stable isotope linkages is not precise enough to link specific breeding areas to specific winter areas, the recent advent of light-level geolocator technology has the potential to provide much more detailed information on migration strategy, stop-over sites, and more precisely linked populations. Henry Streby and collaborators are awaiting the return of over 300 Golden-winged Warblers with geolocators to the breeding grounds in the spring of 2016 to establish precise population linkages. A new geolocator study by Jeff Larkin, Ruth Bennett, and Andrew Rothman seeks to connect Golden-winged Warbler populations from a winter grounds origin. The results of these projects will shed much additional light on the migratory connectivity of this species.

Winter territory establishment and maintenance

Most of what is known about Golden-winged Warbler winter grounds behavior and ecology, as summarized in this chapter, is based on work by Richard Chandler, David King, and collaborators (Chander et al. *in press*, King et al. *in press*, Chander and King 2011). This work has revealed that Golden-winged Warblers maintain large, fixed territories throughout the winter season and aggressively defend them against conspecifics. Most Golden-winged Warblers remain on fixed winter territories from at least 1 November to 15 March, when migratory movements begin during the latter part of March (Chandler 2011). Observations from eBird suggest that most fall migratory movements occur from mid-September through October, implying that territories are probably established during October. More research is needed, however, on how Golden-winged Warblers establish territories, which sites are inhabited first, and which sites are defended most rigorously.

Golden-winged Warblers exhibit high site fidelity, both throughout the stationary portion of the nonbreeding season, and among years. Individuals generally use one or two core areas where foraging activity is concentrated, although individuals in Nicaragua and Costa Rica have been observed to conduct brief, long-distance forays outside of their normal home ranges (Chandler et al. *in press*). Similar behavior has been documented on the breeding grounds as well (Streby et al. 2012). Such forays generally were less than 2 km from the home range and lasted for 24 hr or less. Tolfree (2013) observed one male in Nicaragua with an abnormally large home range

with no center. The individual was hypothesized to be a floater: an individual that covers an area much larger than the size of an average home range (Brown and Long 2007). Despite this evidence of occasional floaters, the majority of Golden-winged Warblers are highly territorial and respond aggressively to audio and visual stimuli playback of song and calls and decoys.

While Golden-winged Warblers maintain fixed territories throughout the winter, Chandler et al. (*in press*) report home-range sizes that are much larger than those of other migratory parulids. Telemetry work shows that Golden-winged Warblers maintain territories with an average size of 8.77 ha (±0.92 ha) in Monteverde, Costa Rica and 4.09 ha (±1.30 ha) in Nicaragua. For comparison, Brown and Sherry (2008) report an average home-range size of 0.78 ha for Ovenbirds in Costa Rica and even smaller home ranges (0.25 ha) for American Redstarts in Jamaica (Holmes et al. 1989). Golden-winged Warbler home-range sizes do not differ between sexes. Male-male overlap is minimal and normally only occurs along home-range boundaries. In contrast, female home-ranges commonly overlap those of neighboring males. However, Bennett (unpublished) has observed females aggressively maintaining territory boundaries against other females in habitat that is dominated by females. The extent of female-male interactions in territory establishment and maintenance is unclear and worthy of future research. Chandler hypothesized that Golden-winged Warblers occupy large territories on the winter grounds due to their specialized foraging behavior (see below), especially selection for hanging dead leaves and epiphytes. These resources appear to be sparsely distributed across the landscape, potentially limiting the number of Golden-winged Warblers that can successfully occupy an area (Chandler 2011).

Foraging behavior

The Golden-winged Warbler is a specialized dead-leaf forager on the winter grounds and utilizes a specialized foraging technique in which it uses its bill to probe and pry open hanging dead leaves to extract insects as shown in Figure 4-1.5. (Rosenberg et al. in press, Chandler 2011). The species has only been observed to eat insects on the winter grounds. The specialized foraging behavior is characteristic of certain tropical resident species and has been shown to contribute to overall high tropical avian diversity (Gradwohl and Greenberg 1982, Remsen and Parker 1984, Rosenberg 1997). Dead-leaf foraging specialization has been noted in only a few other Nearctic-Neotropical migrant species that join tropical residents in mixed-species foraging flocks in

Figure 4-1.5. Golden-winged Warbler female displaying typical bill-opening behavior inside a dead-leaf cluster in Honduras. Photo by John VanDort.

winter, namely the Worm-eating Warbler *(Helmitheros vermivorum)* and the Blue-winged Warbler *(Vermivora cyanoptera)* (Remsen and Parker 1984). Golden-winged Warblers favor probing maneuverers over gleaning maneuvers on the winter grounds, and over 70% of their foraging maneuvers consist of probes (Chandler et al.. *in press*). Hanging dead leaves are the most commonly substrate investigated by Golden-winged Warblers, followed by live leaves and moss. Other substrates utilized for foraging include epiphytes, bark, and flowers, though these are used infrequently when compared with leaves. Foraging maneuvers are generally short, but longer maneuvers occur when individuals probe dead *Cecropia* leaves. These large broad leaves fall and hang suspended in the canopy of humid tropical forests and hold a diverse assemblage of arthropods (Rosenberg 1997). Golden-winged Warblers forage from the understory to the canopy, though there is evidence for differences in that foraging heights differs between males and females in Nicaragua, where males foraged higher than females (13.1±1.5m vs. 4.2±2.4 m; t_9 = 3.19, P = 0.01, Tolfree 2013). This trend was not observed in Costa Rica, though small female sample sizes produced unclear patterns.

Mixed-species flock participation

On the winter grounds, Golden-winged Warblers spend most of their time in mixed-species flocks with other migrant and resident species. Golden-winged Warblers do not appear to follow one particular species, rather, their associated species depend on location and elevation. In Costa Rica and Honduras, Golden-winged Warblers are most associated with Common Chlorospingus *(Chrolospingus flavopectus)* and Slate-throated Redstart (*Myioborus miniatus*) at mid to upper elevations, while in Honduras at low and mid-elevations, Golden-winged Warblers are most associated with Blue-winged Warblers *(Vermivora cyanoptera)*, Worm-eating Warblers *(Helmitheros vermivorum)*, and Lesser Greenlets *(Hylophilus decurtatus)* (Bennett 2012 and Chander 2011). Golden-winged Warblers spend an average of 85% of their time flocking or associating with other species in mixed flocks (Chandler et al. *in press*). Mixed-species flock participation does not seem to be related to sex, though data is limited for females.

Overlap with Blue-winged Warbler

The winter distribution of the Blue-winged Warbler overlaps broadly with that of the Golden-winged Warbler in the northern part of the latter's winter range, mainly in southern Mexico, central Guatemala, and across much of the midlands and lowlands of Honduras. In Honduras, Blue-winged Warblers are more associated with agricultural ecosystems and less associated with evergreen broadleaf forest than Golden-winged Warblers, though the two co-occur and are often found in the same mixed flocks within their sympatric winter range (Bennett 2012). Blue-winged Warblers are associated with lower elevations as well, occurring infrequently above 1200 meters above sea level. Where the two species co-occur, Blue-winged Warblers appear to forage at similar strata and use similar foraging techniques to Golden-winged Warblers with targeted dead-leaf probing and gleaning (Bennett, personal observation, Figure 4-1.5). In much of the Golden-winged Warbler winter range (Costa Rica through northern South America), however, Blue-winged Warblers are rare or absent, and a majority of Blue-winged Warblers winter in regions (e.g. Yucatan Peninsula, Belize) where Golden-winged Warblers are rare. Hybrid individuals have been found in winter throughout the ranges of both species, though records seem to be concentrated in the sympatric range. Interactions and competition between these two species in the non-breeding season may therefore have very important implications for the how these species interact, and potentially hybridize, on the breeding grounds—

especially in light of the probable winter range shift of Golden-winged Warbler northward into the winter range of Blue-winged Warbler, as described above. Critical research into these interspecific interactions on the winter grounds has just begun (Bennett, in progress).

Figure 4-1.6. Blue-winged Warbler female gleaning for insects on underside of dead leaf in Honduras. Blue-winged Warblers use similar foraging techniques to Golden-winged Warblers on the winter grounds and often occur in the same flocks in Guatemala and Honduras. Photo by Ruth Bennett.

Winter grounds habitat requirements

Habitat associations

Golden-winged Warblers are associated with mid-elevation forests characterized by intermediate disturbance within a narrow precipitation band. These conditions generally occur between 700-1400 m in Central America and between 1200-2200 m in South America. Due to their specialized foraging behavior, Golden-winged Warblers act as microhabitat specialists on the winter grounds rather than large-scale habitat specialists. Golden-winged Warblers appear to prefer disturbance features within disturbed forests during the winter season (Chandler 2011, Figure 4-1.7). Individuals occupy territories with dead leaves suspended in vegetation (at the canopy, the midstory, or a shrub level), with curled dying leaves, or live leaves rolled up by caterpillars (Figure 4-1.8). Golden-winged Warblers also utilize small and medium sized epiphytes and prefer forests with medium levels of epiphyte abundance (Chandler and King 2011, Figure 4-1.7D). Such microhabitat features often occurred near light gaps, along forest edges, rivers, steep slopes, and in forests undergoing secondary succession (Figures 4-1.8, 4-1.9, and 4-1.10).

Figure 4-1.7. Cerro Hoya National Park, Panama: mid-elevation humid broadleaf forest with extremely steep slopes create the disturbance type habitat preferred by Golden-winged Warblers. Photo by Ruth Bennett.

The particular microhabitat conditions required for Golden-winged Warblers occur within a variety of different ecosystems, which vary throughout the winter range. In Guatemala, Honduras, and Nicaragua, Golden-winged Warblers occur in cloud forest, mid-elevation humid forest, pine-oak forest, and forested riparian corridors in lowland semi-deciduous forest. Recent findings from Costa Rica indicate that Golden-winged Warblers are most common in naturally disturbed primary forest and advanced secondary humid forest with intermediate levels of precipitation and intermediate canopy heights (Chandler and King 2011). Chandler (2011) found the species to be absent from tropical dry forest on the Pacific slope. In Panama, Golden-winged Warblers occur in cloud forest with canopy gaps, mid-elevation broadleaf forest, and mid-elevation and lowland semi-deciduous forest on the Pacific slope (Bennett, unpublished). Bennett found them to be rare or absent from lowland humid forest.

While Golden-winged Warbler preferred microhabitat conditions can occur in a variety of different ecosystems, habitat analysis show that they occur most frequently in forest around 20 meters tall and with intermediate densities of epiphytes. Intermediate density of epiphytes is correlated with intermediate levels of humidity. At very high levels of humidity, Golden-winged

Warblers become much less frequent. In Costa Rica, Golden-winged Warbler abundance peaked at middle-elevations on the Pacific slope of the Central Mountain Range. In Panama, Golden-winged Warbler males occur more frequently at the Continental divide or on the Caribbean slope, while females occupy drier forest on the Pacific slope (Bennett, unpublished).

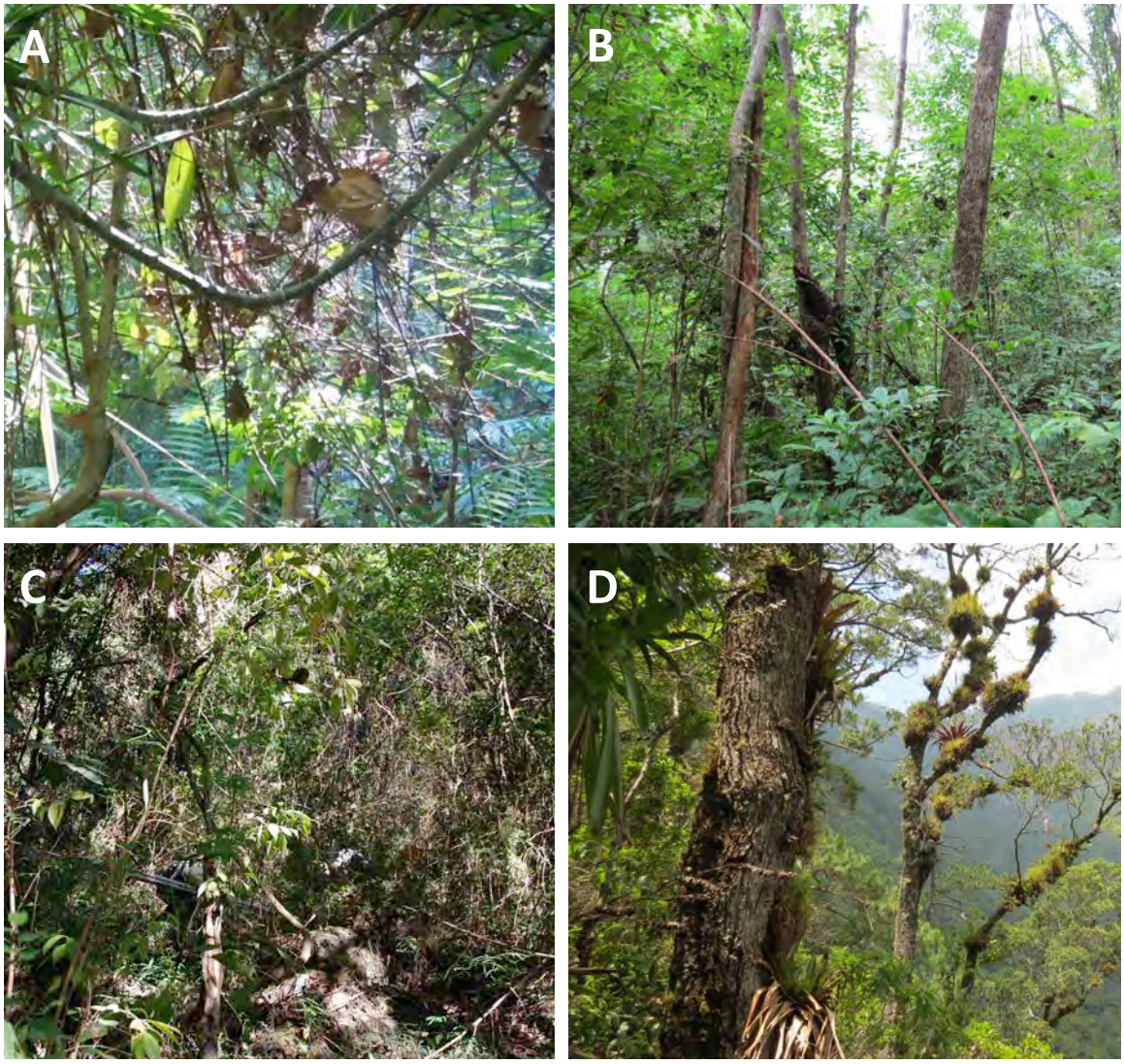


Figure 4-1.8. Microhabitat features selected for by Golden-winged Warblers. The species targets dead leaves suspended in vine tangles (A) and in the mid-story layer (B). Within pine-oak and semi-deciduous forests, the species occurs in humid drainages with vine tangles and suspended dead-leaves, (C) and areas with small and medium sized epiphytes (D). Photos by Ruth Bennett.

Figure 4-1.8. Golden-winged Warblers prefer landscapes with intermediate levels of disturbance such as small coffee farms with significant overstory tree retention and large patches of adjacent forest (A, Patuca National Park, Honduras) and the secondary forest edge along large river corridors (B, Sierra de Agalta National Park, Honduras). Photos by Ruth Bennett.

Figure 4-1.9. Golden-winged Warblers prefer landscapes with intermediate levels of disturbance including premontane humid broadleaf forest with canopy gaps (A, Tachira National Park, Venezuela; photo by Adrian Naveda) and humid secondary forest at middle-elevations (B, El Arenal, Nicaragua; photo by Liliana Chavarria).

Figure 4-1.10. Golden-winged Warblers prefer landscapes with intermediate levels of disturbance including primary montane oak forest with canopy gaps (A, La Muralla National Park, Honduras, photo by Ruth Bennett). Female Golden-winged Warblers occupy habitats with similar microhabitat features to males, but at lower elevations, lower-precipitation levels, and lower canopy heights than males, such as the vine-covered secondary forest of Meteti, Darien, Panama (B, photo by Ken Rosenberg).

Use of Agriculture and Other Human Disturbance Systems

Golden-winged Warblers are associated with mid-elevation coffee plantations in the tropics, and they routinely join mixed-species flock and maintain territories in a coffee-broadleaf forest matrix (Chandler and King 2011). Conflicting reports exist as to the degree to which Golden-winged Warblers use shade coffee plantations as habitat relative to adjacent broadleaf forest. In Costa Rica, telemetry and foraging observations of radio-marked individuals showed that Golden-winged Warblers did not actively feed in the retained canopy trees above coffee plantations (Chandler 2011). However, telemetry work in Nicaragua showed that Golden-winged Warblers with territories adjacent to shade coffee, occasionally foraged in retained overstory trees above coffee and to a lesser extent within coffee plants themselves (Tolfree 2013). In rustic shade coffee in Honduras, Golden-winged Warblers have been observed to actively forage both in coffee plants and in overstory trees above coffee (Bennett, ongoing study). The difference in these three findings suggests that the type of management of a coffee plantation likely impacts the degree to which it provides suitable habitat to the Golden-winged Warbler, though no study has yet quantified how differences in foraging behavior change with shade-coffee management. Use of agro-ecosystems may differ between males and females as well. In Honduras and Nicaragua, Golden-winged Warbler females have been documented to establish territories in highly disturbed areas with overstory tree retention, small patches of forest in agricultural landscapes, and within overgrown pastures (Tolfree 2013, Bennett 2012). Quality of these forest fragments and highly disturbed landscapes is unknown, however. Due to the possibility that these highly disturbed areas represent an ecological trap for wintering females, we do not recommend targeting them for conservation until their habitat quality has been documented.

Conservation implications of winter ecology

The specialized foraging behavior and heavy participation in mixed-species foraging flocks by Golden-winged Warblers have important implications for conservation of this species on the winter grounds, as highlighted by Chandler et al. (in press), King et al. (in press), and Chandler and King (2011). First, specialization on patchily distributed dead-leaf clusters, combined with participation in wide-roaming mixed-species flocks, is likely responsible for the large observed home range in this species compared with other migrants. With large home ranges of non-overlapping, aggressively defended territories comprised primarily of forest, the species will need large extensions of mostly intact tropical forest to support a large wintering population. Second, the structural microhabitat features preferred by Golden-winged Warblers, namely dense vine tangles that support dead-leaf clusters, occur only under certain forest-disturbance regimes and are generally eliminated under most agroforestry, agriculture, and grazing systems. The dependence on sparsely distributed, structural microhabitat features that often disappear in human-disturbed landscapes suggests that most disturbed habitats will not support large numbers of wintering Golden-winged Warblers, despite their use by other Neotropical migrants. These characteristics combine to make Golden-winged Warblers more vulnerable to forest fragmentation and loss than most migrant species, and present especially challenging conditions under which to develop conservation strategies. In general, conservation action should strive to both preserve contiguous expanses of forest at middle elevations and to expand existing forest patches in Central and northern South America. As average territory size is large and distribution is disperse, any known areas with relatively high densities of Golden-winged Warblers should be targeted for conservation action, with the goal of retaining as much currently forested habitat as

possible. Within a forested landscape, land-use practices that retain or create the microhabitat features preferred by Golden-winged Warblers should be identified and promoted. Within non-forested landscapes, reforestation efforts that strive to bring back large expanses of structurally complex forest should be promoted.

SECTION 2: WINTER RANGE CONSERVATION PLAN

The Golden-winged Warbler winters across ten different countries (Figure 4.1-1), creating a complex geopolitical landscape in which to plan conservation actions. Despite the numerous national boundaries, landscapes are often being altered in similar ways and due to similar land-use pressures throughout Central America and the northern Andes. While some threats to Golden-winged Warbler winter habitat are best addressed at a country level (see Section 3), this section identifies common threats to habitat and identifies conservation goals appropriate to the entire winter range. The structure of this section is based on the conservation goals, objectives, and actions identified for the winter range in Chapter 2, and a structural conservation framework is presented in Figure 4-2.1 Specifically, this section (1) identifies and prioritizes focal areas for winter grounds conservation and (2) identifies conservation goals and strategies based on an analysis of the key threats within winter grounds focal areas.

The process of creating a coordinated conservation strategy began with the identification of winter grounds focal areas. Once focal areas were identified and refined through a collaborative process with local experts, an analysis of land use change and drivers of habitat alteration was conducted within the areas. Range wide habitat goals were developed based on the current rate of habitat loss across the Golden-winged Warbler winter range. Local partners analyzed the drivers of the threats to Golden-winged Warbler habitat and developed a series of conservation objectives and actions to address threats and meet the regional habitat goals. Conservation actions were linked with the highest priority focal areas in each country, creating a concrete roadmap to show where and how to begin the process of conserving Golden-winged Warbler winter habitat. The information presented in this Section 2 is intended to help conservation practitioners select the areas and the actions with the greatest potential to effectively conserve habitat for Golden-winged Warblers throughout their winter range. Specific projects for all prioritized focal areas are developed in greater detail in Section 3.

Winter Range Focal Area Selection and Assessment

A total of 73 focal areas covering 46,765 km^2 have been selected for prioritized conservation of Golden-winged Warblers on their winter grounds in the countries of Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, and Venezuela (Figure 4-2.2). Focal areas were not selected in Mexico, Belize, or El Salvador due to the relative scarcity of wintering individuals and disperse distribution as identified from historic records, opinions of in-country experts, and low predicted occupancy (Figure 4-1.3). The focal areas in all countries except Guatemala were selected by delineating polygons around the areas of highest predicted occupancy of male Golden-winged Warblers in each country where they regularly occur during the winter (model described in Section 1, Figure 4-1.3). Local experts then refined focal areas based on local knowledge of the occurrence of Golden-winged Warbler in their respective countries. Focal area boundaries follow the boundaries of forested landscapes, nationally protected areas, and/or the upper and lower elevation bounds where Golden-winged Warblers regularly occur in each region. In the case of Guatemala, no Golden-winged Warbler surveys were conducted under the methodology that created the male occupancy model (Figure 4-1.3). But due to regular occurrence of Golden-winged Warblers, in-country experts were contracted to summarize records and create a map of their distribution within Guatemala. Guatemala focal areas were then selected based on areas with significant threats to Golden-winged Warbler habitat within the area of known winter distribution in that country (methods further explained in Section 3.1). These focal areas should be treated as preliminary and should be refined as additional surveys are conducted in the country.

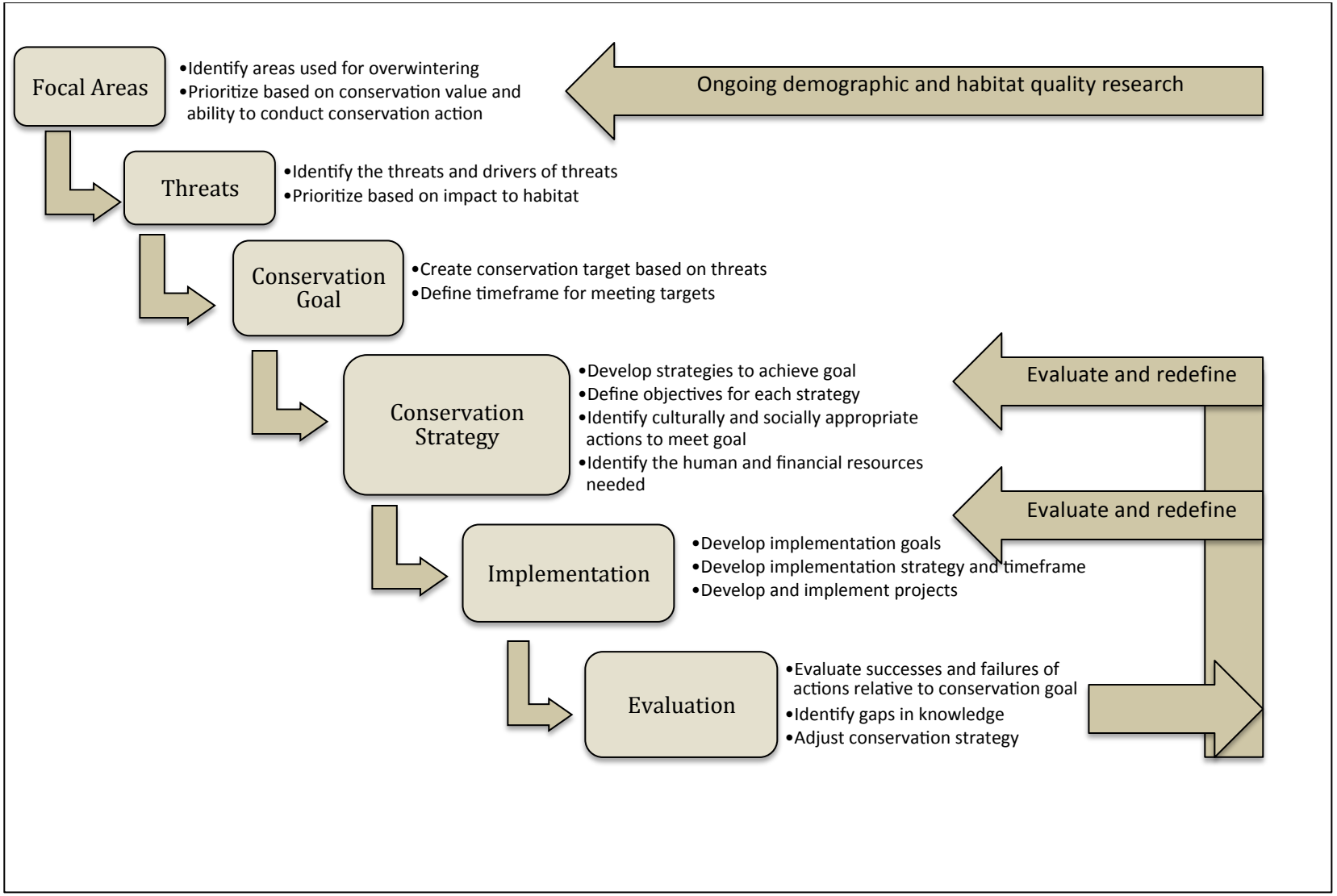


Figure 4-2.1. Adaptive management strategy for Golden-winged Warbler wintering grounds conservation with ability to incorporate results from ongoing research into habitat quality and selection and ongoing results of monitoring and evaluation into conservation strategy and actions.

In the case of Costa Rica, focal areas underwent an additional revision through a collaborative effort with in-country partners to identify areas of immediate conservation concern within the larger focal areas that were selected initially. While this process was not possible all countries given differences in institutional capacity and support, we recommend that local ornithologists, land managers, and protected areas managers further revise focal areas as new information on Golden-winged Warbler distribution and ecology arises and as conservation capacity increases. If future research identifies new areas with regular occurrence of wintering Golden-winged Warbler, additional focal areas should be selected and added to this plan.

A physical comparison of the focal areas

Predicted occupancy of male Golden-winged Warblers is highest in northern Central America and decreases in the southern portion of the winter range (Figure 4-1.3). This trend holds within the selected focal areas. Golden-winged Warblers occur most frequently in the focal areas of Honduras and Nicaragua. Occupancy decreases in the focal areas to the south (Figure 4-2.3). As such, the focal areas of Honduras, Nicaragua, Costa Rica, and northern Panama encompass the areas of highest predicted occupancy of Golden-winged Warblers in the winter range. The occupancy model presented in Section 1 suggests that Golden-winged Warblers have a disperse distribution throughout the northern Andes with little resolution to show areas of highest occupancy over the large geographic area. As such, Colombia and Venezuela focal areas cover more area than those of northern Central America, but have lower predicted occupancy. By validating focal areas with historic records, birding observations, and the knowledge of in-country experts, we have a high degree of certainty that the Winter Focal Areas delineated in Honduras, Nicaragua, Costa Rica, and northern Panama represent the areas of highest population density for overwintering Golden-winged Warblers. Due to the low predicted occupancy of Golden-winged Warblers in the Andes, focal area validation has focused on confirming presence of Golden-winged Warblers within the areas. Colombian ornithologists have verified the presence of Golden-winged Warblers within all Colombia focal areas, though there is uncertainty about the density of Golden-winged Warblers in those areas because recent records and detections during surveys have been sparse. All Venezuela focal areas have historic records, though political instability in the western region of the country has hindered efforts to confirm current status of the Golden-winged Warbler in those focal areas.

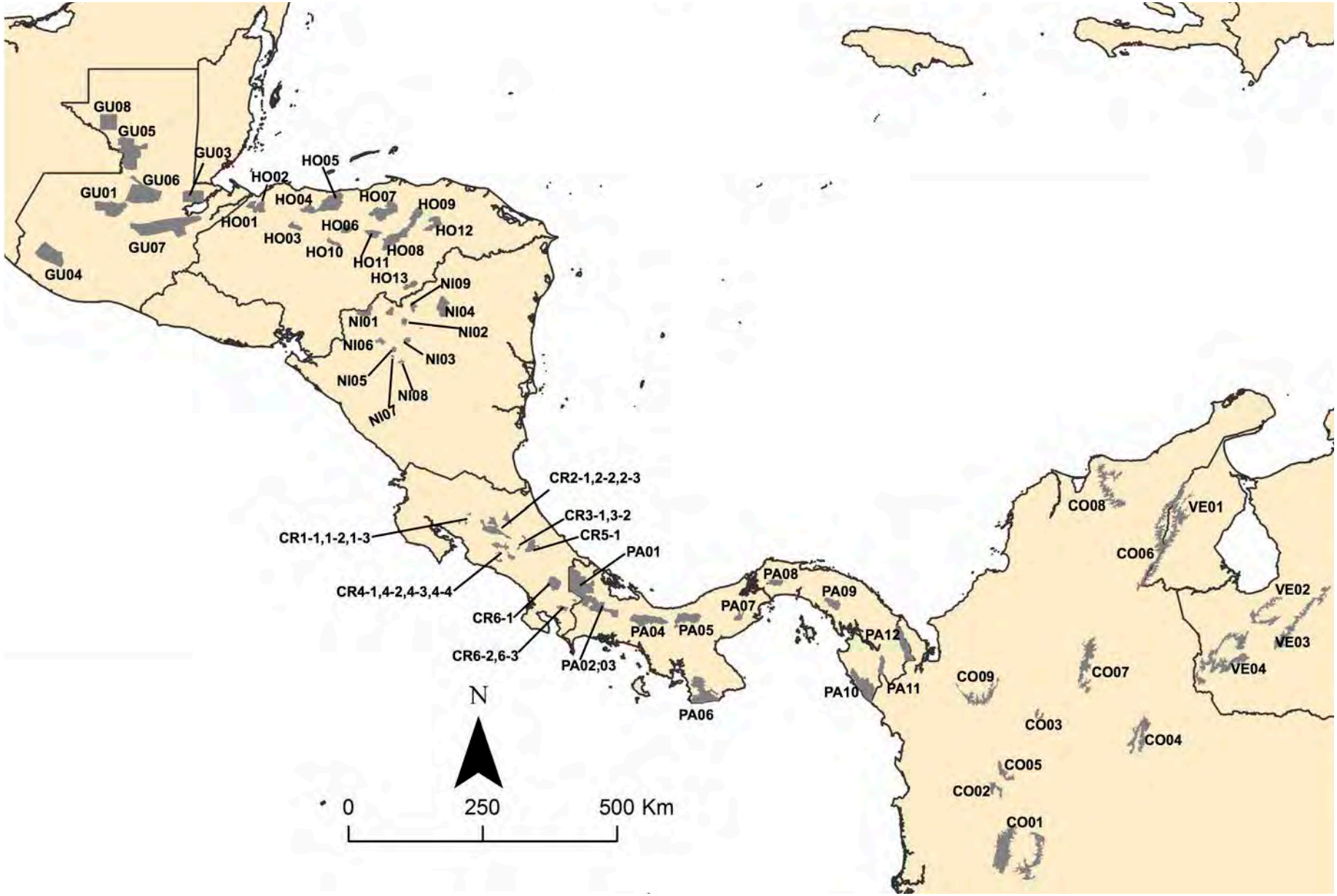


Figure 4-2.2. Locations and codes of the focal areas for Golden-winged Warbler winter habitat conservation. Country-level maps are located in Section 3.

Table 4-2.1. Golden-winged Warbler winter range focal areas. Top prioritized focal areas for each country are highlighted gray.

Focal Area	Name	Country
GU01	Sacranix IBA	Guatemala
GU02	Cerro El Amay	Guatemala
GU03	Sierra Santa Cruz	Guatemala
GU04	Volcán Santiguito: Ladera Sur	Guatemala
GU05	Petén: Areas Protegidas del Sur-oeste	Guatemala
GU06	Candelaria-Campur IBA	Guatemala
GU07	Sierra Las Minas	Guatemala
GU08	Sierra Del Lacandón	Guatemala
HO01	Cusuco	Honduras
HO02	El Merendón	Honduras
HO03	Pico Pijol: Zona Nucleo y Alrededores	Honduras
HO04	Texiguat: Zona Nucleo	Honduras
HO05	Pico Bonito	Honduras
HO06	La Muralla	Honduras
HO07	Montaña de Botaderos	Honduras
HO08	Sierra de Agalta y El Boqueron	Honduras
HO09	El Carbon	Honduras
HO10	El Armado y Montana de la Flor	Honduras
HO11	El Tablon	Honduras
HO12	Zona Sur: Biosfera del Rio Platano	Honduras
HO13	Cordillera Entre Rios: PNN Patuca	Honduras
NI01	Coordillera Dipilto y Jalapa	Nicaragua
NI02	Cerro Kilambe	Nicaragua
NI03	Macizo de Peñas Blancas	Nicaragua
NI04	Cerro Saslaya	Nicaragua
NI05	Cerro Datanli-El Diablo	Nicaragua
NI06	Yali, El Jaguar, y Corredor	Nicaragua
NI07	Cerro El Arenal	Nicaragua
NI08	Yucul	Nicaragua
NI09	Kinuias	Nicaragua
NI10	La Murra	Nicaragua
NI11	Kubali	Nicaragua
VE01	Sierra de Perija	Venezuela
VE02	La Azulita: Caño Guayaba	Venezuela
VE03	Altamira	Venezuela
VE04	Tachira	Venezuela

Focal Area	Name	Country
CR1-1	Monteverde: Pocosol	Costa Rica
CR1-2	Monteverde: San Luis	Costa Rica
CR1-3	Monteverde: Cedral	Costa Rica
CR2-1	Braulio Carrillo-Cinchona: Horquetas de Sarapiquí	Costa Rica
CR2-2	Braulio Carrillo-Cinchona: Poás-Barva	Costa Rica
CR2-3	Braulio Carrillo-Cinchona: Río Cuarto-San Miguel	Costa Rica
CR3-1	Turrialba: Guayabo	Costa Rica
CR3-2	Turriabla: Cachí	Costa Rica
CR4-1	Escazú-Acosta: Cerros de Escazú-El Guarco	Costa Rica
CR4-2	Escazú-Acosta: Tarrazu	Costa Rica
CR4-3	Escazú-Acosta: Dota-Cerro de la Muerte	Costa Rica
CR4-4	Escazú-Acosta: Aserri	Costa Rica
CR5-1	Talamanca-Caribe: Pacuare	Costa Rica
CR6-1	Talamanca-Coto Brus: Buenos Aires	Costa Rica
CR6-2	Talamanca-Coto Brus: San Vito de Coto Brus	Costa Rica
CR6-3	Talamanca-Coto Brus: Las Alturas	Costa Rica
PA01	La Amistad	Panama
PA02	Boquete	Panama
PA03	Fortuna	Panama
PA04	Ngobe Bugle Highlands	Panama
PA05	Santa Fe	Panama
PA06	Cerro Hoya	Panama
PA07	Valle de Antón	Panama
PA08	Chagres	Panama
PA09	Chucanti	Panama
PA10	Cordillera de Jurado	Panama
PA11	Cerro Pierre	Panama
PA12	Tacaruna	Panama
CO01	PNN Los Nevados - Zona de amortiguación	Colombia
CO02	Antioquia: Jericó - Támesis	Colombia
CO03	Antioquia: Cuenca alta del Río Porci – Anori	Colombia
CO04	Santander/Boyacá: Serranía de Los Yariguíes	Colombia
CO05	Antioquia: La Romera – Sabaneta	Colombia
CO06	Serranía del Perijá	Colombia
CO07	Bolívar: Serranía de San Lucas	Colombia
CO08	Magdalena: Sierra Nevada de Santa Marta	Colombia
CO09	Paramillo: Zona Sur	Colombia

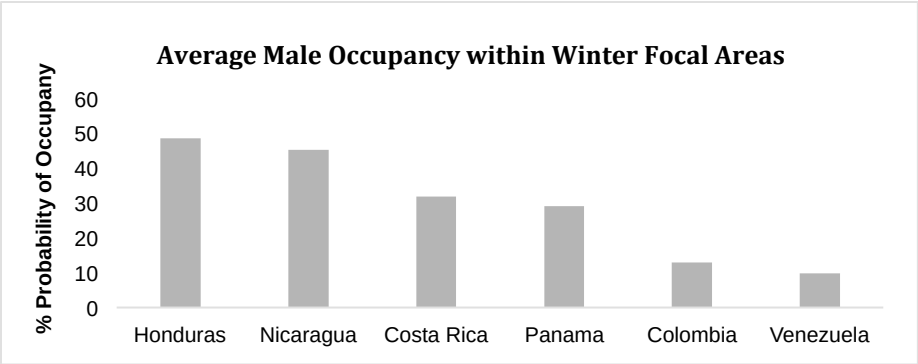


Figure 4-2.3. A comparison of the average predicted occupancy of wintering male Golden-winged Warblers in the focal areas of each country. Guatemala Focal Areas are not represented as they fall outside of the predictive power of the occupancy model.

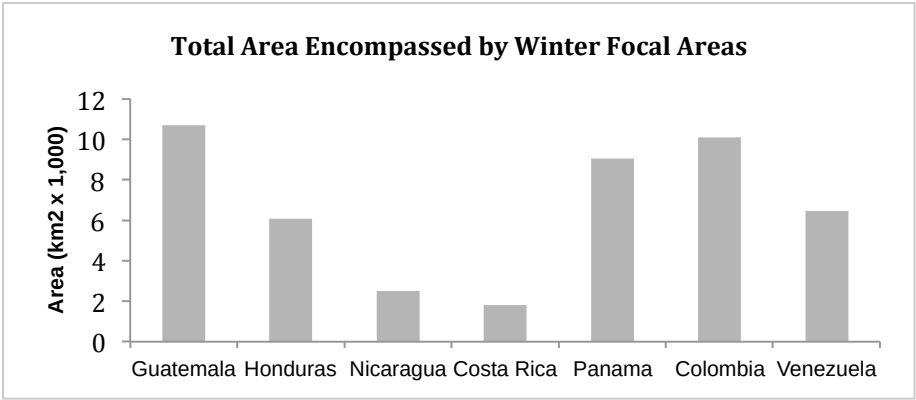


Figure 4-2.4. A comparison of the total land area encompassed within the proposed focal areas of each country.

Land cover and forest structure within focal areas

According to the most recent MODIS land-cover product and the IGBP global land-cover classification scheme, more than 70% of all focal areas are covered with the Evergreen Broadleaf Forest land cover type (Figure 4-2.5, Channan et al. 2014, Friedl et al. 2010). A cropland-natural vegetation mosaic comprises the second most abundant land-cover type in the focal areas for all countries except Nicaragua, where Woody Savannas cover 11% of the focal area land. Actual forest composition and structure within the "Evergreen Broadleaf Forest" land-cover type varies widely, however. Secondary forest and agroforestry systems all occur within this land-cover type. An analysis of Percent Tree Cover derived from Landsat Tree Cover Continuous Fields (Sexton et al. 2013) allows for a more complex view of forest cover level of forest disturbance within all focal areas (Figures 4-2.6 and 4-2.7). In the year 2000, each country had closed canopy forest (defined as >80% forest coverage in a 30m x 30m pixel) covering between 67% and 85% of the focal area. Focal areas in Panama and Honduras had the greatest percentage of closed-canopy forest coverage in the year 2000, with 87% and 85% coverage respectively. Semi-

disturbed forest (defined as >40-80% canopy coverage in a 30m x 30 m pixel) covered between 7 to 17% of land within the focal areas in the year 2000. Deforested or highly disturbed landscapes (defined as 0-40% forest coverage in a 30 m x 30 m pixel) covered 4-17% of the focal areas.

The recently developed Global Forest Change Product (Hansen et al. 2013) allowed us to compare rates of forest gain and forest loss in focal areas between the years of 2000 and 2013. In that period, all countries experienced greater rates of forest loss than forest gain within focal areas (Figure 4-2.7). The Guatemalan, Nicaraguan, and Honduran focal areas suffered the greatest rate of forest loss over this period, losing between four and eleven percent of the total forest within the focal areas since the year 2000**. This result is especially concerning as the Honduran and Nicaraguan focal areas have the highest predicted probability of Golden-winged Warbler occupancy in the winter range (Figure 4-2.3).** In terms of total area of forest loss, Guatemalan focal areas have lost the most forest (Figure 4-2.4) followed by Colombia. Though this loss is alarming, the immediate impact on Golden-winged Warbler wintering populations is uncertain due to lack of data on Golden-winged Warbler overwintering densities in Guatemala and low Golden-winged Warbler occupancy in Colombia. In total, 2,149 km^2 of forest have been lost from all focal areas over the period of 2000-2013.

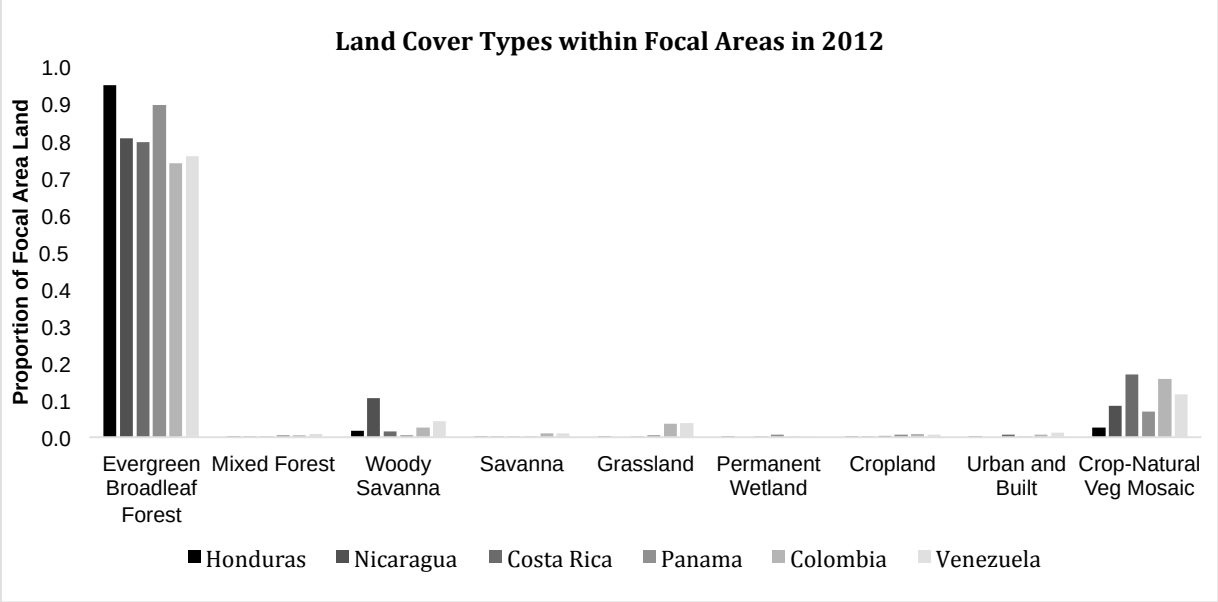


Figure 4-2.5. Distribution of IGBP land cover types within Winter Focal Areas based on the MODIS 2012 Global Land Cover Product (Channan et al. 2014).

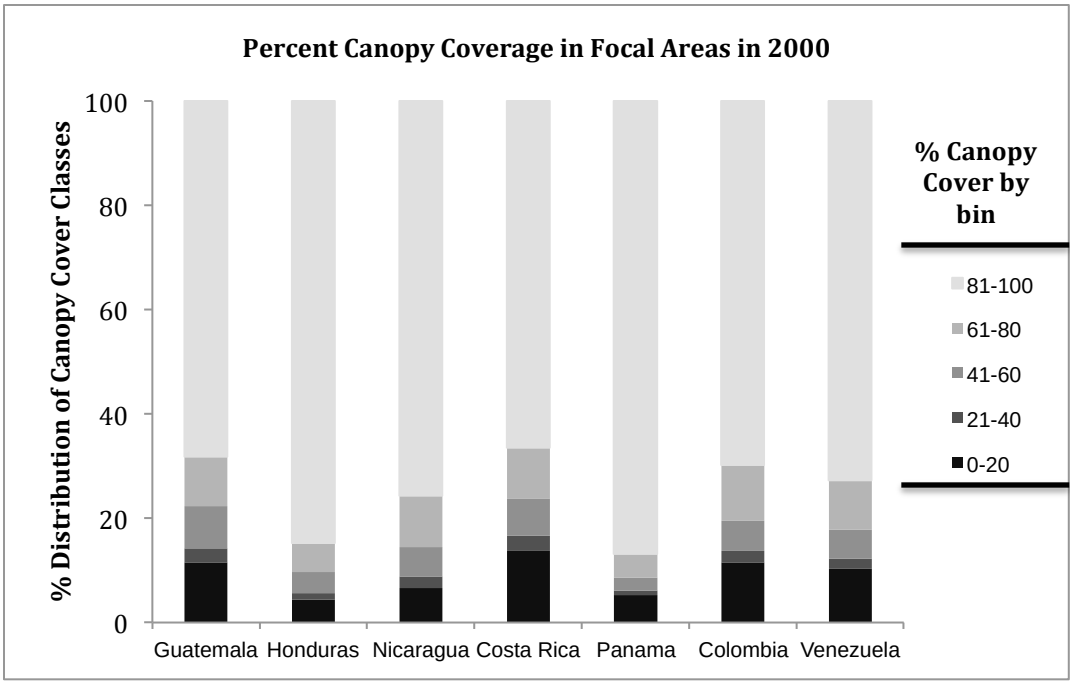


Figure 4-2.6. Distribution of forest coverage within winter focal areas in the year 2000. This data was extrapolated from the UMD Land Cover Continuous Fields product with 30m x 30m resolution (Sexton et al. 2013).

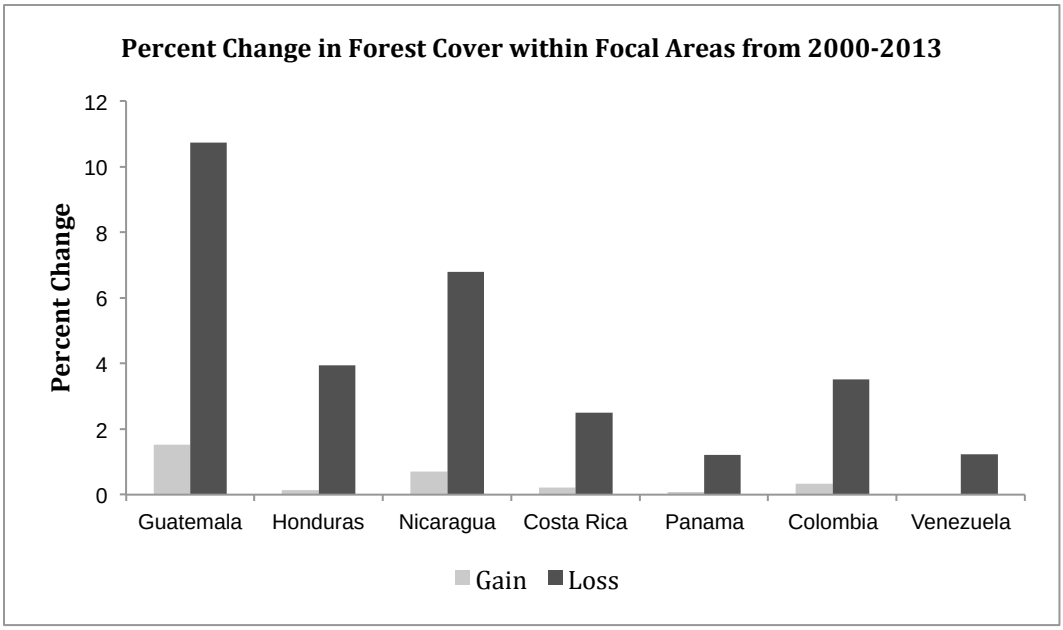


Figure 4-2.6. Aggregated gains and losses of forest at 30m x 30m resolution within the winter focal areas of each country. This data was calculated from the UMD global forest change product and represents the cumulative change between the years 2000-2013. Forest loss is considered a complete change from a forested pixel to a non-forested pixel (Hansen et al. 2013).

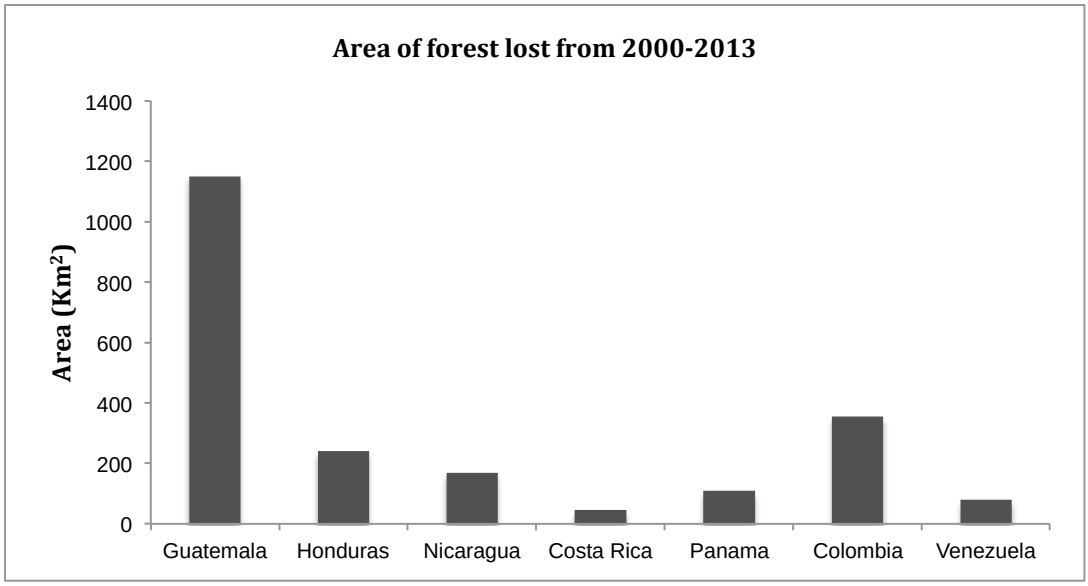


Figure 4-2.7. Total land area converted from forest to non-forested cover (<30% forest per 30m x 30m pixel) from year 2000 to 2013 within the designated focal areas of each country. Data derived from Hansen et al. 2013.

Prioritizing threats and developing a strategic conservation strategy

In order to determine the most important threats to Golden-winged Warbler winter habitat and develop a strategy to address these threats, the American Bird Conservancy (ABC) and the Cornell Lab of Ornithology (CLO) commissioned in-country experts to assess the proposed focal areas. Fifty of the seventy-three focal areas received an initial evaluation through this process. These threats assessments were conducted with the objective of verifying land-use inside focal areas, identifying threats to Golden-winged Warbler habitat, and identifying conservation action appropriate to address the threats. The results of this initial threats assessment were presented to the Central and South American Highlands Working Group at the 2013 Partners in Flight Fifth International Conference in Snowbird, Utah (PIF V). The Highlands Working Group discussed the principal threats and drivers causing habitat loss in the region and proposed five conservation actions aimed at addressing habitat loss in the Central and South American highlands. Although the PIF V threat prioritization and conservation actions were broadly applicable to the Central and South American highlands, they were not specifically linked to Golden-winged Warbler focal areas or Golden-winged Warbler microhabitat features. While these recommendations were an important first step, the Highlands Working Group did not prioritize specific highlands areas based on their conservation value, level of habitat alteration, or potential for successful conservation action.

In order to continue this regional conservation planning effort and solidify conservation recommendations for wintering Golden-winged Warblers, the Alianza Alas Doradas organized a three-day workshop in Copan Ruinas, Honduras to bring together Golden-winged Warbler experts, conservation practitioners, and land managers from across the winter range. In anticipation of the workshop, ABC produced a report that outlined threats and conservation actions for Golden-winged Warbler focal areas in Honduras, Nicaragua, Costa Rica, Panama, and Venezuela. This report also linked the recommendations of the PIF V working group with specific Golden-winged Warbler focal areas. ABC also commissioned reports in Guatemala and Colombia, resulting in refined focal areas, the identification of threats to wintering Golden-winged Warbler, and proposed conservation actions in those countries. With this information, the 22 workshop participants sought to (1) validate and prioritize focal areas for Golden-winged Warbler conservation in the winter range, (2) prioritize conservation strategies and actions in the winter focal areas, and (3) identify knowledge gaps in Golden-winged Warbler winter distribution, ecology, focal area threats, and focal area conservation initiatives.

Prioritization took place at two spatial levels: the full Golden-winged Warbler winter range and the regional level. Regions were based on the three major blocks in Golden-winged Warbler distribution (See Section 1 and Rosenberg et al. in press) and defined as Northern Central America (Guatemala, Honduras, and Nicaragua), Southern Central America (Costa Rica and Panama), and Northern South America (Colombia and Venezuela). At the summit, 22 participants narrowed down the total list of threats present within focal areas to the ten most influential threats within the full Golden-winged Warbler winter range. These threats were analyzed in the workshop to elucidate their direct and indirect drivers. Using this total list of threats and drivers, participants met in regional breakout groups to brainstorm conservation actions that would address each threat present in their region. The total list of conservation actions was then narrowed down using a prioritization process that ranked each project's potential to conserve Golden-winged Warbler habitat and to be successfully implemented. This

process resulted in the top eight prioritized conservation actions below. However, analysis after the summit revealed that the following three threats were not adequately addressed through the prioritized conservation actions: lack of effective management in protected areas, expansion of energy and infrastructure, and mining. In order to address these threats, a follow up meeting was held in Warrenton, VA in May 2015 with eleven conservation partners from the winter range countries. Together, these partners reviewed the conservation actions, prioritized them, discussed ways to increase their effectiveness, and added two actions to address all of the identified threats.

In order to guide conservation action, the *Alianza Alas Doradas* developed a series of regional goals relating to habitat alteration, the dissemination of this conservation plan, and the implementation of recommended conservation action. These goals were reviewed and refined in the Golden-winged Warbler Winter Plan Meeting in Warrenton, VA in 2015, and provide five-year, ten-year, and twenty-year goals. Habitat goals were developed based on the understanding that it will not be possible to completely halt the conversion of forested land-cover types to non-forested land-cover types. Recommendations seek to balance the conservation of existing habitat with the creation of new habitat in order to achieve equilibrium where habitat losses equal habitat gains.

Range-wide Threats to Golden-winged Warbler Conservation.

Ten threats were prioritized as the most significant threats to Golden-winged Warbler overwintering habitat in focal areas by the Alianza Alas Doradas. While not all threats are present in all focal areas or all countries, each threat significantly threatens Golden-winged Warbler overwintering habitat on the scale of the winter range. Participants from each country

Table 4-2.2. Threats ranked by their range-wide impact on wintering Golden-winged Warblers.

Threat	Average Impact*	Total number of focal areas affected
T1. Growth and intensification of industrial-level agriculture	3.0	51
T2. Sub-optimal practices in agricultural	2.9	52
T3. Sub-optimal practices in cattle farming	2.7	48
T4. Growth and intensification of cattle farming	2.6	50
T5. Lack of effective management in protected areas	2.4	63
T6. Expansion and intensification of small-holder agriculture	1.9	59
T7. Fuelwood collection	1.9	54
T8. Forest fires intentionally caused by humans	1.6	39
T9. Expansion of energy and road infrastructure	1.4	44
T10. Mining	1.4	18

**Impact scores averaged from responses from all countries where 3=high impact, 2=moderate impact, 1=low impact, and 0=no impact on Golden-winged Warbler winter habitat. Total number of focal areas=73.*

ranked the threats by their impact on Golden-winged Warbler habitat and identified whether or not the threat was increasing within their country. By averaging the impact results across countries, we have ranked the threats in terms of their overall impact on Golden-winged Warblers. We furthermore identified the total number of focal areas where each threat occurs (Table 4-2.2). All threats directly cause Golden-winged Warbler habitat loss or degradation.

Descriptions of Threats to Golden-winged Warbler Winter Habitat

T1: Growth and intensification of industrial-level agriculture.

Fast Facts: Industrial agriculture

Trend: Increasing in every country
Description of threat: Conversion of forested Golden-winged Warbler habitat to agricultural production with no or low habitat value.
Principal agricultural product: Coffee
Other agricultural products: Pineapple, cardamom, plantain, yucca, ornamental flowers, potatoes, *malanga* (taro), other vegetables.
Effect on Golden-winged Warbler habitat: Total habitat loss through forest conversion to agro-industry or loss of micro-habitat features due to intensification of agricultural production.
Principal drivers of threat:

- Increasing economic demand for agricultural products
- Ability to increase production by removing GWWA microhabitat features
- Shift from small-holder to corporate ownership and management of agricultural products
- Region with highest quality coffee production broadly overlaps area of highest Golden-winged Warbler density.

Coffee and other agricultural production comprise the primary anthropogenic land use type within Golden-winged Warbler winter focal areas. The expansion of coffee production and other agricultural products are currently responsible for habitat loss and degradation within Golden-winged Warbler habitat in every country in the winter range. The indirect drivers of this type of land-use change are nuanced and vary by region and crop type. Agricultural crops can be produced across a spectrum of intensities, from low-intensity poly-culture systems that retain substantial forest and microhabitat features to fully mechanized production with no retention of natural habitat features. Conflicting information exists about the degree to which Golden-winged Warblers use shade trees over coffee as foraging substrate. Chandler (2012) reported that Golden-winged Warblers travel through coffee patches on their way to adjacent secondary forest patches that retain the vines, hanging dead leaves, and epiphytes that these birds prefer, avoiding shade coffee trees in preference for forest. However, Bennett and Roth (pers. comm.) have both observed Golden-winged Warblers actively foraging in shade coffee trees and coffee plants and participating in mixed-species flocks that principally forage in and above coffee. The degree of use likely depends on the management of the coffee plantation, both in terms of

pesticide use and overstory structure. Although Golden-winged Warblers potentially use shade-coffee plantations as habitat, forest clearing for coffee production and the intensification of coffee production through canopy removal are critical threats to the overwintering habitat of Golden-winged Warblers.

Threat 2: Sub-optimal agricultural practices.

Fast Facts: Sub-optimal agricultural practices

Trend: Increasing in every country except Colombia
Description of threat: Agricultural practices that destroy or degrade remnant patches of Golden-
winged Warbler habitat within an agricultural matrix.
Effect on GWWA habitat: Degradation and loss of remnant forest patches in agricultural areas.
Principal drivers of threat:

- Lack of knowledge or ability to keep soils productive and retain nutrients for long periods of time
- Lack of investment, policy, or local will to keep rivers, streams, and microwatersheds forested
- Lack of economic incentive and market demand to produce "eco-friendly" agricultural products
- Lack of communication between producers, government officials, and conservationists

In landscapes where agro-industry already exists, sub-optimal agricultural practices can destroy remnant patches of forest or degrade these forest patches to the point where they no longer represent viable Golden-winged Warbler winter habitat. National policy often supports the retention of forest around rivers, streams, and microwatersheds, especially in protected areas. Yet lack of knowledge, enforcement, or economic incentives prompt landowners to clear, thin, or degrade these areas and subsequently destroy the Golden-winged Warbler habitat that could have co-existed with the agricultural matrix. Other suboptimal agricultural practices result in overuse and exhaustion of soils, which may force landowners to clear new areas in their landholding. These practices include repeated burning of soils, elimination of hedgerows and live fences, unconstrained cultivation on steep slopes, among others. Sub-optimal agricultural practices stand in direct opposition to the land-sharing method of conservation, which encourages both optimal agricultural production and habitat retention.

Threat 3: Suboptimal practices in cattle farming.

Fast Facts: Sub-optimal cattle practices

Trend: Increasing in Honduras, Nicaragua, Costa Rica, and Panama
Description of threat: Livestock management practices that destroy/degrade remnant patches of Golden-winged Warbler habitat within a matrix already dominated by pasture.

Effect on GWWA habitat: Degradation and loss of remnant forest patches in silvo-pastoral areas.

Principal drivers of threat:

- Lack of knowledge or ability to keep soils productive and retain nutrients
- Producers feel leaving trees will reduce forage available
- Lack of investment, policy, or local will to keep rivers, streams, and microwatersheds forested
- Lack of economic incentive or market demand to produce "eco-friendly" beef and milk.
- Lack of communication between producers, government officials, and conservationists

Similar to Threat 2, suboptimal livestock practices can make silvo-pastoral areas unsuitable to Golden-winged Warblers. While Golden-winged Warblers do not use pasture unless it has many trees and is adjacent to secondary forest (Bennett and Chandler, pers. obs.), livestock can degrade secondary forest adjacent to pasture and forest patches surrounding water sources. In Nicaragua, livestock have been observed to destroy the understory and midstory of secondary forest patches near pasture. While the direct impact on Golden-winged Warbler is unknown, landowners anecdotally report that Golden-winged Warblers do not occur frequently in secondary forest patches with significant livestock use, potentially due to the destruction of vines and understory and mid-story shrubs that create a complex habitat structure (Chavarria, pers. com). Retention of high canopy coverage of 60% in silvopastoral systems has also recently been shown to support the presence of mixed-species flocks, in which Golden-winged Warblers strongly participate (McDermott and Rodewald 2015). Unfortunately, lack of economic incentive to restrict the movements of livestock and retain high canopy coverage in pasture is eliminating potential Golden-winged Warbler habitat in silvo-pastoral systems.

Threat 4: Expansion of cattle farming.

Fast Facts: Cattle Farming

Trend: Increasing in all countries except Costa Rica

Description of threat: Clearing of forest to establish pasture for cattle farming.

Effect on GWWA habitat: Complete loss of Golden-winged Warbler habitat through forest conversion.

Principal drivers of threat:

- Increasing local and international demand for beef and milk
- Cheap or "free" forest economically viable to clear for cattle production
- Need for additional land due to loss of productivity of established pasture due to soil depletion and watershed destruction causes need to expand to new areas.
- High cultural status of cattle owners
- Government subsidies of cattle production for exportation
- Rapid appreciation of cattle investment vs. no or slow increase in forest value
- Land value increases when cleared of forest and converted to pasture.

Of all the drivers of forest loss in Latin America, perhaps none has received as much international attention as the expansion of cattle pasture. While many lowland valleys with tropical dry forest were converted to pasture over the past several hundred years, pasture is now replacing humid broadleaf forest and mid-elevation forest for reasons that vary by region and focal area. Countries in Northern Central America are experiencing migration of smallholder ranchers to regions of unclaimed and unprotected forest that can be converted into pasture. Simultaneously, large-scale ranchers often linked to narco-trafficking are converting forest in remote areas to pasture to launder drug money (McSweeny et al., 2013). Representatives from Costa Rica, Panama, and Colombia identified increasing internal demand for beef and dairy as responsible for the growth and intensification of cattle ranching in mid-elevation areas with humid broadleaf forest. The governments of Colombia and Panama also actively encourage the expansion of ranching and offer subsidies to ranchers that export beef. With such a wide variety of drivers of forest conversion to pasture, this threat is perhaps best addressed at the level of individual countries or focal areas, where conservation action can target the specific drivers of this threat.

Threat 5: Lack of capacity for effective management in protected areas.

Fast Facts: Protected Areas Management

Trend: Increasing in Honduras, Nicaragua, and Venezuela
Description of threat: No effective prevention of forest loss or forest degradation in nationally protected areas by government and law enforcement agencies.
Effect on GWWA habitat: Loss/degradation of Golden-winged Warbler habitat in areas that have legal protection.
Principal drivers of threat:

- Insufficient government funding for effective protected areas management
- Lack of inter-institutional coordination in management of protected areas
- Pressure from foreign companies to extract resources from protected areas
- Lack of economically viable alternatives to forest exploitation for people living in buffer/nuclear zones of these protected areas
- Multiple and conflicting land tenure schemes within protected areas
- Human migration into buffer zones of protected areas, especially in Venezuela

Nearly all of the designated Golden-winged Warbler Focal Areas contain areas with legal protection. Many focal areas fall entirely, or in part, within national parks or other nationally recognized protected areas. How this legal designation translates into management and forest retention varies by protected area and by country. Honduras, Nicaragua, and Venezuela have identified a systematic problem in which national protected area designation does not translate into protection of forest. In Honduras and Nicaragua, communities living within or adjacent to protected areas are able to expand their landholdings through many of the previously listed threats (subsistence agriculture, firewood collection, conversion of forest to pasture or agroindustry) with no legal repercussions. In fact, the zone with the greatest loss of forest this decade anywhere in Central America is found inside Honduran National Park Patuca. In Venezuela, people who were displaced from the buffer zones of protected areas by political violence are now moving back into those regions and beginning to expand their impact on the land and forest.

Threat 6: Expansion and intensification of small-holder agriculture.

Fast Facts: Small-holder Agriculture

Trend: Increasing in all countries except Costa Rica and Venezuela
Threat: Forest loss, often through slash and burn, to convert land for subsistence farming
Location: Often expands an agricultural frontier into remote areas with no landowner/government presence.
Effect on GWWA habitat: Loss/degradation of Golden-winged Warbler habitat in remote areas.
Principal drivers of threat:

- Rural population growth
- Soil depletion in currently farmed areas causes need for expansion
- Subsistence farming culture
- Human migration away from conflict zones
- Lack of economic alternatives

The growth of small-holder/subsistence agricultures was identified as a threat inside almost all focal areas in Northern Central America, Panama, and Colombia. This form of agriculture differs from agroindustry in that production is small scale and products are either traded in local markets or consumed by the family. The families and communities converting forest to plots for subsistence-level agriculture are often located in areas with few governmental services or access to education. The same families may also participate in small-scale coffee production and livestock production. Conversion of forest is often conducted through slash-and-burn along remote agricultural frontiers or inside nationally protected areas. Forest conversion for subsistence agriculture occurs both within agricultural matrixes and along the borders of agricultural-forest frontiers. The indirect drivers of this threat are linked to rural poverty and include lack of alternative sources of food and income and the need for new land to sustain the subsistence of the family. Expansion of this threat is also tied to overuse of soil in areas currently under cultivation by smallholder farmers in areas with rapidly growing populations, which drives the need to open up new lands for cultivation.

Threat 7: Fuelwood collection.

Fast Facts: Fuelwood Collection

Trend: Increasing in Guatemala, Honduras, and Nicaragua
Immediate threat: Degradation of forest structure, especially understory, through removal woody material for use as fuel to cook.
Long-term threat: Opens up forest to increasing levels of human activities and gradual conversion of forest to agriculture and cattle pasture.
Effect on GWWA habitat: Degradation and eventual loss of Golden-winged Warbler habitat.
Principal drivers of threat:

- Dependence on wood for cooking and heating in rural communities due to cultural or economic barriers to renewable or alternative energy sources.

- Lack of alternative fuel sources
- Lack of efficient wood burning stoves
- Lack of planned and cultivated renewable woody resources

While dependence on wood for fuel is increasing only in the focal areas of Northern Central America, its impact on Golden-winged Warbler habitat is significant enough for inclusion as a major threat. Estimates of the per-person rate of firewood consumption can be as high as one ton per year in the highlands of Central America (Univ. Rafael Landivar-USAID, 1984, II, 99, 171 f. from http://www.wiseinternational.org/node/1248). Alianza members from Nicaragua indicate that firewood collection is an important driver of deforestation, though it occurs over a longer time span than direct forest conversion. Firewood collection degrades Golden-winged Warbler habitat first by eliminating understory trees and reducing the structural complexity of the forest, and then by opening up forest to overstory tree removal, livestock use, and eventual conversion to coffee, pasture, or other crops.

Threat 8: Provoked forest fires.

Fast Facts: Forest Fires

Trend: Occurs regularly in Guatemala, Honduras, Nicaragua, and Venezuela
Description of threat: Intentionally set fires destroy forest understory, halt forest regeneration, reduce the structural complexity of forests, and destroy dead leaf material that Golden-winged Warblers use as overwintering habitat and foraging substrait.
Effect on GWWA habitat: Degradation of Golden-winged Warbler habitat.
Principal drivers of threat:

- Desire to improve soil quality (fire provides brief nutrient release and reduces pests)
- Cheap land clearing mechanism
- Subsistence and sport hunting pressure: Burning improves hunting success by eliminating understory.

Use of fire as a management tool for livestock production is widespread in the pine-oak forests of Northern Central America where landowners believe it reduces tick populations and promotes the regeneration of grass. Unfortunately, many pine-oak forests are burned indiscriminately and fires escape and burn large swaths of forest. Fires also escape from small corn and bean plots that are burned to create a nitrogen boom and suppress insect pests. In humid broadleaf forest, fires are set by hunters to facilitate successful hunting. This often occurs inside legally protected areas. Even controlled forest fires result in a loss of forest complexity by eliminating understory, killing vines, and killing regenerating trees. Pine-oak forests that are burned yearly are not occupied by Golden-winged Warblers, while pine-oak forests with complex vegetation structure especially in ravines, streams, or river valleys are occupied by Golden-winged Warblers (Bennett, pers. obs).

Threat 9: Expansion of energy and road infrastructure.

Fast Facts: Infrastructure

Trend: Increasing in Guatemala, Panama, Costa Rica, and Colombia

Description of threat: Infrastructure cutting through or running adjacent to focal areas increases the accessibility of areas previously protected due to remoteness. Development of hydroelectric projects in Focal Areas.
Effect on GWWA habitat: Potential loss of Golden-winged Warbler habitat by increasing the availability of habitat for loss/degradation by previously listed threats.
Principal drivers of threat:

- International and national investment in development
- Expansion of mining and other energy sectors
- Increasing local energy demands

While new infrastructure is being constructed in all countries, the relative impact of this threat on Golden-winged Warbler habitat is minimal. However, in Panama, Colombia, and Guatemala roads being constructed adjacent to focal areas have the potential to open up those areas to the threats listed above, particularly forest conversion to livestock, agro-industry, and subsistence agriculture. A proposed road through the Darien Department in Panama could open up substantial habitat for logging and agriculture. The infrastructure being constructed for current and proposed mines in Colombia and Guatemala is already opening up previously inaccessible forest patches for conversion as well. New hydroelectric dams could similarly destroy habitat.

Threat 10: Mining.

Fast Facts: Mining

Trend: Increasing in Guatemala, Honduras, Panama, and Colombia
Description of threat: Forest clearing for mining activities. Potential long term habitat degradation though pollution, workers camps, and infrastructure.
Effect on GWWA habitat: Potential loss of Golden-winged Warbler habitat.
Principal drivers of threat:

- Economic viability of mineral resource extraction
- Strong international pressure on local governments to open up new areas for mining
- Lack of political will and capacity to oppose mining ventures

At the time of writing, mining activity is present inside relatively few focal areas. However, the governments of Guatemala, Honduras, and Colombia are considering opening up several of the focal areas for new mining ventures. The potential effects of new mining activity include total forest loss in the mining zone and large residual impacts from associated human migration to mining area, and development of infrastructure to support the mining activities. Current mines extract gold, silver, nickel, and cobalt.

Strategic Conservation Plan to Address Range-Wide Threats

Regional Conservation Goals

The Alianza Alas Doradas developed the following series of goals to guide the dissemination of this plan to the governmental and non-governmental agencies that have the ability to raise funds and/or implement conservation action. Conservation implementation goals provide targets for the number of focal areas where work should begin and the type of actions that should be immediately pursued. The *Alianza Alas Doradas* believes that while these goals are ambitious, they are achievable with funding and coordination in the designated time frame. All conservation goals should be reviewed in five years (2020) by *the Alianza Alas Doradas* to assess progress, promote successes, evaluate failures, and reassess the ten-year goals.

1. Within ten years of plan publication (by 2026), reduce the net loss of Golden-winged Warbler winter habitat by 50% within identified focal areas.
2. Within ten years of plan publication (by 2026), restore 30% of the habitat lost since the year 2000 (approximately 45,000 ha) within the identified focal areas.
3. Within twenty years of plan publication (by 2036), reduce the net loss of Golden-winged Warbler winter habitat by 100% in focal areas. Habitat gains should equal or surpass habitat losses.
4. Achieve institutional buy-in with Latin American stakeholders and international funding entities; Within five years, all government authorities in all focal areas adopt the plan and sign an accord to recognize the actions identified in the plan as priority for conservation.

Regional Conservation Strategies

In order to address the direct and indirect drivers of the regional threats identified in this plan and to meet the conservation goals above, the Alianza Alas Doradas developed the following five strategies to guide conservation actions.

Strategy 1	Provide regional coordination for the fundraising and implementation of conservation activities.
Strategy 2	Reduce loss and degradation of forest habitat through outreach and education of landowners and land users in focal areas.
Strategy 3	Retain and create forest habitat by developing and promoting economic incentives to keep forest on useable lands.
Strategy 4	Support the creation and enforcement of protected areas.
Strategy 5	Increase local community involvement in mining and infrasturcture development decision-making process.

Regional Conservation Actions

The Alianza Alas Doradas developed and prioritized ten regional conservation actions (Table 4-2.3) to directly carry out the regional conservation strategies. The recommended actions represent a cohesive strategy to address multiple threats that are simultaneously eliminating or

degrading habitat in the Golden-winged Warbler winter range. These actions create both economic and cultural incentives to leave complex forest on the landscape. While specific threats, such as the growth of the cattle industry, are directly responsible for the conversion of forest to pasture, multiple interacting social and economic pressures support that type of land-use change. The Alianza Alas Doradas specifically identified the following indirect drivers as important forces behind the majority of the threats to Golden-winged Warbler habitat: (1) a tangible economic reward from intensifying land use or clearing a forest, (2) a belief that forest is unutilized or wasted space with little value, and (3) lack of economic incentive to leave forest on the landscape. The following conservation actions seek to address the specific threats outlined in the Threats Assessment by working with landowners, land users, and management agencies to create a culture that values both the ecosystem services and intrinsic qualities of forest. These actions also seek to provide viable economic incentives to preserve forest. In order to ensure a balanced and successful approach to the development and implementation of these projects, we strongly recommend hiring a regional coordinator that will oversee Golden-winged Warbler conservation actions throughout Latin America. This position will be crucial to engaging local governments and ensuring open communication between the various participants among projects. It is also important to note that these conservation actions are designed to address regional threats. Specific threats may exist purely on a local scale, and these are addressed with local conservation recommendations for specific focal areas in Section 3. Integrating the conservation actions identified in Sections 3 and 4 will increase the regional effectiveness to conserve Golden-winged Warbler winter habitat.

Table 4-2.3. Conservation actions ranked by their potential to preserve or create GWWA habitat.

	Conservation Action	Strategy Addressed	# Threats Addressed
CA1	Employ a regional coordinator to manage and implement projects in the Golden-winged Warbler winter range.	Strategy 1	6
CA2	Develop best management practices for Golden-winged Warbler habitat retention in coffee farms.	Strategy 2	2
CA3	Develop best management practices in silvopastoral systems and promotion of habitat retention through model livestock farms.	Strategy 2	2
CA4	Develop best management practices for sustainable subsistence agriculture.	Strategy 2	1
CA5	Create an adult community education program focused on ecosystem services and human impacts on the environment.	Strategy 2	5
CA6	Create a youth environmental education program focused on ecosystem services and natural history.	Strategy 2	4
CA7	Expand use of improved wood-burning stove project in conjunction with community managed firewood parcels.	Strategy 2	1
CA8	Develop and support for Ecosystem Services (PES) programs.	Strategy 3	4
CA9	Develop a partnership program for effective protected areas management	Strategy 4	6
CA10	Develop an advocacy and community decision-making program for infrastructure and mining development within focal areas	Strategy 5	2

Descriptions: Regional Conservation Actions

Conservation Action #1: Regional Coordinator

Objective: Employ a Regional Coordinator for Alianza Alas Doradas to facilitate implementation and management of GWWA Conservation Plan and associated projects.
Step 1: Identify employment logistics (management, location, reporting, etc)
Step 2: Hire Regional Coordinator
Step 3: Develop annual and five year work plan
Step 4: Begin communication and coordination with local ngo's, governments and other partners
Step 5: Assist with fundraising, project coordination and management, and project communication
Linked Conservation Strategy: Provide regional coordination for the fundraising and implementation of conservation activities.
Time-frame: Minimum of five years
Threats addressed: Threats 1-6
Countries where action is appropriate: All, but initial focus proposed for Nicaragua and Honduras.
Operational Needs:

- A dedicated organization to provide oversight and logistics, including office space
- Cooperation of, and communication with, Alianza Alas Doradas partners

There is strong need for a regional coordinator to develop feasible objectives, coordinate projects with local NGOs, the Alianza Alas Doradas and governmental agencies, and obtain and manage project fundsThe Alianza Alas Doradas has prioritized employment of a regional coordinator as the first step to developing the proposed suit of conservation actions. While all conservation action has the potential to positively impact wintering Golden-winged Warblers, a well-coordinated effort will greatly increase the group's ability overall to generate funds and monitor the successes and failures of specific conservation efforts. This will greatly increase the efficiency and impact of all conservation action.

Conservation Action #2: Model Coffee Farms

Objective: Develop best management practices (BMP) that retain Golden-winged Warbler habitat in coffee (or other agroforestry systems) and promote habitat retention through model coffee farms.
Step 1: Develop BMPs for coffee farmers in Year 1.
Step 2: Promote the BMPs through model coffee farms, one in each country by the end of Year 2 and one in each focal area by the end of Year 5.
Time-frame: At least five years.
Linked Conservation Strategy: Reduce loss and degradation of forest habitat through outreach and education of landowners and land users in focal areas.
Threats addressed: Threats 1 and 2.

Countries where action is appropriate: All
Operational Needs:

- Research and integration of knowledge on which management practices provide highest quality habitat for Golden-winged Warblers.
- Project leader who is an expert in coffee production and understands a land-sharing approach to sustainable production and conservation
- Teams to develop region-specific best management guidelines
- Selection of model farms in collaboration
- Farmer transportation to the model farms for workshops
- Integration of activities with ongoing conservation and land-sparing action within the coffee industry and with adult-education programs.

Research Needs:

- Synthesis of existing information about bird community response to different management practices
- Research to confirm the affect of associated management practices on habitat quality

The best management guidelines should strive to incorporate the retention of Golden-winged Warbler habitat features into existing coffee/agroforestry systems. For example, in a rustic-shade coffee system, these guidelines can encourage landowners to retain shade trees with epiphytes and vines or to retain fully forested areas around streams and rivers. In an Integrated Open Canopy Coffee system, these guidelines can encourage landowners to fence off the forest surrounding their coffee to prevent understory and midstory degradation by livestock use and fuelwood collection. Because the specific management recommendations will vary with type of agroforestry/coffee system, it is important to develop these BMPs in association with farmers who work within the focal areas. The project leader should seek to integrate habitat-specific recommendations into other compatible BMPs, such as those of organic/sustainable coffee production, watershed protection, pollinator diversity, and broader wildlife conservation recommendations. The project leader should work with coffee cooperatives, coffee buyers, and regulatory agencies to adopt and promote these recommendations. The BMPs must not decrease the economic viability of coffee production within focal areas. Whenever possible, farms that are already actively retaining habitat features and forest that support Golden-winged Warblers should be promoted as model farms or centers where other farmers can interact with the farm staff, learn about the management practices, and actively observe the farming system and the habitat features that have been preserved.

Conservation Action #3: Model Silvopastoral Systems

Objective: Develop best management practices in silvopastoral systems and promotion of habitat retention through model livestock farms to make production systems more friendly for birds
Step 1: Hire a project leader with silvopastoral management experience and experience in a market-based incentives program.
Step 2: Develop region-specific Best Management Guidelines for silvopastoral systems in year 1
Step 3: Identify model farms. One per country in year 2, one per focal area by year 5

Step 4: Identify and promote incentives for bmp implementation
Step 5: Promotion of these management practices to landowners in focal areas through education programs
Time-frame: Minimum of five years
Linked Conservation Strategy: Reduce loss and degradation of forest habitat through outreach and education of landowners and land users in focal areas.
Threats addressed: Threats 3 and 4
Countries where action is appropriate: All with focus on Nicaragua and Honduras
Operational Needs:

- Understanding of regional ranching economics and market chains
- Understanding of local incentive programs
- Cooperation of ranchers
- Teams to develop region-specific best management guidelines
- Education materials and programing

Research Needs:

- Synthesis of existing information about bird community response to different management practices
- Research to confirm the affect of associated management practices on habitat quality

These best management guidelines should strive to incorporate the retention of Golden-winged Warbler habitat features into existing livestock systems. As Golden-winged Warblers only occur regularly in pasture with greater than 30% canopy coverage that is adjacent to forest, management recommendations should focus on the retention of existing forest in silvopastoral systems. Because the specific management recommendations will vary with eco-region, it is important to develop them in association with livestock owners at a local level. Livestock farms that are already actively retaining habitat features and forest that support Golden-winged Warblers should be promoted as model farms or centers where other farmers can interact with the farm staff, learn about the management practices, and actively observe that the livestock system functions adjacent to habitat features that have been preserved. Employment of a project supervisor is crucial to the implementation of this project. The project supervisor should have experience managing silvopastoral systems and have ties to market-based incentives programs, such as Rainforest Alliance, to help create market-based incentives to follow these management guidelines.

Conservation Action #4: Sustainable Subsistence Agriculture.

Objective: Increase the efficiency and livelihood value of subsistence plots through development and implementation of best management practices in order to reduce the amount of forest converted to subsistence agriculture.
Action 1: Hire horticultural specialist with agro-ecology focus to oversee development and implementation of project
Action 2: Conduct local analysis to determine types of products and systems to be improved.
Action 3: Develop improved practices for improving production methods.

Action 4: Facilitate local technicians to communicate with subsistence farmers and coordinate with pre-existing projects (municipal, national, NGO) to increase the efficiency of and livelihood value of subsistence plots.
Action 5: Develop and implement incentive program (where necessary) to encourage implementation of improve practices.
Time-frame: Minimum of five years
Linked Conservation Strategy: Reduce loss and degradation of forest habitat through outreach and education of landowners and land users in focal areas.
Threats addressed: Threat #6
Countries where action is appropriate: All countries except Costa Rica and Venezuela
Operational needs:

- Project leader to train staff, oversee development of educational materials, and to coordinate actions collaboratively with the work proposed in Conservation Actions #5 and #6.
- Trained technical assistance staff to communicate with landowners
- Materials and seeds to establish tree nurseries with fruit trees, live fence-post trees, and desirable forest tree species to provide to landowners
- Understanding of local agricultural economics and market chains
- Understanding of local incentive programs
- Teams to develop region-specific best management guidelines
- Development of educational materials and programing

This project must operate in conjunction with an adult education and outreach program. All countries already have programs that target subsistence farmers for assistance, though most programs do not incorporate an agro-ecological focus. This program should be developed in association with Conservation Action #5, an adult education and outreach program. This collaboration will facilitate education focused on maintaining soil fertility, diversifying subsistence crop production, and evaluating ecosystem services so that subsistence farmers can improve the value of their plots while simultaneously increasing their appreciation of the forest that remains on the landscape.

Conservation Action #5: Adult Education and Outreach

Objective: Increase adults' awareness of the services provided by forests, specifically watershed protection and erosion control through adult community education program focused on ecosystem services and watershed protection.
Step 1: Hire a team of community educators with an environmental background to develop program content and conduct education programs to promote forest retention and forest restoration as beneficial ecosystem services for local communities.
Step 2: Develop and implement community restoration programs.
Time-frame: Minimum of five years
Linked Conservation Strategy: Reduce loss and degradation of forest habitat through outreach and education of landowners and land users in focal areas.
Threats addressed: Threats #2, 3, 6, 7, and 8
Countries where action is appropriate: All

Operational Needs:

- Trained adult education staff to communicate with local community members and landowners
- Educational materials and programing
- Communication with local communities
- Reforestation program supplies and technical assistance.

This conservation action is geared at challenging the widespread cultural belief that forested land is useless, dangerous, or wasted space. By promoting the direct benefits of forest to community water sources, we hope to engage the interest of local communities. The team of educators will also be well placed to communicate with local communities about the benefits of the previously listed projects.

Conservation Action #5.1: Watershed Protection

Objective: Obtain legal protection of forest surrounding community watersheds, rivers, and streams.
Step 1: Identify existing legal mechanisms for formal protection of watersheds in each country
Step 2: Identify governmental and non-governmental organizations already working to legally protect watersheds.
Step 3: Identify key watersheds within focal areas in need of formal protection.
Step 4: Work jointly with communities and existing partner organizations to promote legal protection of these areas.
Step 5: Advocate for increased support and protection of watersheds at the country
Linked Conservation Strategy: Support the creation and enforcement of protected areas.
Time-frame: Five years
Threats addressed: Threats 2,3, and 5
Countries where action is appropriate: Guatemala, Honduras, Panama, Colombia, Venezuela
Operational needs:

- Coordinator with extensive experience in protected areas policy throughout the region
- Field team to conduct visits and identify high priority watersheds
- GIS capacity
- Legal support

This team should work collaboratively with the team of community educators described in Conservation Action 5. By targeting legal protection and environmental education efforts in the same community, these teams should increase community involvement and willingness to protected watersheds. By offering funds and/or advice to legal protect community watersheds, we hope to engage a range of community leaders in forest preservation and appreciation. Substantial opportunity exists to partner with hydroelectric companies operating in Latin America that depend on forested watersheds for water quality and flow regulation. The team of educators will also be well placed to communicate with local communities about the benefits of the previously listed projects.

Conservation Action #6: Youth Environmental Education

Objective: Increase the environmental awareness of elementary school aged children through education programs focused on ecosystem services and natural history. education of landowners and land users in focal areas.
Step 1: Develop goals, strategies, and educational activities that support active conservation of forested ecosystems
Step 2: Hire team of biological educators to lead students in activities that promote awareness and excitement about birds, forested landscapes, and ecological processes that result in changed behaviors OR support and expand current youth environmental awareness curriculums in countries with well developed programs.
Step 3: Initiate or expand use of Bird Sleuth in GWWA Focal Areas
Step 4: Implement small scale, student developed conservation projects
Time-frame: Minimum of five years
Linked Conservation Strategy: Reduce loss and degradation of forest habitat through outreach and **Threats addressed**: Threats #1, 4, 6, and 8.
Countries where action is appropriate: All
Operational Needs:

- Curriculum training programs for educators
- Education materials
- Biological educators
- Communication with local communities
- Conservation and monitoring project supplies and technical assistance

Several environmental education programs already exist in Central and Northern South America. Rather than creating a totally new program, funds could actively support these programs when they are working within Golden-winged Warbler Focal Areas. Hiring additional biological educators is essential, as no program has a staff capable of working within all the focal areas in a country. Regional coordination is needed to help develop objectives and to coordinate with ongoing programs and local schools.

Conservation Action #7: Improved Wood-burning Stoves

Objective: Decrease the amount of wood collected and use for cooking fuel through the implementation of wood-burning stove project with community managed firewood parcels.
Step 1: Provide high efficiency wood-burning stoves to communities that rely on wood for cooking fuel.
Step 2: Establish forested parcels within communities for continuous generation of fuelwood
Step 3: Conduct adult education about use of stoves and management of fuelwood parcels
Time-frame: Minimum of five years
Threats addressed: Threat #7
Linked Conservation Strategy: Reduce loss and degradation of forest habitat through outreach and education of landowners and land users in focal areas.
Countries where action is appropriate: Guatemala, Honduras, and Nicaragua.

Operational Needs:

- Stoves and technical staff to train communities on use of stoves
- Forester to design community fuelwood parcels
- Materials for fuelwood plantations (fencing, nursery materials, fertilizer, etc)

Improved wood-burning stove projects have been implemented across Northern Central America for many years and reduce fuelwood consumption by around 40% per household (Boy et al. 2000). In areas like the highlands of Guatemala where each household may consume up to 2,000 lbs. of wood per year (ESMAP 2003), improved wood-burning stoves offer a rapid, cost-effective, and tangible way to reduce forest degradation. NGOs like ADESA and Trees, Water, People have substantial experience designing stoves that are appropriate for the cooking style and conditions of a region. These NGOs also have staff to teach communities how to assemble a stove and how to cook on it. The inclusion of community fuelwood parcels in this project should further decrease pressure on these forests. This project has the potential to reduce forest degradation within nearly all of the Honduran and Nicaraguan focal areas, the areas with highest wintering occupancy of Golden-winged Warblers. Costs per stove are low at approximately $350.

Conservation Action #8: Payment for Ecosystems Services (PES)

Objective: Conserve existing forest habitat through Payment for Ecosystem Services (PES) programs.
Step 1: Assess feasibility of a PES program for each focal area within each country by identifying land ownership status and relationships between communities that have resources to be protected and communities who are requiring use of ecosystem services
Step 2: Establish support for PES programs in focal areas from governments, NGOs, communities and other stakeholders.
Step 3: Assist government agencies and/or NGOs to establish PES regulations, management, payment processes and compliance monitoring.
Step 4: Conduct community outreach on PES opportunities where they become available
Step 5: Provide technical assistance for forest protection and management to communities and landowners to develop plans that meet criteria for PES program.
Time-frame: Five years for each focal area, though focal areas may be evaluated concurrently.
Linked Conservation Strategy: Retain and create forest habitat by developing and promoting economic incentives to keep forest on useable lands.
Threats addressed: Threats # 1, 4, 5, and 6.
Countries where action is appropriate: Costa Rica, Panama, and Colombia. All other countries may be able to develop PES, but may require significantly more investment.
Operational Needs:

- Focal area resource – user assessment and PES feasibility study
- Funding for logistical coordination and legal fees
- Capital for PES Fund
- Technical assistants
- Communications strategy

While other conservation actions address some of the cultural and economic drivers of forest loss, Payment for Ecosystem Services provides a direct, monetary benefit to leaving forest on the landscape. Costa Rica already has a well-developed government program that facilitates and manages PES programs supported by a national gas tax. Research has documented that PES payments have led to secondary forest regeneration on abandoned agricultural areas and that Golden-winged Warbler occupy those forests (Chandler, 2012). Funds will be most efficiently used to support the development of PES programs in Costa Rica, Panama, and Colombia, where the government or NGOs are already managing PES projects. Costa Rican representatives believe that 50% of the forest remaining in their focal areas can be protected through PES, and Colombian representatives believe that within five years they can implement PES in one focal area and have begun the process in a second focal area.

Conservation Action #9: Protected Areas Management

Objective: Increase the effectiveness of governance of protected areas that overlap with priority Focal Areas.
Action 1: Review status of management of key protected areas within focal areas
Action 2: Engage governmental agencies and potential co-managers in order to develop protection improvement plans.
Action 3: Advocate for the use of Global Environment Facility funds to increase salaries for park guards and number of park staff in protected areas.
Action 4: Provide additional resources and training to improve protection of protected areas.
Action 5: Engage communities that border or are located within protected areas to increase sense of ownership and management of protected area.
Time-frame: Five years per country
Linked Conservation Action: Improve and support the enforcement of protected areas.
Threats addressed: Threats # 5, 6, 7, 8
Countries where action is appropriate: Honduras, Nicaragua, Panama, Colombia, Venezuela
Operational needs:

- Coordinator for each country
- Systemization of improved protection protocols
- Equipment and training programs
- Education and outreach materials

Lack of effective governance of protected areas often begins with insufficient or no national funds allocated to maintaining dedicated staff within the protected area. In many cases, local communities do not feel ownership of the area or investment in its protection and maintenance. While each country has a government department specifically dedicated to maintaining protected areas, an outside coordinator could help advocate that increased funding and attention be given to the protected areas that harbor high numbers of wintering Golden-winged Warblers. The coordinator could also actively seek out partnerships with local communities, local governments, NGOs, and conservation groups to enhance the local interest in maintaining the area. The current needs differ between each protected area, but a coordinator could help identify and implement specific actions that increase the probability that Golden-winged Warbler habitat is protected within these areas. These actions include but are not limited to: training park guards to recognize illegal activities, developing incentive programs to encourage

exceptional park guards, developing community education programs in buffer zones of protected areas to socialize park management plans, developing incentive programs to encourage communities to reduce their impact within the park, and revising management plans to fund activities with high probability of success.

Conservation Action #10: Advocacy and Community Decision-Making

Objective: Empower local communities to be able to participate in decision-making on implementation of new energy infrastructure and mining development within focal areas through advocacy programs.
Step 1: Research and synthesize national planning strategies for energy, mining, and infrastructure development
Step 2: Identify poorly planned projects with potential to destroy habitat in focal areas.
Step 3: Inform and engage local communities to be affected by infrastructure development.
Step 4: Increase the capacity of local communities to oppose destructive projects and participate in decision making-process about development projects.
Step 5: Facilitate communication between project developers, government, and communities.
Step 6: Engage communities that border or are located within protected areas to increase sense of ownership and management of protected area.
Time-frame: Five years
Linked Conservation Strategy: Increase local community involvement in mining and infrastructure development decision-making process.
Threats addressed: Threats # 9 and 10
Countries where action is appropriate: Guatemala, Honduras, Panama, Colombia, Venezuela
Operational needs:

- GWWA Regional Coordinator
- Communication with communities and governments
- Outreach and workshop materials
- GIS capacity
- Legal team

This action will best implemented by existing groups that focus specifically on this Central American energy and mining policy and advocacy. The Regional Golden-winged Warbler Coordinator (Action #1) should actively reach out to these existing groups and disseminate this conservation plan. When specific threats present themselves inside of prioritized conservation areas, the Coordinator can lead fundraising efforts to support advocacy groups and legal education for the potentially impacted communities.

Linking regional threats, conservation actions, and priority focal areas

In order to identify the areas where conservation actions should first be implemented, 22 conservation practitioners and biologists ranked the focal areas in their countries in terms of action priority based on the predicted rate of male Golden-winged Warbler occupancy, local knowledge of the areas of highest density of Golden-winged Warblers, and the current capacity

within the focal area to implement conservation action. The initial focal area ranks were revised by the eleven participants who attended the Golden-winged Warbler Winter Grounds Plan Meeting in Warrenton, VA in May of 2015. These participants examined new data on the rates of forest loss and land use change in each focal area. They then identified three focal areas per country were conservation action should begin immediately based on the degree of habitat loss, the capacity to create or preserve habitat, and the relative importance of the focal area for Golden-winged Warblers. These prioritized focal areas were then linked to the conservation actions that could be successfully implemented in each area to address the specific threats present in each focal area as shown in Table 4-2.4. The information presented in Table 4-2.4 can be used to identify appropriate areas to conduct conservation actions and the appropriate actions to address specific threats. It should be used by land managers, conservation NGOS, and government organizations to structure and prioritize conservation action.

Table 4-2.4. Threats linked to appropriate conservation actions and priority focal areas. Conservation action codes defined in Table 4-2.3. Priority focal areas codes defined in Table 4-2.1.

Threat	Conservation Action(s) Addressing Threat	Priority Focal Areas Linked to Threat and Conservation Actions
T1. Growth and intensification of industrial-level agriculture	CA1, CA2, CA6, CA8	HO06, H008, NI03, NI05, NI07, CR4-3, CR6-2, PA02, PA03, VE01, VE02, VE03
T2. Sub-optimal agricultural practices	CA1, CA2, CA5	HO06, HO08, HO12, NI03, NI05, NI07, CR1_2, CR1_3, CR4-3, CR6-2, PA 2, PA3, CO01, CO03, CO04, VE01, VE02, VE03
T3. Sub-optimal practices in cattle farming	CA1, CA3, CA5	HO06, HO08, HO12, NI03, NI05, NI07, CR1_2, CR1_3, CR4-3, CR6-2, PA02, PA03, CO02, CO03, CO04, VE02, VE03
T4. Growth and intensification of cattle farming	CA1, CA3, CA6, CA8	HO06, HO08, HO12, NI03, NI05, NI07, PA02, PA03, CR6-2, CO01, CO03, CO04, VE 02, VE03
T5. Lack of effective management in protected areas	CA1, CA8, CA9	HO06, HO08, HO12, NI03, NI05, NI07, PA02, PA03, CO01, CO03, CO12, VE01, VE02, VE03
T6. Expansion and intensification of small-holder agriculture	CA1, CA4, CA5, CA6, CA8, CA9	GU01, GU02, GU03, HO06, HO08, HO12, NI03, NI05, NI07, PA02, PA03, PA07, CO02, C001, CO03, CO04
T7. Fuelwood collection	CA5, CA7, CA9	GU01, GU02, GU03, HO06, HO08, HO12, NI03, NI05, NI07
T8. Provoked forest fires	CA5, CA6, CA9	HO06, HO08, HO12, VE 01, NI06
T9. Expansion of energy and road infrastructure	CA10	CO03, HO12, PA02, PA03, PA07
T10. Mining	CA10	CO03, VE01

Implementation and next steps

This section provided an overview of the highest priority areas for Golden-winged Warbler winter grounds conservation and the appropriate conservation goals, strategies, and conservation actions based on the threats in those areas. The Alianza Alas Doradas identified the following implementation goals as an ambitious, but achievable structure and timeline for conservation action.

1. Implement prioritized conservation action in 25% of focal areas (18 areas) in the next 5 years, 50% of focal areas (35 areas) within 10 years, and 100% of focal areas (70 areas) within 20 years (by 2036).
2. Within five years, conduct research necessary to support and validate the best management practices described in Conservation Actions 2, 3, and 4 for Golden-winged Warbler winter habitat management in the major ecosystems where they occur. In 10 years, best management practice outcomes should be evaluated and management plans revised to reflect the new information.
3. Develop a methodology to monitor the composite effect of the top threats on Golden-winged Warbler habitat and reduce the impact of these threats by 25% in focal areas in the next 10 years.

Conservation action can and should begin immediately, as outlined in Section 3 project descriptions. While individual groups already established in priority focal areas have the capacity to begin work, conservation action will not be able to reach all focal areas without full time direction and coordination. Hiring a coordinator immediately to oversee fundraising and project implementation is critical to the success of this plan. . Finally, the Alianza Alas Doradas should meet every six months to ensure that progress is made allowing conservation goals to be achieved within their defined time frames.

SECTION 3: COUNTRY-LEVEL CONSERVATION ASSESSMENTS AND PLANS

While many of the threats to Golden-winged Warbler habitat occur throughout the winter range, conservation actions may be most easily implemented at the country level. Country-level conservation strategies and recommendations have the potential to be integrated within national land-use planning and national protected areas initiatives. As most partner NGOs and governmental agencies only work at the level of the country, the *Alianza Alas Doradas* decided to develop the most detailed conservation planning at this level. Conservation recommendations presented in this section respond to the range-wide prioritized threats identified in Section 2 and were derived from the ten prioritized conservation actions in Section 2. Each country prioritized three or four focal areas where conservation work should begin immediately. Prioritization of focal areas considered:

- The importance of the area for Golden-winged Warblers based on average rate of male occupancy and local knowledge
- The level of current threat to Golden-winged Warbler habitat
- The local capacity to conduct conservation action within the focal area.

Representatives from each country developed a five-year conservation plan with projects and budgets detailed for each prioritized conservation area. All projects proposed within the conservation plan fit within the scope of the recommended conservation actions detailed in Section 2. In the absence of multi-national coordination and fundraising efforts, the country-level conservation plans function as stand-alone plans and projects that can be undertaken on a case-by-base basis. These five-year plans are designed to allow each country to reach the midpoint of the ten-year habitat conservation goals as defined in Section 2:

1. In the next 10 years, reduce the net loss of Golden-winged Warbler winter habitat by 50% within identified focal areas.
2. In the next 10 years, restore 30% of the habitat lost since the year 2000 (approximately 45,000 ha) within the identified focal areas.

The specific number of hectares to be targeted for conservation and restoration depends on the amount of forest lost within focal areas in each country since the year 2000. Local partners with the capacity to implement these actions have been identified within the priority focal areas. While further project development will be required to effectively implement these projects, the recommendations in this chapter should both serve as a guideline for initial fundraising and focus initial conservation investments.

The country-level, five-year conservation plans are intended to be implemented within an adaptive management framework. All collaborators and project managers should document failures and successes of their projects, number of hectares with new protection from habitat alteration, and number of hectares where habitat restoration has been successful. The general conservation actions and country-specific projects should be reassessed after five years to determine how much progress has been made toward meeting the ten-year goals, to refine habitat conservation goals and the development and implementation of conservation projects.

The format of Section 3 is designed to allow collaborators to raise funds both national and international funds to meet the five-year conservation goals. These recommendations can be used as a menu of conservation actions from which donors can choose the option that most closely aligns with their particular objectives and investment goals. Alternatively, the

conservation actions proposed in this section can be integrated with the implementation of the range-wide conservation actions proposed in Section 2.

3.1 Guatemala Focal Area Assessment and Conservation Plan

Although Guatemala has historically been considered to be on the margin of the Golden-winged Warbler wintering range, recent records and surveys indicate that the country likely hosts roughly 10% of the global population of this species (Eisermann 2015, unpublished report). Guatemala was not included in the standardized survey data collected from 2008-2012 and therefore the occupancy model presented in Rosenberg et al. (*in press*) could not be used to select focal areas. An analysis of eBird and personal birding checklists within Guatemala, however, showed relatively equal rates of Golden-winged Warbler detections throughout four large geographic regions (Areas 01-04, Figure 4-3.1), which encompass both lowland and highland broadleaf and mixed conifer forest. Within those four areas, the majority of Golden-winged Warbler records occur in a broadleaf forest ecosystem and secondarily in a mosaic landscape of forest, regenerating fields, agroforestry plots, open fields, and settlements. This is consistent with Golden-winged Warbler habitat preferences documented in other parts of the winter range. An intensive survey conducted in January 2015 in the Atlantic slope highlands and foothills (Area 3) showed that Golden-winged Warblers occur regularly throughout the elevational gradient surveyed (1300-2000 meters). All Golden-winged Warbler detections during this survey occurred in disturbed primary forest or disturbed secondary forest with agroforestry components. At this time, records and surveys suggest that Golden-winged Warbler distribution in Guatemala is disperse, and that conservation efforts should focus on maximizing the amount of broadleaf forest remaining on the landscape. However, if future survey efforts are able to detect other areas with relatively high Golden-winged Warbler densities, conservation efforts should target those areas as well

Threats Assessment

The greatest threat to Golden-winged Warblers in Guatemala is the loss and degradation of broadleaf forest due to human activity. Guatemala is estimated to have experienced a loss of 5,500 km^2 of forest during the decade of 2000-2010, and rates of forest loss are as high as 1.4% per year at the country level (FAO 2011, Regalado et al. 2012). The human population of Guatemala is growing rapidly and is expected to double from 2010 to 2015 (CEPAL 2013). Population growth in rural areas, which are dominated by subsistence or small-scale agriculture, will lead to increased pressure on remaining forested areas. The expansion of subsistence agriculture is particularly strong in the Atlantic slope highlands and foothills (Area 03).

In the Atlantic slope lowlands, industrial agriculture has caused rapid land cover changes as forest is converted to coffee, sugar cane, banana, cattle, and oil palm. Oil palm plantations in particular increased in area by over 500% during the decade of 2000-2010, and provide no conservation value to Golden-winged Warblers (FAOSTAT 2012). Open cast mining and infrastructure development represent a large-scale future threat to Golden-winged Warbler habitat. Eisermann and Avendaño (2014) reported that 20% of the remaining forest in Guatemala has been approved for mining exploration and exploitation. This threat encompasses nearly all remaining broadleaf forest in the Pacific slope highlands and foothills (Area 02) and much of the Atlantic slope highlands and foothills (Area 03). While legally protected areas cover more than a third of Guatemala (CONAP 2013), most protected areas lack management and law enforcement. In addition, both formal and informal conservation efforts can be hindered by a lack of recognition of the importance of natural areas for biodiversity and human health and livelihoods (Eisermann 2014, unpublished report).

Focal Areas

To select focal areas for conservation, in-country experts identified eight areas within the regions of Golden-winged Warbler's regular occurrence that are facing high rates of loss of broadleaf forest and have conservation potential. Most of the focal areas are delineated around existing Important Bird Areas or Protected Areas boundaries in order to increase opportunities for collaboration between conservation groups. The focal areas were prioritized by ranking the opportunity to undertake conservation action that will retain and restore Golden-winged Warbler habitat. The ranking process took into account government plans to formally protect areas and NGO and government capacity to implement conservation action on the ground. However, Golden-winged Warbler habitat is threatened at a broad scale in Guatemala, so the feasibility of undertaking conservation action in other areas within the range should be

Table 4-3.1. Guatemala focal areas ranked in terms of conservation priority (1=highest priority, 2=medium priority, 3=lower priority). Conservation priority is based on the opportunity to undertake conservation action. All areas have high levels of habitat loss due to conversion of forest to other land uses.

Focal Area	Name	Conservation Priority
GU01	Sacranix IBA	1
GU02	Cerro El Amay	1
GU03	Sierra Santa Cruz	1
GU04	Volcán Santiguito: Ladera Sur	2
GU05	Petén: Areas Protegidas del Sur-oeste	2
GU06	Candelaria-Campur IBA	2
GU07	Sierra Las Minas	3
GU08	Sierra Del Lacandón	3

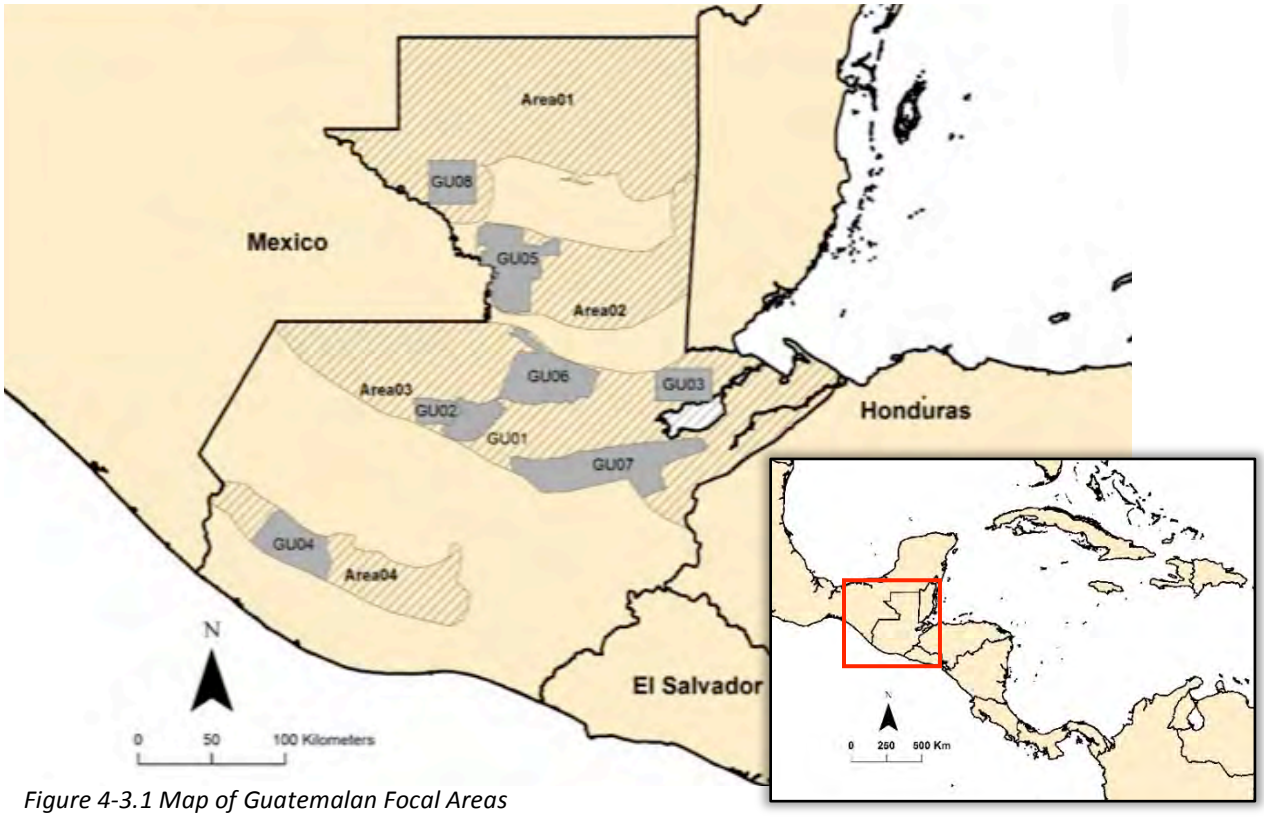


Figure 4-3.1 Map of Guatemalan Focal Areas

reassessed in the future as further conservation partnerships develop. We analyzed the rate of forest change between 2000 and 2013 in these focal areas using the Global Forest Watch dataset (2014, Figure 4-3.2), and determined that the Guatemala focal areas have suffered the highest rates of recent forest loss relative to the rest of the Golden-winged Warbler winter range. Rates of forest loss in the Peten (Focal Areas GU05 and GU08) are as high as 40%, over five times greater than the background rate of deforestation occurring in the network of range-wide focal areas. Guatemalan focal areas require rapid and effective action if Golden-winged Warbler habitat is to be preserved.

Long-Term Conservation Strategy

The most effective long-term strategy is to decrease pressure of ?? on natural areas. This process begins with education, and any project to improve access to education, increase teacher preparation, or increase enrollment of rural youth has a positive long-term conservation implication. In that vein, supporting or starting environmental education programs within focal areas have the potential to begin a long-term shift in local attitudes about the importance of natural areas and forest. This is critical to the long term success of any conservation action, and especially to the conservation of forest with no legal protection. On a shorter term timeline, agroforestry and polyculture systems, such as those practiced in the central highlands, should be promoted. In areas with subsistence farming and agroforestry, Golden-winged Warbler habitat can be improved through the diversification of canopy trees and the retention of a complex understory and midstory structure. Local livelihoods and household incomes can be improved through this approach as well (Gifford, in prep.), providing local people with an economic incentive to retain habitat. As an alternative to the growth of industrial agriculture in the Atlantic lowlands, Eisermann (2014, unpublished report) recommends investment in hardwood plantations over oil palm or cattle pasture. Hardwood plantations outperform cattle ranching on the mid-term and are comparable to oil palm in terms of profit. The Instituo Nacional de Bosques (INAB) offers incentives to reforest with hardwoods, but additional international funds are needed to increase the impact of incentive programs.

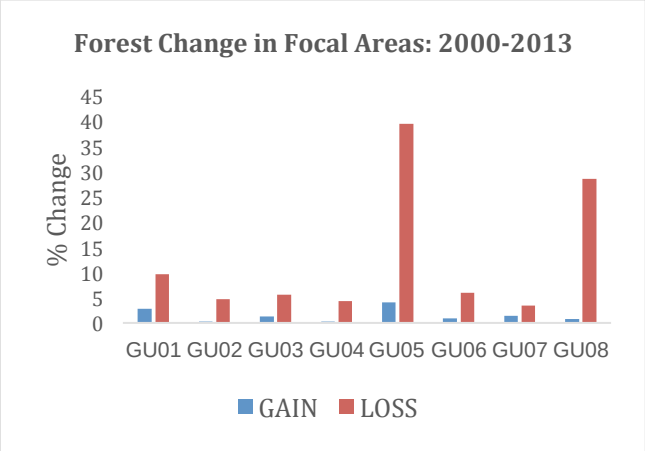


Figure 4-3.2. Percent loss and gain of forested habitat in Guatemalan focal areas. GU05 has experienced the greatest rate of forest loss at 39% followed by GU08 at 28%. These two focal areas have the greatest rate of forest loss of all GWWA winter focal areas.

Guatemala Conservation Plan (2015-2020)

In order to begin effective conservation action as quickly as possible, four actions with a five-year time frame and a total cost of $957,500 are proposed. The following actions are targeted to occur within the Focal Areas with the highest conservation priority (Table 4-3.1), though many could be replicated in all focal areas.

1. *Conduct a systematic, country-wide survey for Golden-winged Warblers:*

This effort has already been conducted in all other countries where Golden-winged Warblers regularly occur, allowing for the delineation of focal areas based on areas of highest predicted occupancy. Without this effort in Guatemala, conservation action will not be as focused or efficient as it could be. Such a survey will also serve as a baseline for evaluating Golden-winged Warbler population change as a result of future conservation with standardized monitoring.

2. *Hire a bird conservation coordinator*:

While Guatemala used to have many biologists specializing in birds, the majority have left the country, leaving a serious gap in the capacity to undertake future research or implement bird related education or conservation. The Guatemalan NGO FUNDAECO, who has active avian monitoring and habitat conservation projects in Guatemala, has offered to host such a position. With this coordinator they believe they could conduct surveys for Golden-winged Warblers and implement conservation action within focal areas. This position would be critical to the implementation of Golden-winged Warbler conservation in Guatemala.

3. *Assist the declaration of Sierra Santa Cruz as a National Protected Area:*

The Sierra Santa Cruz Focal Area (GU03) is the last large area lacking protection that was recommended for protection by CONAP in the 1980s. Funding for a baseline study, community engagement, and the legal support to marshal it through the Guatemalan congress could result in legal protection within the next few years. Simultaneous funding would be needed to acquire a core area for protected and to work with communities and landowners to develop management plans and promote agroforestry systems in the buffer areas of the National Protected Area

4. *Support the Women in Agroecology Leadership for Conservation program:*

The NGO Community Cloud Forest Conservation currently implements a three-week, on-site education program for young indigenous women in the Sacranix IBA (GU01). This program focuses on sustainable agriculture, leadership, family planning, and other aspects of sustainable livelihoods that have a direct impact on the future land use of this focal area. We recommend supporting the participation of 150 women per year. Support should be sought to expand this successful program to other areas of Guatemala as well.

5. *Develop a tropical hardwood production project to restore lost habitat*:

While this project was not initially proposed in the priority actions, developing a restoration project that restores lost habitat while providing sustainable income for protection of existing forest patches should be developed and this process promoted. Lands need to be identified where restoration should occur, investors need to be identified to fund restoration and then best management practices to support timber production and bird production need to be implemented over a period of 30 years.

Other Focal Area Conservation Projects:

It should be noted that not all organizations that are active in conducting conservation projects within identified focal areas were fully able to participate in the project identification and prioritization processes. As such there may be other projects proposed or on-going that are worthy of immediate conservation investment.

3.2 Honduras Focal Area Assessment and Conservation Plan

The central highlands of Honduras have the highest predicted occupancy and abundance of male Golden-winged Warblers in the entire winter range (Chandler 2013). Surveys conducted from 2011 to 2013 show that Golden-winged Warblers occur at all elevations in Honduras, though males are highly associated with middle elevations (700-1300 m) and females are most associated with lower elevations (300-600) (Bennett 2012). Similar to other areas in the winter range, Golden-winged Warblers favor mosaic-type habitats or disturbance features along the edges of mature broadleaf forests, though they also occur in pine-oak forest, agroforestry systems, closed-canopy cloud forest, and occasionally semi-deciduous forest. Golden-winged Warblers are frequently associated with mixed species flocks in Honduras and associate with numerous other Neotropical migratory birds, including the endangered Golden-cheeked Warbler (Bennett 2012).

Focal Areas

In-country experts identified thirteen focal areas for Golden-winged Warbler conservation in Honduras based on the areas of highest predicted male occupancy and local knowledge of high-density Golden-winged Warbler sites. Eleven of these areas occur within nationally protected areas managed by the Honduras Forest Conservation Institute. These areas include national parks, national wildlife reserves, and the Rio Platano Biosphere Reserve. Of the thirteen focal areas, three were prioritized for immediate conservation action based on their highpredicted occupancy of male Golden-winged Warblers, high threat of habitat loss, and local capacity to conduct conservation action. The prioritized focal areas are HO06, HO08, and HO12.

Table 4_3.2. Honduran Focal Areas ranked in terms of conservation priority (1=highest priority, 2=medium priority, 3=lower priority). Conservation priority is based on a combination of the relative importance of each focal area for the Golden-winged Warbler population wintering in Honduras and the opportunity to undertake successful conservation action in that area.

Focal Area	Name	Conservation Priority
HO01	Cusuco	2
HO02	Merendón: Area de Producción de Agua	2
HO03	Pico Pijol: Zona Nucleo y Alrededores	2
HO04	Texiguat: Zona Nucleo	3
HO05	Pico Bonito: Zona Amortiguamiento y Nucleo	2
HO06	La Muralla: Zona Amortiguamiento y Nucleo	1
HO07	Montaña de Botaderos: Zona Amortiguamiento y Nucleo	3
HO08	Sierra de Agalta y El Boqueron	1
HO09	El Carbon	3
HO10	El Armado y Montana de la Flor	3
HO11	El Tablon	3
HO12	Biosfera del Rio Platano: Zona Sur	1
HO13	Cordillera Entre Rios: Parque Nacional Patuca	2

Figure 4-3.3 Map of Honduran Focal Areas

Threats assessment and conservation strategy

The greatest threat to Golden-winged Warblers in Honduras is the loss and degradation of broadleaf forest by human activity. Golden-winged Warbler habitat loss is occurring due to two widespread land conversion forces in Honduras: the gradual expansion of subsistence agriculture and the total conversion of forest to pasture for livestock production.

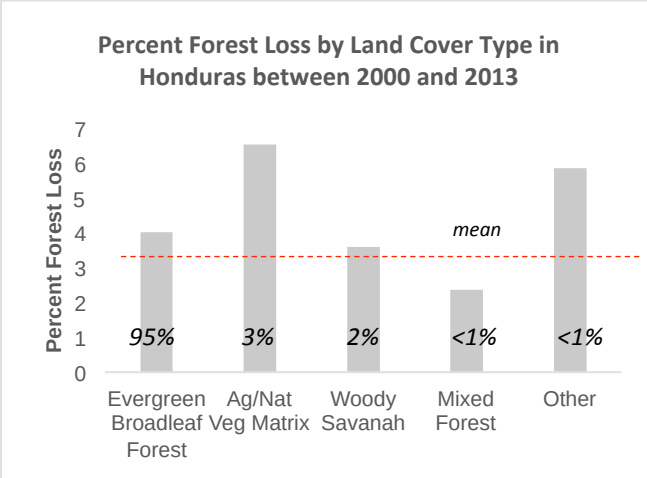


Figure 4-3.4. Difference in forest loss by land cover type relative to the mean Honduran forest loss of 4.1% in focal areas with % of each land cover type. Loss of forest in the Agriculture/Natural Vegetation Matrix land cover type is disproportionately higher than forest loss in all forested land-cover types (X^2=13.8, df=4, p<.01)

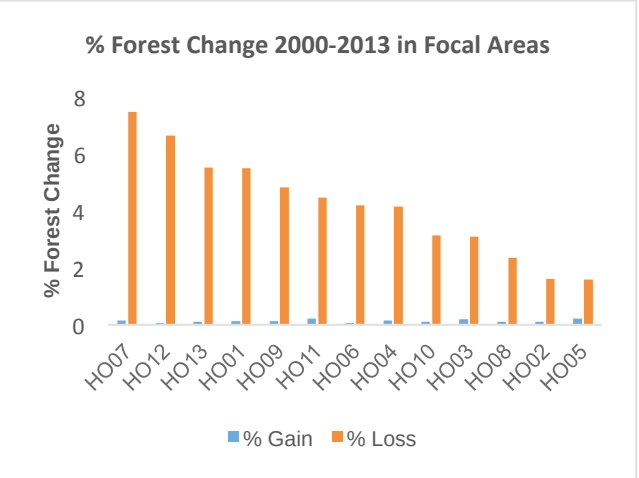


Figure 4-3.5. Percent loss and gain of forested habitat in Honduran focal areas. Structured by degree of recent forest loss with the focal area that has lost the most forest (HO07) on the left and the focal area with the least amount of recent forest loss (HO05) on the right.

Sun Coffee is expanding rapidly, and the use of wood for coffee drying exacerbates deforestation. Additionally, the national protected area system is extremely weak. While many protected areas have been designated, the majority could be considered "paper parks" as they have little capacity or infrastructure to manage the protected areas. This is changing as the national forest institute (ICF) takes on additional management responsibilities and co-management agreements with NGO's are beginning. Providing economic incentives for alternative and improved production methods are needed, as is additional investment in protected area management.

Honduras has seen a slower growth in bird tourism than other countries in Central America. The first Field Guide to The Birds of Honduras was just published in 2015 and there is an opportunity to expand bird tourism in Honduras in the coming years. Increasing bird tourism infrastructure and capacity is also a part of the Conservation Strategy.

Honduras Conservation Plan (2015-2020)

Within the three highest priority focal areas, local collaborators identified three objectives: achieve compliance with best management practices in 50% of the farms found within the focal areas and achieve a 10% increase in forest coverage on 50% of the farms. In order to achieve these objectives, projects have been developed specific to each focal area.

Focal Area HO06: La Muralla

1. *Improve Livestock and agriculture practices:* The goal of this project is to increase the use of beneficial livestock and agricultural practices to reduce the expansion and intensification of these systems. This project would; identify farms that currently retain habitat appropriate for Golden-winged Warblers to act as demonstration sites; promote recommended practices to local communities; organize producers in the region to promote their sustainably produced products, look for sustainable production incentives for producers and identify markets for product sale. Fundamental to this project is the establishment of management practices for cattle production and agricultural systems that maximize benefit to GWWA's .

2. *Establish Payment for ecosystem services program:* The goal of this project is to ensure protection of habitat and encourage appropriate management and production practices. This project will assess the appropriateness and feasibility of establishing a payment for ecosystem services for properties and communities between the towns of La Union and Olanchito and the villages within the focal area. If appropriate, a formal payment for ecosystem services program would be established and promote the retention and creation of habitat by providing economic incentives for landowners who protect habitat or produce in bird friendly ways.

3. *Native Species Reforestation:* The goal of this project is to restore habitat within this focal area using native species. Establish local nurseries to produce and plant 30,000 native trees per year on private lands.

Estimated First Year Subtotal: $154,800.
Estimated Total Five Year Project Cost: $639,000

Focal Area HO08: Sierra de Agalta.

1. *Improve Livestock and agriculture practices:* The goal of this project is to increase the use of beneficial livestock and agricultural practices to reduce the expansion and intensification of these systems. In this focal area in addition to identifying farms that currently retain habitat appropriate for Golden-winged Warblers to act as demonstration sites; training programs and conservation credits would be provided to local cooperatives to support conservation practices, reduce forest fires and reduce cutting of forests. Fundamental to this project is the establishment of management practices for cattle production and agricultural systems that maximize benefit to GWWA's.

2. *Private Reserve Creation:* The goal of this project is to increase direct protection of key habitat. Purchase 200 hectares of the buffer zone of Sierra de Agalta for a private reserve. Deforestation in Honduras occurs most frequently in areas that already have human activity. This national park does not have the institutional capacity to protect the buffer zone from encroachment from surrounding villages. A 200 hectare parcel has already been identified with high quality Golden-winged Warbler habitat that will not survive unless it is purchased from the surrounding land-owners.

3. *Promotion and Development of Bird tourism:* The goal of this project is to stimulate more bird friendly economies and increase local understanding of conservation. This project would train local community members in the identification of birds and the intricacies of establishing businesses to facilitate bird tourism. A coordinator would work with the local guides to help establish connections, promote the region and begin attracting clients.

4. *Biological Education Program:* The goal of this project is to increase local awareness, understanding and capacity to influence future behaviors and management decisions. The Universidad Nacional de Agricultura is already conducting environmental education in twenty elementary schools in the Sierra de Agalta focal area. Despite having conducted four years of environmental education, the program does not have permanent funding. As a long term investment strategy, this focal area should seek funds to permanently support the Biological Education Program and expand to include education on migratory birds and their conservation The program would also ensure education programs for adults.

5. *Establish Payment for ecosystem services program:* The goal of this project is to facilitate protection and improved management of GWWA habitat. A program to support the protection of 1000 ha (2470 acres) has been proposed for this Focal Area.

Estimated First Year Subtotal: $325,900
Estimated Total Five Year Project Cost: $817,000

Focal Area HO12: Zona Sur de la Biosfera Rio Platano

1. *Promotion and Development of Bird tourism:* The goal of this project is to stimulate more bird friendly economies and increase local understanding of conservation. This project would train local community members in the identification of birds and the intricacies of establishing businesses to facilitate bird tourism. A coordinator would work with the local guides to help establish connections, promote the region and begin attracting clients.

2. *Livestock and agriculture best management project:* The goal of this project is to increase the use of beneficial livestock and agricultural practices to reduce the expansion and intensification of these systems. This project would identify and create demonstration farms to promote the use of GWWA best management practices for livestock and agriculture production systems. These farms would be promoted and through education programs additional landowners would become aware of the bmps and be encouraged to actively use them on their farms.

3. *Biological Education and Community Leaders Program:* The goal of this project is to increase local awareness, understanding and capacity to influence future behaviors and management decisions.The Universidad Nacional de Agricultura is already conducting environmental education in six elementary schools in the Sierra de Agalta focal area. They also run an adult education program which seeks to develop leadership skills and networking abilities throughout the communities in this focal area. As a long term investment strategy, this focal area should seek funds to permanently support these two programs.

4. *Improved management of protected areas:* The goal of this project to ensure better protection of GWWA habitat. To facilitate additional protection of this established protected area, additional equipment, capacity, training and resources are required.

Estimated First Year Subtotal: $233,400
Estimate Total Five Year Project Cost: $682,000

Other Focal Area Conservation Projects:
It should be noted that not all organizations that are active in conducting conservation projects within identified focal areas were fully able to participate in the project identification and prioritization processes. As such there may be other projects proposed or on-going that are worthy of immediate conservation investment.

Focal Areas HO03 and HO04: The Mesoamerican Development Institute (MDI) has recently secured co-management of the Pico Pijol and Texiguat Protected Areas to support ICF in conservation and protection measures in those protected areas. These areas are also areas of expanding coffee production. A new alternative coffee production system called Integrated Open Canopy Coffee (IOC) is being proposed for promotion in these areas to reduce forest loss, and increase forest sparing. Funding for promotion, education and integration of IOC coffee in these focal areas is needed. Funding for improved protected area management is also needed.

3.3 Nicaragua Focal Area Assessment and Conservation Plan

The northern highlands of Nicaragua contain important winter habitat for Golden-winged Warblers. This region consists of mid-elevation broadleaf forest, mixed pine-broadleaf forest, and broadleaf cloud forest at the highest elevations. As in their other winter areas in Central America, Golden-winged Warblers in Nicaragua favor mosaic-type habitats or disturbance features along the edges of mature forests, where low-level secondary growth is prominent. Golden-winged Warblers are frequently associated with mixed flocks in coffee plantations and mid-elevation broadleaf forest. Species surveys suggest that Golden-winged Warblers are fairly abundant in the highland areas of northern Nicaragua, particularly in areas with humid broadleaf forest, and less frequently in areas with pine-oak forest.

From 2009 to 2011, 303 points were surveyed for Golden-winged Warbler presence in this region. Golden-winged Warblers were successfully detected at 60% of these sites, most frequently in mid-elevation broadleaf forest and forest edge. A territory mapping study showed that Golden-winged Warblers wintering in the coffee-broadleaf matrix of this region have significantly smaller territory sizes than Golden-winged Warblers wintering at comparable elevations and land-cover types in Costa Rica (Chandler et al. *in press*). This suggests that the habitat in northern Nicaragua is able to support a higher density of Golden-winged Warblers than other areas in the winter range. Conservation of the Nicaragua focal areas (together with the Honduran focal areas) is the highest priority of this conservation plan.

Within the Nicaragua focal areas, continuous patches of primary forest are being cleared for subsistence agriculture, cattle pasture, and coffee farms. Remnant patches of forest in agricultural areas are being converted or degraded as firewood is collected and livestock remove the forest understory. Conservation efforts in Nicaragua should focus on reversing these trends in forest conversion, in order to conserve as much of the remaining broadleaf forest habitat as possible.

Focal Areas

Focal areas for Nicaragua were selected by a group of in-country experts, who chose 11 areas in the northern highlands with high-predicted occupancy of male Golden-winged Warblers. All have great value to Golden-Winged Warbler populations and are especially vulnerable to land use change. Many of these focal areas surround designated parkland or protected areas, providing opportunities for collaboration with national authorities and conservation groups in the area. The selection process for focal areas was based, foremost, on the quality of

Table 4_3.3. Nicaraguan focal areas ranked in terms of conservation priority (1=highest priority, 2=medium priority, 3=lower priority).

Focal Area	Name	Conservation Priority
NI01	Coordillera Dipilto y Jalapa	2
NI02	Cerro Kilambe	2
NI03	Macizo de Peñas Blancas	1
NI04	Cerro Saslaya	2
NI05	Cerro Datanli El Diablo	1
NI06	Yali, El Jaguar, Corredor	1
NI07	Cerro El Arenal	1
NI08	Yucul	2
NI09	Kinuias	3
NI10	La Murra	2
NI11	Kubali	3

broadleaf forest in the area for Golden-Winged Warbler habitat. The focal areas were then ranked based on the potential for new conservation measures to conserve and improve local Golden-winged Warbler habitat.

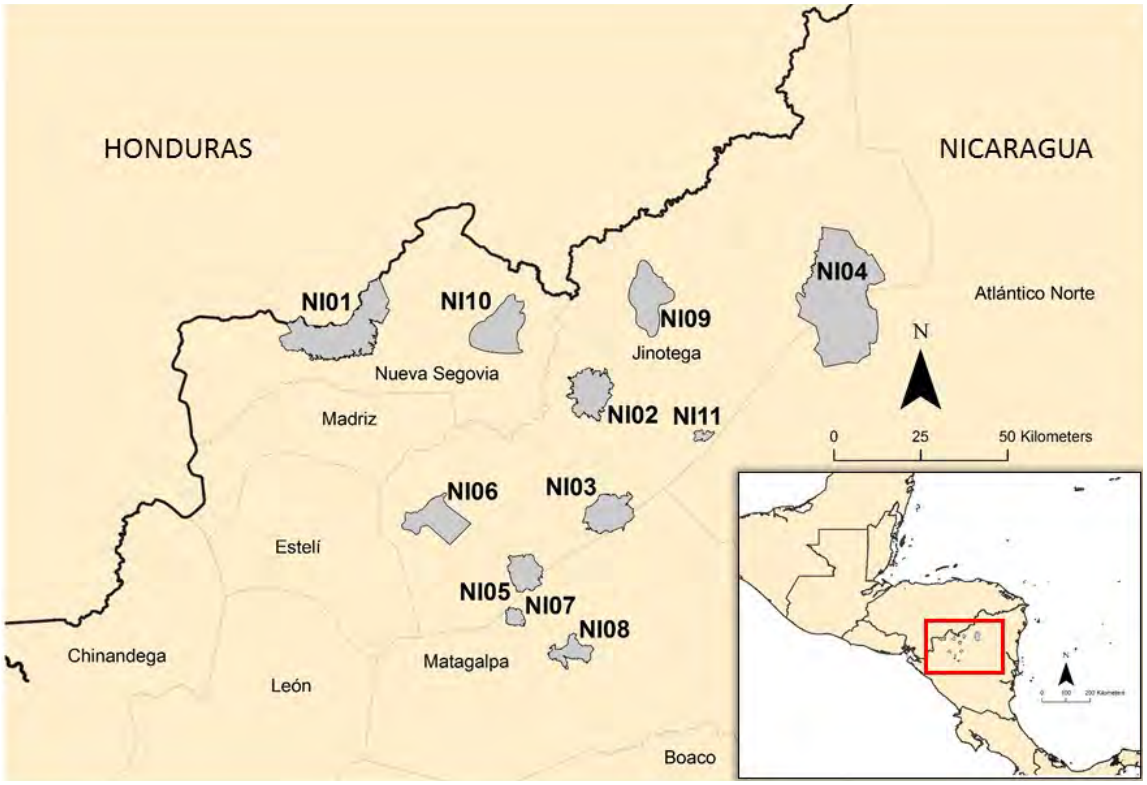


Figure 4-3.6. Map of Nicaraguan focal areas

Threats Assessment

Habitat loss is the greatest threat to Golden-winged Warblers in Nicaragua. Complex broadleaf forest at mid and high elevations is being transformed by agriculture, cattle ranching, and increasing levels of natural resource extraction. Between 1997 and 2012, Nicaragua lost 26% of its forest cover (Nicaragua Country Profile, FAOSTAT). Forest loss within Golden-winged Warbler focal areas has occurred at lower rates than the national average (2-10% per focal area between 2000 and 2013, Figure 4-3.7). However, the forest loss within focal areas is concerning, as it is occurring despite the legal protection that the majority of focal areas have under the Nicaragua Protected Areas System (SINAP). Focal areas NI01, NI04, and NI09 have experienced the greatest rate of forest loss of any focal areas in the Golden-winged Warbler range outside of Guatemala (Figure 4-3.7), which is especially concerning considering the high predicted Golden-winged Warbler occupancy in those areas (Figure 4-1.3).

Habitat loss within focal areas is being driven by multiple factors, including expansion of coffee production, expansion of pasture for cattle, and lack of government presence within protected areas. The expansion of coffee production is of particular concern in this region. Between 1992 and 2011, Nicaragua has experienced a 60% increase in the land used to produce coffee (FAOSTAT). Although coffee and other agroforestry systems can retain habitat for Golden-winged Warblers, intensification of agricultural and livestock production threaten the patches of retained habitat (Chandler et al. *in press*, Chandler 2011). Integrated open canopy systems, where forest is retained as an edge around open-canopy coffee, are used in some places such as Finca El Jaguar (NI06), but the majority of coffee farms employ full-sun or limited shade production. Traditional shade-coffee has been shown to provide habitat for many Neotropical migratory passerines (citation), though quality of these forest patches for Golden-winged Warblers has yet to be determined. Golden-winged Warbler foraging preference tends towards broadleaf forest over coffee, suggesting that shade-coffee alone will not serve as a viable habitat alternative to broadleaf forest for the Golden-winged Warbler(Chandler, 2010;Tolfree 2013). Much of the critical habitat for Golden-Winged Warblers in Nicaragua has legal protection under the National System of Protected Areas (SINAP), including the Bosawas Biosphere Reserve and six natural reserves. Despite legal protection, enforcement of protected areas boundaries and laws is low due to low government presence and investment in these areas.

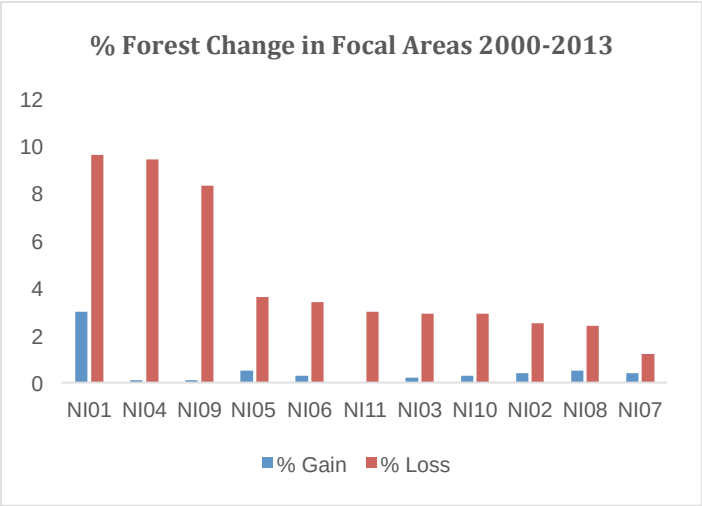


Figure 4-3.7. Percent loss and gain of forested habitat in Nicaraguan focal areas. Structured by degree of recent forest loss. Area with greatest forest loss (NI01) on the left and area with the least recent forest loss (NI07) on the right.

Conservation Strategy

In Nicaragua, Golden-winged Warbler habitat is rapidly being lost or degraded as human impact intensifies in rural and agricultural areas. This conversion occurs for a variety of reasons including population growth and economic and social pressure to clear land. Conservation strategy should focus on providing viable economic alternatives to clearing forest and intensifying land use. Improving the quality of education in the region, especially in regards to environmental issues, will have a positive impact on long-term conservation. This will be particularly important when landowners are asked to partner with conservation groups to implement best management practices on their land. In the shorter term, steps should be taken to provide sustainable alternatives to subsistence agricultural practices in focal areas. Providing local homes with high efficiency wood burning stoves or gas stoves will decrease local dependence on firewood, a practice that actively degrades Golden-winged Warbler habitat. Coffee plantations and livestock grazing can be compatible with Golden-winged Warbler habitat retention under certain circumstances. The development of best management practices and model farms are needed to promote habitat retention in these industries. Other investments,

such as payment of ecosystem services and ecotourism investment may provide local residents with economic incentives to conserve habitat as well. Ultimately, a multi-faceted conservation strategy is necessary to address the multiple, ongoing threats that remove Golden-winged Warbler habitat from the landscape.

Nicaragua Conservation Plan (2015-2020)

In order to begin protecting Golden-winged Warbler habitat immediately, we propose seven actions to be implemented between 2015 and 2020, at a total cost of $5,167,650. The overall goals of these proposed actions are:

1. Improve GWWA habitat quality on 10% of all coffee farms in these focal areas
2. Restore 10% of all pastures in these focal areas to useable habitat by GWWA
3. Protect 10% of remaining forest in focal areas
4. Decrease deforestation rate by 4% (50% of current rate)

These actions can be managed concurrently and are recommended for implementation in these four priority **Focal Areas; NI03, NI05, NI06, and NI07.** The following actions are proposed for implementation in these four focal areas, but many of these actions will be relevant for all focal actions.

1. *Improve agriculture production practices and reduce expansion and intensification of agriculture (Coffee in particular):* The goal of this project is to improve habitat for GWWA and reduce habitat loss and degradation. Fundamental to this project is the establishment of management practices for cattle production and agricultural systems that maximize benefit to GWWA's. This project will use model coffee farms and outreach workshops encourage use of beneficial coffee production practices in the region, and preserve habitat on coffee plantations. It includes workshops for coffee producers, demarcation of boundaries on three private protected areas, and certification of sustainable practices on at least 3 properties in each focal area.

2. *Improve cattle production practices*: The goal of this project is improve GWWA habitat quality and quantity. The intensification of livestock
Roaming livestock are a threat to the secondary growth which Golden-winged Warblers use as habitat. Model farms that use sustainable silvipasture practices will be established and workshops will be run to educate local farmers about these practices. Native plant nurseries will also be established, in order to breed understory plants for restoration of overgrazed areas.

3. *Improve the enforcement of protected areas:* The goal of this project to ensure better protection of GWWA habitat. Although there are protected areas within the Golden-winged Warbler focal areas in Nicaragua, these areas are not adequately protected. Additional Park rangers (or guards) are needed for improved protection of established protected areas. This project proposes to hire, train and equip 32 new guards. This work will be conducted in conjunction with local authorities and several workshops and meetings will be held to facilitate collaboration between the rangers and MARENA and other local authorities. This project will also include the marking of boundaries of three protected areas.

4. *Conservation and restoration of private lands:* The goal of this project is to maintain and increase the amount of habitat available for GWWA in these focal areas. This multi-faceted project proposed the development of an environmental service payment program to protect 1000 hectares of forest habitat used by GWWA on private lands, the reforestation of 90 hectares that have already been degraded; the installation of electric fences on 20 properties, in order to keep livestock from wandering into protected areas; the purchase of 400 hectares of private land for the creation of two new private reserves; and the establishment of16 new private reseves as part of the private reserve network.

5. *Efficient Stove Program:* The goal of this project is to reduce deforestation of GWWA habitat for firewood. The continual need for firewood for cooking is a major threat to the secondary forest which Golden-winged Warblers use as habitat. High-efficiency wood stoves (n=120) will be distributed and to local residents in focal areas in order to decrease the local demand for firewood. Workshops will be held to demonstrate how to use the stoves and in home visits will conducted to ensure proper use.

6. Community education and training: Community outreach is important to ensure that locals are aware of the Golden-winged Warbler's presence and conservation status. The goal of this project is to educate local communities to encourage beneficial land management and protection of GWWA's and their habitat. Education programs will be conducted through workshops at schools near focal areas in order to educate youth about local bird life and conservation opportunities. Promotional materials, including calendars and posters, will also be distributed to promote Golden-winged Warbler conservation.

7. *Promotion of ecotourism:* The goal of this project is to provide local residents a financial incentive to conserve Golden-winged Warbler populations through tourism. The project will include the guide training workshops, tourism promotion, familiarization tours (FAM trips) will local operators and a monitoring program to to monitor the impact of human activity on Golden-winged Warbler habitat and populations in the focal areas

Other Focal Area Conservation Project Notes:
It should be noted that not all organizations that are active in conducting conservation projects within identified focal areas were fully able to participate in the project identification and prioritization processes. As such there may be other projects proposed or on-going that are worthy of immediate conservation investment.

3.4 Costa Rica Focal Area Assessment and Conservation Plan

Of all countries within the winter range of the Golden-winged Warbler, Costa Rica has the most information on the distribution and winter ecology of Golden-winged Warblers (eBird 2015, Chandler 2011). In Costa Rica, Golden-winged Warblers occur most regularly in the central mountains. They also occur at sea level in humid areas of the Pacific Coast with high topographic relief, including the Osa Peninsula, and in occasionally in the Caribbean lowlands. In the highlands, Golden-winged Warbler abundance peaks at intermediate elevations on the Pacific slope and decreases on the Caribbean slope (Chandler 2011). As with other areas in their range, Golden-winged Warblers are positively associated with disturbance features in broadleaf forest and agroforestry systems that retain patches of broadleaf forest.

Focal Areas Selection

In-country experts initially identified six large focal areas where Golden-winged Warblers regularly occur in Costa Rica. The majority of the land encompassed by these areas is protected under multiple protected area designations managed by the National System of Conservation Areas. In order to focus conservation efforts, an in-country workshop was held with local ornithologists, biologists, and natural resource managers, which prioritized conservation action within the originally established six focal areas. Participants of the workshop considered the areas currently undergoing habitat loss and degradation and conducted a socioeconomic evaluation of conservation feasibility. As a result of this workshop, 16 smaller focal areas were selected within the conservation regions as priority areas for Golden-winged Warbler conservation. All of these areas are under threat from habitat loss or degradation, and all have high potential to successfully implement conservation activities to decrease habitat loss.

Table 4_3.4. Costa Rican focal areas ranked in terms of conservation priority. While all areas are of high priority, priority values reflect local capacity to conduct conservation actions (1=highest priority, 2=medium priority, 3=lower priority, 4=lowest priority).

Focal Area	Name	Conservation Priority
CR1-1	Monteverde: Pocosol	2
CR1-2	Monteverde: San Luis	1
CR1-3	Monteverde: South	1
CR2-1	Braulio Carrillo-Cinchona: Horquetas de Sarapiquí	2
CR2-2	Braulio Carrillo-Cinchona: Poás-Barva	3
CR2-1	Braulio Carrillo-Cinchona: Río Cuarto-San Miguel	2
CR3-1	Turrialba: Turrialba-Guayabo	2
CR3-2	Turrialba: other	4
CR4-1	Escazú-Acosta: Cerros de Escazú-El Guarco	3
CR4-2	Escazú-Acosta: Other	4
CR4-3	Escazú-Acosta: Dota-Cerro de la Muerte	1
CR4-4	UNKNOWN	4
CR5-1	Talamanca-Caribe: Pacuare	3
CR6-1	Talamanca-Coto Brus: Buenos Aires	3
CR6-2	Talamanca-Coto Brus: San Vito de Coto Brus	1
CR6-3	Talamanca-Coto Brus: Other	4

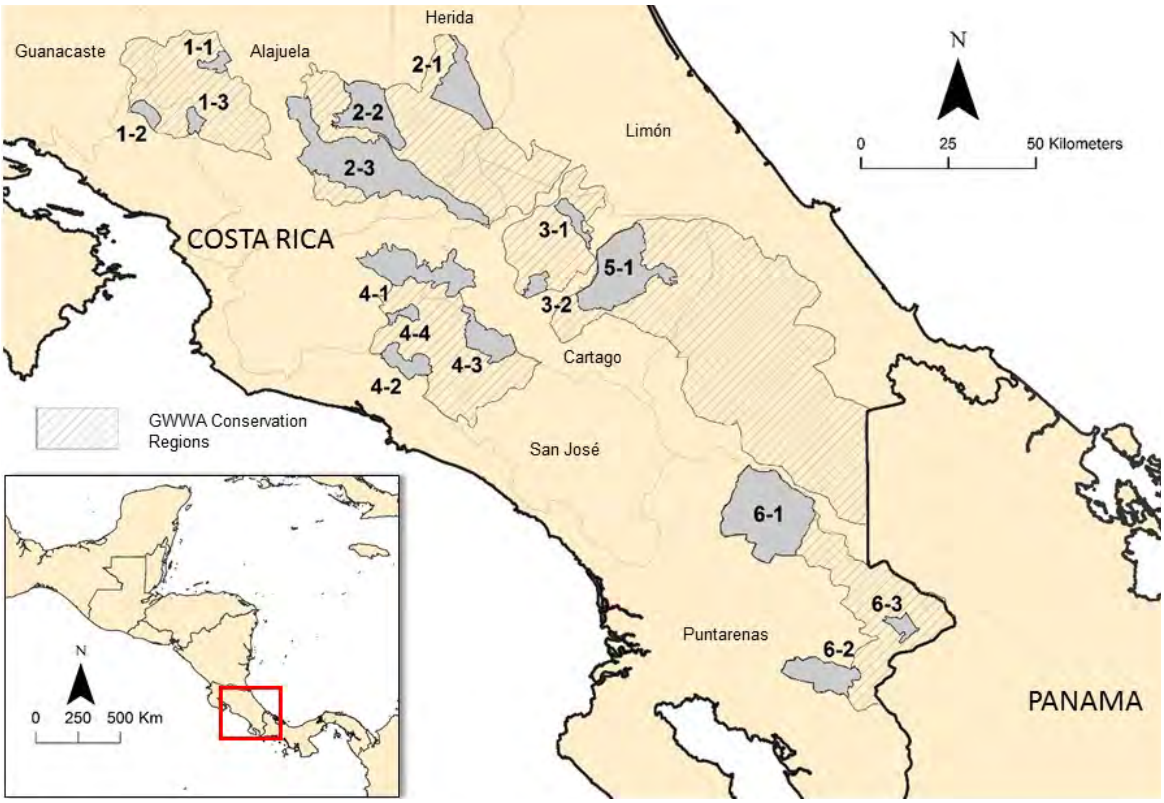


Figure 4-3.8. Map of Costa Rican Focal Areas

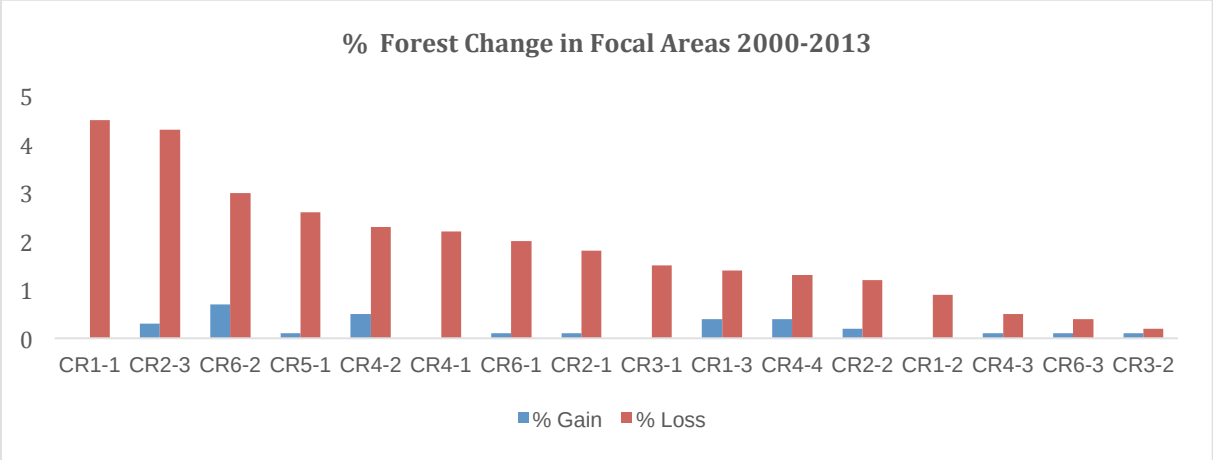


Figure 4-3.9. Percent loss and gain of forested habitat in Costa Rican focal areas. Structured by degree of recent forest loss. Area with greatest forest loss (CR1-1) on the left and area with the least recent forest loss (CR3-2) on the right.

Conservation Strategy

Costa Rica has been a world leader in the development and implementation of Payment for Environmental Services programs that provide economic incentives to private landowners to protect wildlife habitat and sequester carbon. Currently, there are multiple Payment for Environmental Services (PES) program options managed by FONAFIFO in Costa Rica. To conserve habitat within the GWWA Focal Areas, organizations will work with FONAFIFO, MINAET, Conservation International, GEF, GIZ and other funders of PES programs to ensure the GWWA focal areas are prioritized for PES investments. This will provide a source of funding for habitat protection.

Within the PES, and in addition to PES programs, there are established national, regional and local reforestation programs to help facilitate native species reforestation for habitat restoration. It is proposed that these programs help with reforestation efforts in GWWA focal areas.

Finally, the production of coffee, cattle, and other products in Costa Rica needs to be done in a way that is friendlier to sustaining habitat for wildlife including the GWWA and other migratory birds. GWWA Best management practices for different products are necessary. Once in hand it is proposed that efforts be undertaken with local producers and local and international certifiers to promote the production of products in a way that is less impactful to GWWA habitat.

Costa Rica Conservation Plan (2015-2020)

To begin, conservation actions have been proposed in four of the sixteen focal areas that were prioritized based on local capacity to implement conservation actions, level of threat and importance to GWWA's. The following conservation goals were defined for Costa Rica.

1. **Focal Area CR4-3:** Formally protect 70% of the habitat appropriate for Golden-winged Warblers (11,675 ha) in the focal area in the next five years.
2. **Focal Area CR6-2:** Formally protect 20% of the habitat appropriate for Golden-winged Warblers (2,400 ha) in the next five years.
3. **Focal Areas CR 1-2 and 1-3**: Establish sustainable agricultural practices in 25% of the area under production (~100 ha) and formally conserve 70% of the habitat appropriate for Golden-winged Warblers (275 ha).

In order to achieve these conservation goals, the following series of conservation actions to be implemented between 2015 and 2020 with a total cost of $8,900,000 has been proposed.

Focal Area CR 4-3 Cerro de la Muerte:

1. *Land Protection:* The goal of this project is to increase the amount of GWWA habitat under protection. This project proposes the implementation of a payment for ecosystem service project to protect forest habitat on 70% of the landowners with forested land within the Focal Area.

2. *Reforestation:* The goal of this project is increase the amount of GWWA habitat in the focal area over time. The project will facilitate the voluntary reforestation of 10% of the focal area without forest coverage (approximately 447 ha).

3. *Improve Agricultural Production:* The goal of this project is to promote agricultural practices that retain GWWA habitat. This project will identify and promote model farms through producer workshops and increase local capacity to generate money through these practices.

4. *BMP Development:* The goal of this project is to develop best management practices to retain Golden-winged Warbler habitat for coffee and Diary Producers. The project will help identify market-based incentives for coffee and dairy producers who adopt habitat retention practices.

Focal Area CR6-2 Talamanca-Coto Brus: San Vito de Coto Brus:

1. *Improve Agricultural Production Practices:* The goal of this project is to promote agricultural practices that retain GWWA habitat. This project will promote agricultural practices that retain habitat through model farms and workshops for producers to increase capacity to generate money through these practices. The program will strive to have producers adopt agricultural practices that retain habitat over 25% of the areas under production in the focal area (approximately 3625 ha).

2. *BMP Development:* The goal of this project is to develop best management practices to retain Golden-winged Warbler habitat for coffee and Diary Producers. The project will help identify market-based incentives for coffee and dairy producers who adopt habitat retention practices.

3. *Land Protection:* The goal of this project is to increase the amount of GWWA habitat under protection. This project will facilitate the implementation of a PES on 20% of the landowners with forested land. The project also proposes the creation of a private reserve of 100 ha specifically for Golden-winged Warbler habitat preservation

4. *Reforestation:* The goal of this project is increase the amount of GWWA habitat in the focal area over time. The project will facilitate the voluntary reforestation of 500 ha within a biological corridor.

Focal Area CR 1-2 and 1-3 Monteverde: Pocosol and San Luis

1. *Improve Agricultural Production Practices:* The goal of this project is to promote agricultural practices that retain GWWA habitat. This project will promote agricultural practices that retain habitat through model farms and workshops for producers to increase capacity to generate money through these practices. The program will strive to have producers adopt agricultural practices that retain habitat over 25% of the areas under production in the focal area (approximately 1,000 ha).

2. *BMP Development:* The goal of this project is to develop best management practices to retain Golden-winged Warbler habitat for coffee and Diary Producers. The project will help identify market-based incentives for coffee and dairy producers who adopt habitat retention practices. The project goal is to implement BMPS on 25% of the land under production (approximately 1,000 ha).

3. *Land Protection:* The goal of this project is to increase the amount of GWWA habitat under protection. This project will facilitate the implementation of a Payment for Ecosystem Services program with 70% of the landowners who own forest within the focal area (approximately 1,500 ha).

4. *Reforestation:* The goal of this project is increase the amount of GWWA habitat in the focal area over time. The project will facilitate the voluntary reforestation of 15% of the land with no forest coverage in the focal area (approximately 500 ha).

Other Focal Area Conservation Project Notes:
It should be noted that not all organizations that are active in conducting conservation projects within identified focal areas were fully able to participate in the project identification and prioritization processes. As such there may be other projects proposed or on-going that are worthy of immediate conservation investment.

3.5 Panama Focal Area Assessment and Conservation Plan

Golden-winged Warblers in Panama are most frequently found in the western highlands adjacent to Costa Rica. The species also occurs regularly in the isolated highlands regions that occur throughout the rest of the country. While Golden-winged Warblers also occur in the Canal Zone at sea level, their presence is much less frequent than in the mid-elevation and highlands regions of the country. Golden-winged Warblers occur primarily in humid broadleaf forest in Panama, preferring areas of intermediate disturbance or agroforestry landscapes with patches of retained forest.

Focal Areas Selection

In-country experts identified twelve focal areas in Panama based on the areas of highest predicted male occupancy and based on local knowledge of areas with regular presence of Golden-winged Warblers. Three of the focal areas occur in the Darien Province on the border with Colombia. Despite the small size of Panama, and relative economic prosperity of Panama City, several of the focal areas are extremely difficult to access, both to confirm Golden-winged Warbler presence and to conduct conservation actions. Cultural differences between Latino Panamanians and the indigenous groups in the Ngobe Bugle Comarca and the Darien make focal areas PA04, PA10, PA11 and PA12 difficult to access for conservation activities by NGOs and government groups. Lack of access makes these some of the best-conserved focal areas in the entire winter range, however. In contrast, other highlands areas of the country have gone through rapid rates of land conversion to non-forested land-cover types. Cerro Chucanti (PA09) has experienced 9% forest loss since the year 2000, making it one of the most threatened focal areas in the winter range. The Boquete Valley and Valle de Anton (PA02 and PA07) are undergoing rapid land conversion as well, in part for coffee production and in part for urban infrastructure and housing as the populations in those areas grow. Addressing forest loss and providing economic alternatives are key to securing GWWA habitat in Panama.

Table 4_3.5. Panamanian focal areas ranked in terms of conservation priority (1=highest priority, 2=medium priority, 3=lower priority). Conservation priority is based on a combination of the relative importance of each focal area for the Golden-winged Warbler population wintering in Panama and the opportunity to undertake successful conservation action in that area.

Focal Area	Name	Conservation Priority
PA01	La Amistad	3
PA02	Boquete	1
PA03	Fortuna	1
PA04	Ngobe Bugle Highlands	2
PA05	Santa Fe	2
PA06	Cerro Hoya	2
PA07	Valle de Anton	1
PA08	Chagres	3
PA09	Chucanti	2
PA10	Cordillera de Jurado	3
PA11	Cerro Pierre	3
PA12	Tacaruna	3

Conservation Strategy

Due to the wide range of socio-economic and cultural groups present in these focal areas, a one-size fits all approach to conservation is not appropriate. Rather, conservation action should be targeted towards particular threats in each particular focal area. Initial proposed actions focus on educating local communities, improving production methods, native species reforestation and bird tourism promotion and development.

Currently there is little bird conservation capacity in Panama and additional bird conservation leaders need to be developed or increase the capacity and reach of existing entities. Despite this there is a fairly robust amphibian conservation presence due to the plight and expansion of the Chytrid fungus. In addition to existing bird conservation organizations and the federal government, working with amphibian conservationist, along with eco-tourism and private reserve operators is recommended. 2000.

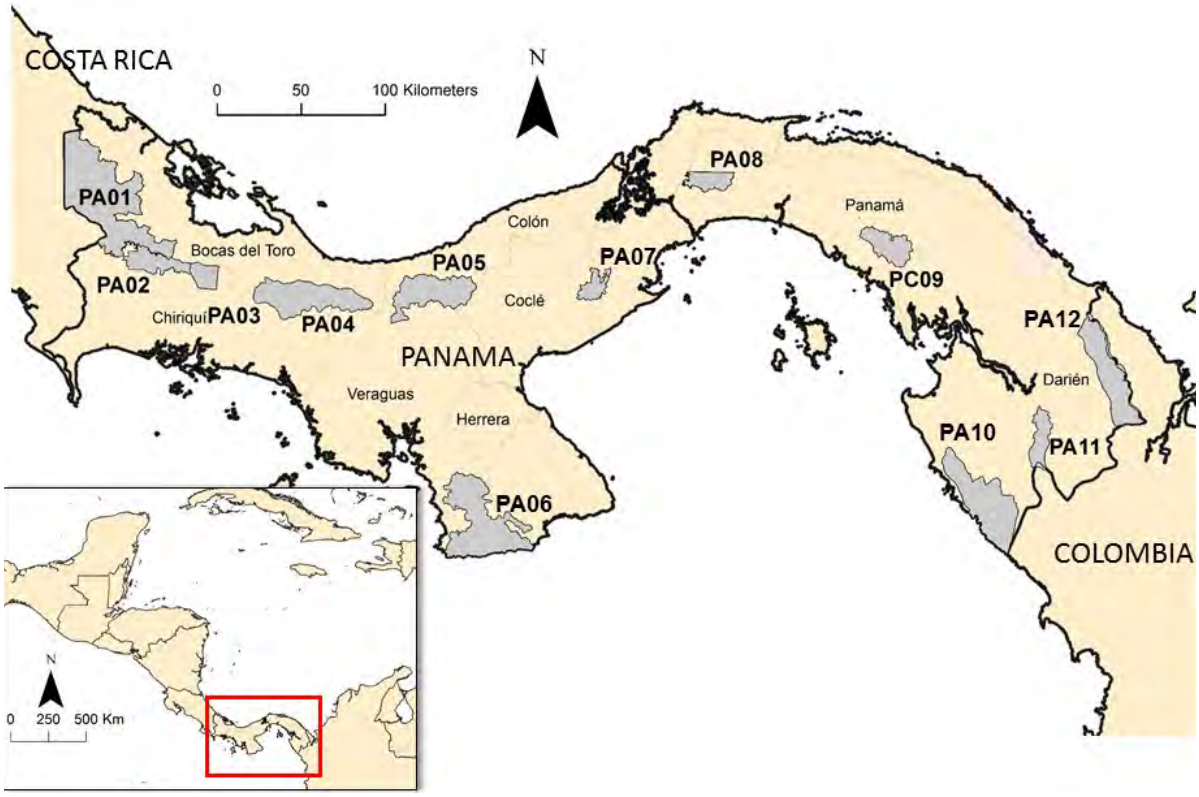


Figure 4-3.10. Map of Panama Focal Areas

Panama Conservation Plan (2015-2020)

Three focal areas have been selected by the Alianza Alas Doradas for immediate conservation action based on habitat loss and opportunity to conduct effective conservation action: PA02, PA03, and PA07. Conservation in all focal areas should be conducted with the goal of decreasing the current rate of deforestation by 50% across all focal areas. This is equivalent to a 1% forest loss across all focal areas between the years of 2015 and 2020. Furthermore, the Alianza seeks to recuperate 3,500 hectares of forest by the year 2000. This corresponds to 15% of the forest that has been converted to non-forested states in the focal areas since the year 2000.

In order to achieve these conservation goals the following series of conservation actions to be implemented between 2015 and 2020 with a total cost of $2,328,000 are proposed.

Focal Area PA02: Boquete:

1. *Bird Tourism:* In order to create an economic incentive to retain forest on the landscape, the creation or improvement of bird tourism infrastructure is recommended. A Bird Guide Training course be conducted with four community groups per year within the focal area. The course will be conducted by the NGO Conservation Panama, a group that will also help connect these guides with clients in the tourist centers of Boquete and Volcan. Each group that completes the course will run as a cooperative unit, where members work on a rotating schedule to provide clients with bird tourism services. Promotional items and development of bird tourism itineraries will be included in this project.

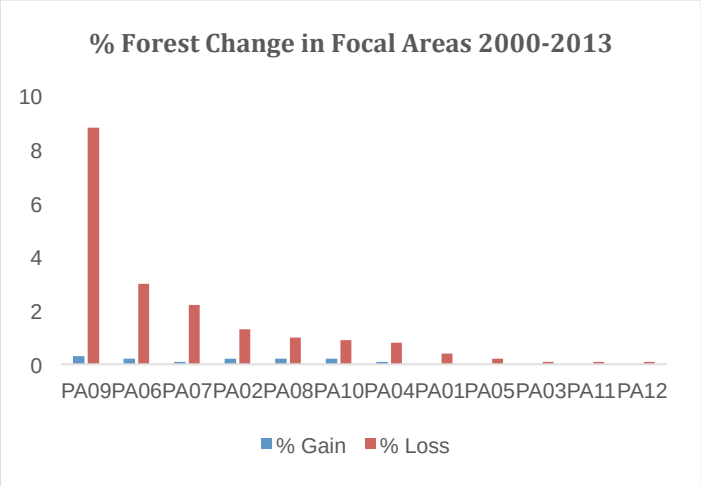


Figure 4-3.11. Percent loss and gain of forested habitat in Panamanian focal areas. Structured by degree of recent forest loss.

2. *Improve Agricultural Production Methods:* The goal of this project is to influence management of agriculture and livestock to result in improved habitat for GWWA. A Model farm program to promote GWWA BMP' in coffee production systems that retain habitat will be developed. Workshops and education programs will be a part of this project.

3. *PES Program:* A Payment for ecosystem services project has been proposed and is aimed at restoring 350 ha of forest per year for five years (total of 1750 ha). PES Program management and funding needs to be analyzed.

Focal Area PA03: Fortuna:

1. *Bird Tourism:* As in the Boquete Focal Area, a Bird Guide Training course should be implemented to help create an economic incentive to keep forest on the landscape. Promotional items and development of bird tourism itineraries will be included in this project.

2. *Youth Environmental Education Program*: The goal of this project is to increase the value of conserving forest habitats by local communities. One of the major obstacles to habitat conservation in Fortuna is a lack of cultural valuation of forested landscapes and the ecosystem services they provide. This environmental education program is modeled on the Programa de Educacion Biologica in Honduras. This program will contract two environmental educators who will conduct visits and presentations at 80 schools in the Fortuna focal area.

3. *Improve Cattle Production Methods:* The goal of this project is to improve GWWA habitat in cattle production systems within this focal area. The project would help develop and promote habitat-retaining practices in silvopastoral systems. This program will use model farms as demonstration sites and incentives such as fencing materials to help landowners exclude livestock from forested riparian corridors and from entering quality primary or secondary forests used by GWWA.

Focal Area PA06: Valle de Anton:

1. *Land Protection:* In order to preserve existing habitat in Valle de Anton, conservation groups must engage the housing developers that are creating developments with large footprints in the forested highlands of Valle de Anton. The goal of this project is to ensure the conservation of at least 25% of the Golden-winged Warbler habitat that exists on undeveloped parcels in the Focal Area. The Alianza Alas Doradas recommends that a policy and advocacy coordinator be hired along with a part-time lawyers to work with developers to preserve these lands.

Other Focal Area Conservation Project Notes:

It should be noted that not all organizations that are active in conducting conservation projects within identified focal areas were fully able to participate in the project identification and prioritization processes. As such there may be other projects proposed or on-going that are worthy of immediate conservation investment.

3.6 Colombia Focal Area Assessment and Conservation Plan

Golden-winged Warblers occur in the mid-elevation humid broadleaf forest in Colombia. Habitat appropriate for Golden-winged Warblers in Colombia is also appropriate for the similarly declining Neotropical migrants Cerulean Warbler and Canada Warbler. Reports from birders and surveys suggest that Golden-winged Warbler presence has declined in the Andes since the 1920s or 1930s. Despite the decline, there are several areas where Golden-winged Warblers still regularly occur in Colombia.

Focal Areas

In order to select focal areas in Colombia, a workshop was held with ornithologists, land managers, and government officials. This workshop resulted in the selection of 30 focal areas selected as important habitat for the three declining warblers species, Golden-winged Warbler, Canada Warbler, and Cerulean Warbler. From this original list of Golden-winged Warblers, in-country experts reviewed historic records, recent sightings, and the predictive male occupancy model to chose the nine areas with highest probability of retaining wintering Golden-winged Warblers. These nine areas were further refined by excluding habitat outside of the elevational gradient where Golden-winged Warbler most commonly occurring in Colombia (1200-2000 meters above sea level). The resulting focal areas are tightly defined regions with high probability of Golden-winged Warbler occupancy. Of these nine identified areas, four focal areas have been prioritized for effective conservation action to begin immediately: CO01, CO03, CO04, and CO05.

Table 4_3.6. Colombian focal areas ranked in terms of conservation priority (1=highest priority, 2=medium priority, 3=lower priority). Conservation priority is based on a combination of the relative importance of each focal area for the Golden-winged Warbler population wintering in Colombia and the opportunity to undertake successful conservation action in that area.

Focal Area	Name	Conservation Priority
CO01	PNN Los Nevados - Zona de amortiguación	1
CO02	Antioquia: Jericó - Támesis	1
CO03	Antioquia: Cuenca alta del Río Porci – Municipio Anori.	1
CO04	Santander/Boyacá: Serranía de Los Yariguíes	1
CO05	Antioquia: La Romera – Sabaneta	2
CO06	Serranía del Perijá	2
CO07	Bolívar: Serranía de San Lucas	3
CO08	Magdalena: Sierra Nevada de Santa Marta	3
CO09	Paramillo: Zona Sur	3

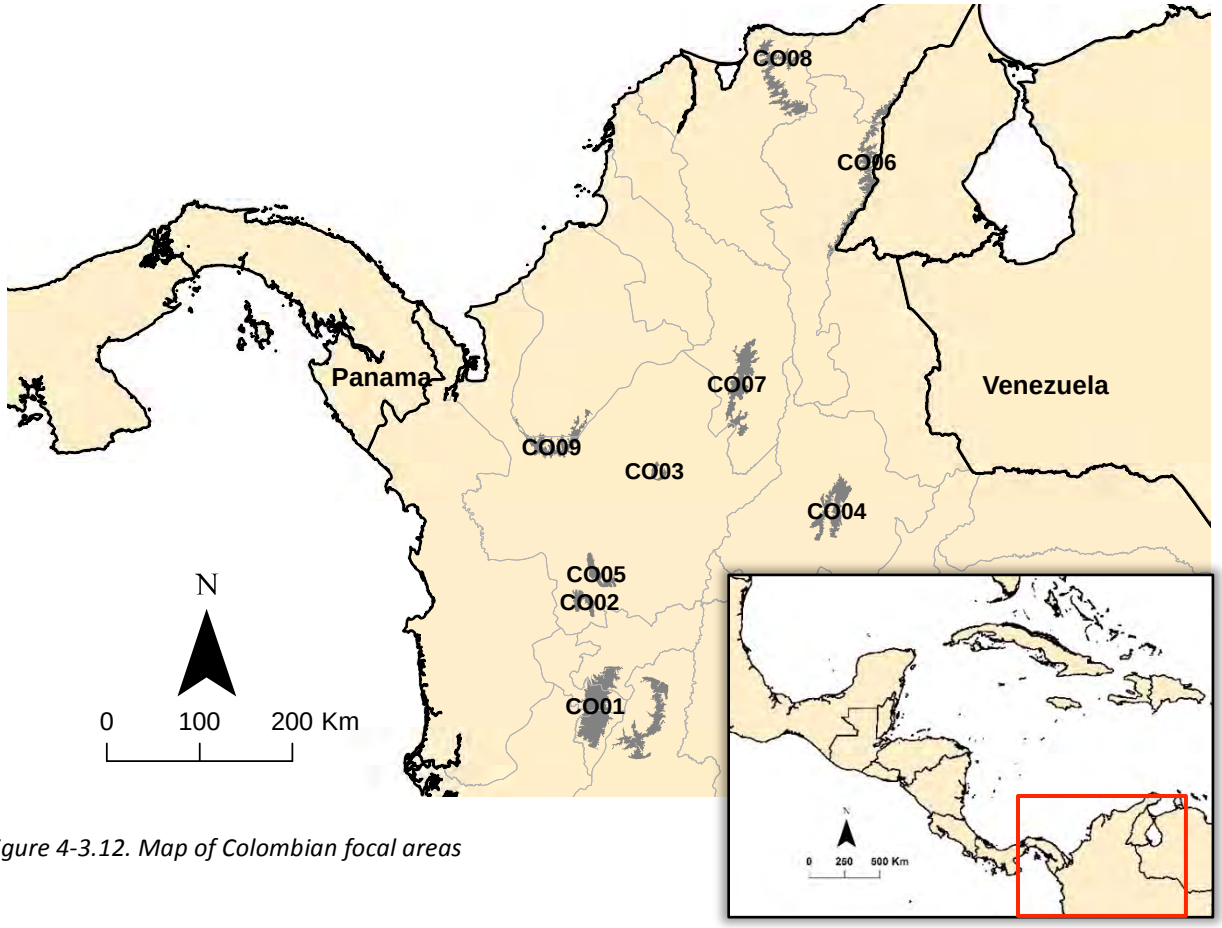


Figure 4-3.12. Map of Colombian focal areas

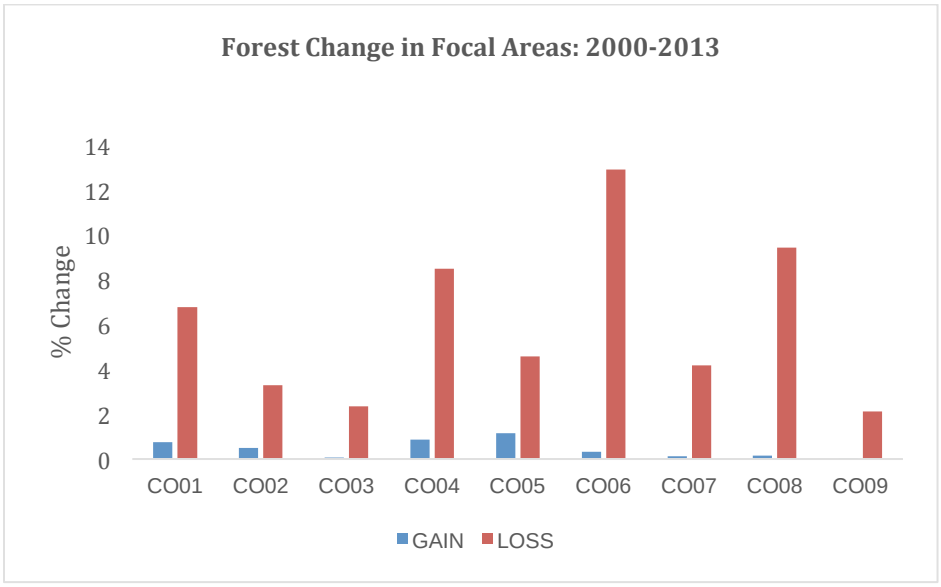


Figure 4-3.13. Percent loss and gain of forested habitat in Colombian focal areas. Derived from UMD Percent Tree Cover raster package (2015).

Conservation Strategy

Colombia is the largest of the countries in which GWWA's reside during the non-breeding period. It is a geographically diverse country, where GWWA's have an expansive distribution. As such the conservation of GWWA habitat in Colombia should occur in many locations. Each of these locations may need a different local organization to help lead conservation efforts. Conservation efforts should be integrated and communication about efforts among local organizations is important to initial and long term success. The Alianza Alas Doradas can pay an important role in helping to facilitate some of this communication; especially if a designated coordinator is established and maintained. A local organization who can help with communication and provide leadership in Colombia for GWWA conservation should be sought.

Key to GWWA habitat conservation efforts in Colombia is the identification and implementation of agricultural practices that not only improve habitat quality but also reduce the rate of land conversion. The development of GWWA BMPs for Coffee Production, and Cattle Production are anchor bmps necessary for Colombia. Working with government in Colombia will be especially important to increase the stature of migratory birds in conservation planning and implantation of internationally funded conservation efforts. Tying GWWA conservation to local endemic and endangered species may be key to this. Additionally, influencing energy development and expansion policy in terms of mining, wind and hydroelectric production and energy infrastructure is important to reduce increased fragmentation of large forest blocks. It is also recognized that some areas where GWWA's are found are still unsafe for conservationist to have impact on land use. Until those areas are safer, investment should be focused on areas where we know conservationists can have an impact.

Colombia Conservation Plan (2015-2020)

Colombian representatives within the Alianza Alas Doradas identified four priority conservation areas for focused initial conservation investment. For these four focal areas the group defined the following goal: Reduce the expansion and intensification of small-scale agriculture and livestock production by 50% by the year 2025 while improving the management of protected areas and buffer zones around protected areas in these Focal Areas.

In order to achieve the conservation goal defined above, the following series of conservation actions were recommended. All actions are proposed to be carried out in the next five years if an estimated total of $1,407,360 was secured.

1. *Implementation of Best Management Practices:* The goal of this project is to influence management of agriculture and livestock to result in improved habitat for GWWA. This project aims to adjust existing best management practices for agriculture, including coffee and for cattle production, to better create suitable habitat conditions for GWWA. The implementation of these BMPs will be promoted and an economic incentive for their implementation will be through the development of a Payment for Ecosystem Service Program (PES). Within each Focal Area demonstration farms will be identified that can be used as tools to educate other members of cooperatives or other producers on recommended practices the PES program.

2. *Payment for Ecosystem Services Program (PES):* To encourage the use of Best Management Practices for GWWA habitat creation, and to encourage habitat protection and reforestation a PES program should be developed. The goal of this project is to directly protect, improve management of or restore 150 ha in each of the four prioritized focal areas. The development and management of the PES program needs to be analyzed and the creation of native species nurseries within each focal area would be required.

3. *Adult Education Program:* The goal of this project is to increase the understanding of the importance of local habitat for GWWA's and other migratory bird species as to influence adult decision making on land use management. This program would include securing the services of experienced educators to work within each focal area for a portion of each year to conduct workshops, education programs and festivals. Educators could use established model farms to teach adults how to implement best management practices, the value the ecosystem services provided by forested areas and watersheds in the focal areas and how to access PES or other incentive programs.

4. *Conservation Policy Avocation:* The goal of this project is to influence the land use planning within the priority Focal Areas and to ensure protection and appropriate land use management within the Focal Areas. The project would hire a coordinator to advocate for policies that would; secure the declaration of new protected areas, facilitate the titling of community lands, improve land use planning and investment of international environmental aid, provide legal protection of micro-watersheds within focal areas, and demarcate the boundaries of currently existing national parks and buffer zones. The person would also assist with the develop of a PES program and identify and implement a program to require companies that damage habitat within the focal areas through poor environmental practices provide compensation for environmental damages. Note that the creation of new protected areas in the CO02, CO03, CO04 and CO05 Focal Areas is proposed.

Other Focal Area Conservation Project Notes:
It should be noted that not all organizations that are active in conducting conservation projects within identified focal areas were fully able to participate in the project identification and prioritization processes. As such there may be other projects proposed or on-going that are worthy of immediate conservation investment.

3.7 Venezuela Focal Area Assessment and Conservation Plan

In Venezuela, the Golden-winged Warbler occurs in humid broadleaf forest, secondary forest, coffee plantation, and semi-deciduous forest (Hilty 2003). It has been recorded between 950 and 2400 meters above sea level, and occurs most frequently between 1200 and 2000 m. Historically, the species occurred along the entire Andes chain from the Colombia border through Caracas and to the highlands south of Cumana. In the past ten years, however, the species has been reported infrequently, and its current status in Venezuela is uncertain. The predictive male occupancy model used to select focal areas suggests that Golden-winged Warblers are most frequent in the western Andes of Sierra la Perija and Tachira, though survey effort was low in Venezuela (Chandler 2013).

Focal Areas Selection

Based on the predictive occupancy model, local knowledge, and the locations of historic Golden-winged Warbler records, four focal areas were selected for Venezuela. Sierra de Perija (VE01) has a predicted occupancy of 20%, while the other three areas only have 10% predicted occupancy. As such, Sierra de Perija is the priority for conservation action, however it continues to be a zone of guerrilla conflict, especially on the Colombian side. Due to difficulty of access and presence of paramilitary groups in the National Park, conservation action can only occur in the northern part of the range, outside of the National Park. While La Azulita (VE02) and Altamire (VE03) have lower predicted occupancy, the ability to conduct effective conservation action is much greater than in Sierra de Perija. Conservation of these areas will likely benefit some Golden-winged Warblers in addition to other high priority migrants such as Cerulean Warbler and Canada Warbler. Lastly, Tachira (VE04) does not possess any known capacity in which to conduct effective conservation action, and as such is the lowest priority focal area for Venezuela.

Table 4_3.7. Venezuelan focal areas ranked in terms of conservation priority (1=highest priority, 2=medium priority, 3=lower priority). Conservation priority is based on a combination of the relative importance of each focal area for the Golden-winged Warblers and the opportunity to undertake successful conservation action in that area.

Focal Area	Name	Conservation Priority
VE01	Sierra de Perija	1
VE02	La Azulita: Caño Guayaba	2
VE03	Altamira	2
VE04	Tachira	3

Threats

Rates of deforestation in these four areas are relatively low, as shown in Figure 4-3.15. The conversion of forest is occurring primarily from the intensification of livestock and agricultural production. In the northern-most area of the Perija Focal Area (VE01), primary broadleaf forest is being cleared at rapid rates for the establishment of vegetable cultivation, including Malanga (a root tuber). Economic instability, including multiple currency values, social class division, poverty, limited access to resources and government policies make working in Venezuela difficult exacerbating the on the ground threats (Naveda pers. comm 2015)

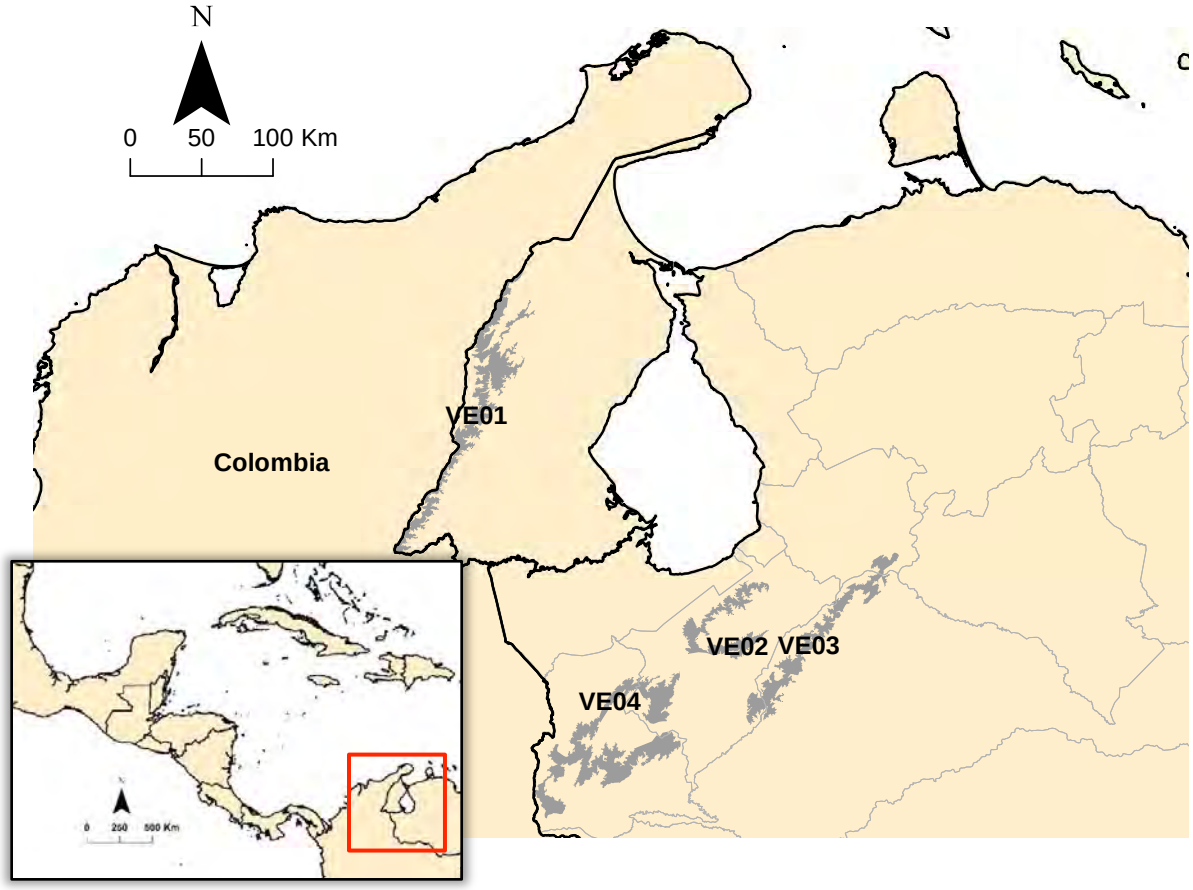


Figure 4-3.14. Map of Venezuelan focal areas

Counterpart organizations

A nationally recognized conservation plan technically falls under the jurisdiction of the Environmental Ministry, but conservation action typically occurs through counterpart organizations. The current restructuring of the Venezuelan government has caused confusion over the avenues for collaboration in conservation action. In the latest governmental proclamation, the national government announced that the Environmental Ministry (Ministerio del

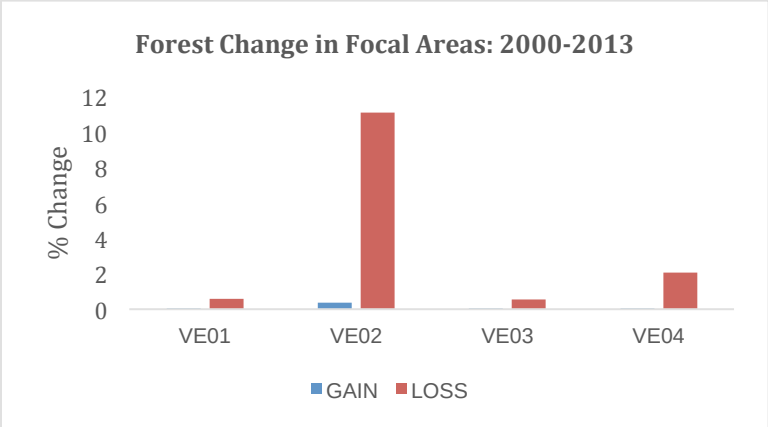


Figure 4-3.15. Percent loss and gain of forested habitat in Venezuelan focal areas. Derived from UMD Percent Tree Cover raster package (2015).

Ambiente) has been restructured into a new Minitry of Ecosocialism and Water (Ministerio de Ecosocialism y Aguas, Decreto 1701 Gacenta Numero 40634, 2015). At the moment no information has been released about the structure or function of this new ministry. Despite the current difficulty of collaborating formally with the national government, several NGOs exist in Colombia with the goal of preserving biodiversity. Venezuelan biologists recommend that conservation action be undertaken in collaboration with the NGO PROVITA (http:/www.provita.org.ve), due to their recent success in running conservation projects. Another potential partner is the Network of Ornithologists of Venezuela (Red de Ornitologs de Venezuela OVUM), which has membership from over 200 Venezuelan ornithologists. These members could potentially assist or form part of a team conducting conservation or monitoring of the Golden-winged Warbler. Local biologists recommend Dr. Luis Gonzalo Morales (luis.morales@ciens.ucv.ve) as a point of contact with this organization. Note also that Venezuelan vertebrates of conservation concern are evaluated at a country level in the Red Book of Venezuelan Fauna (Rodriguez y Rojas-Suarez, 2008). Despite widespread evidence of the decline of the Golden-winged Warbler, the Venezuelan Red Book does not provide a conservation evaluation or recommendation for this species due to lack of data within the country. As such, the species does not appear in any national conservation plans.

Venezuela Conservation Plan (2015-2020)

The Alianza Alas Doradas defined the following conservation goals for the Venezuelan focal areas: Reduce the net loss of habitat by 25% and recuperate 15% of the habitat lost since the year 2000 over the next five years. In order to achieve this goal, the Alianza Alas Doradas recommends the following actions occur directed towards VE01: Sierra La Perija with a five-year budget of $1,079,400. If the Azulita or the Altamira Focal Area is selected for targeted investment, the following activities can be replicated for approximately $1,020,000 for each each focal area. The actions for all three focal areas have a proposed total cost of $3,119,400.

1. *Influence Conservation Planning:* Before any conservation action can occur, the government must recognize that the GWWA is a threatened species requiring conservation action. The conservation status of GWWA in Venezuela needs to be re-evaluated at a government level. The goal of this project would be the inclusion of protected area zoning for GWWA, and to include management of winter habitat for GWWA in protected areas management plans. As part of this action, government officials would be engaged and would receive information on the importance of migratory bird winter habitat and winter habitat conservation, and the actually status of GWWA in Venezuela and how it has changed over the years. The project would evaluate existing management plans and provide recommendations for their improvement as to include considerations for GWWA.

2. *Improved Protected Area Management:* The goal of this project is to improve the management of existing protected areas by increasing the capacity and conservation knowledge base of park guards and managers. The project would conduct an education campaign geared at park guards, local protected areas administrators, and local municipal government officials to teach them about ecosystem services and migratory

bird habitat conservation. It would also provide recommendations for improving habitat protection within protected areas.

3. *Implementation of Best Management Practices:* The goal of this project is to improve habitat for GWWA in agricultural and cattle production systems. The project would develop or use existing best management practices for small scale agriculture, intensive malanga production, and highlands cattle production. The BMPs would then be promoted through an adult education program geared towards producers and landowners in the Focal Areas. This program would also promote the incorporation of trees into agricultural and silvopastoral systems.

4. *GWWA and BMP Monitoring:* To better define the current distribution and frequency of Golden-winged Warblers and submit a report to the government explaining the current status of the species further surveys for GWWA in the Andes of Venezuela is necessary. Additionally, a monitoring program to determine success of GWWA BMP's and there implementation effects on GWWA habitat should be conducted.

SECTION 4: FOCAL AREA MAPS

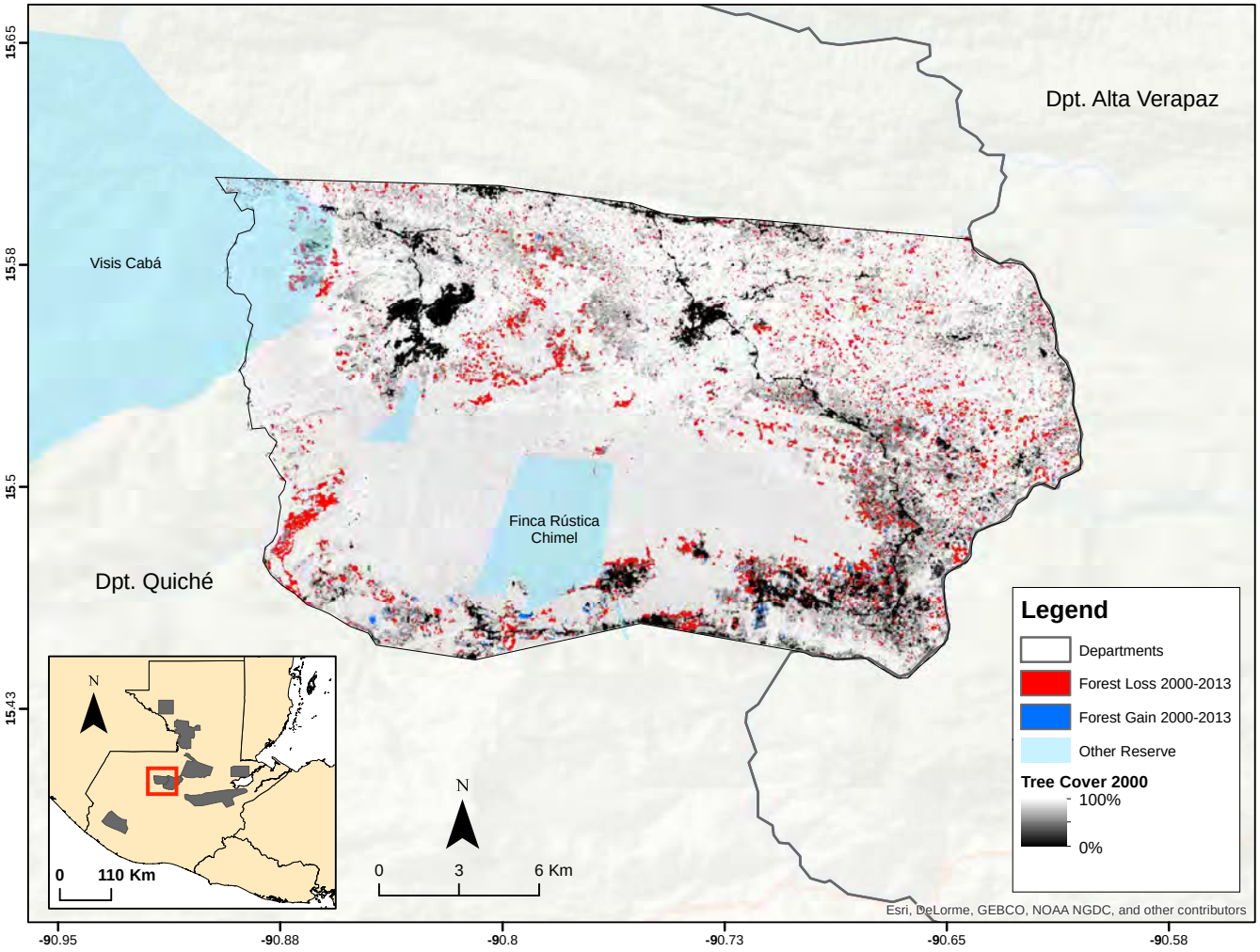
For purposes of conservation planning, we have created a map of each focal area with four layers:

1. Tree Cover: This layer forms the background of the focal area polygon. The layer has 30m x 30 m resolution and shows the percentage of each pixel covered by forest. The layer has a white to black scale with white representing closed canopy forest and black representing areas with no forest coverage. Primary closed canopy forest occurs as large white extensions where large extensions of cattle pasture or urban areas appear as large black extensions. Fragmented landscapes are a combination of white, black, and gray pixels. Layers are derived from Sexton et al. 2013.
2. Forest Loss 2000-2013: This layer shows areas that have been converted from forest (defined as a 30m x 30 m pixel with greater than 60% forest coverage) to non-forest (defined as a 30m x 30 m pixel with less than 30% forest coverage) between the years 2000-2013. Pixels that have lost forest coverage are red. This layer is derived from Hansen et al. 2013.
3. Forest Gain 2000-2013: This layer shows areas that have been converted from non-forest (defined as a 30m x 30 m pixel with less than 30% forest coverage) to forest (defined as a 30m x 30 m pixel with greater than 60% forest coverage) between the years 2000-2013. Pixels that have gained forest coverage are blue. This layer is derived from Hansen et al. 2013.
4. Protected Areas: Important protected areas are shown in transparent colors and identified in the map legend. Protected area polygons were obtained from the IUCN Global Protected Areas Program and are available online at http://www.iucn.org/about/work/programmes/gpap_home/. While we attempted to verify the locations of these protected areas, the database does have some errors, especially in the countries of Guatemala and Honduras. Maps may have associated errors as a result.

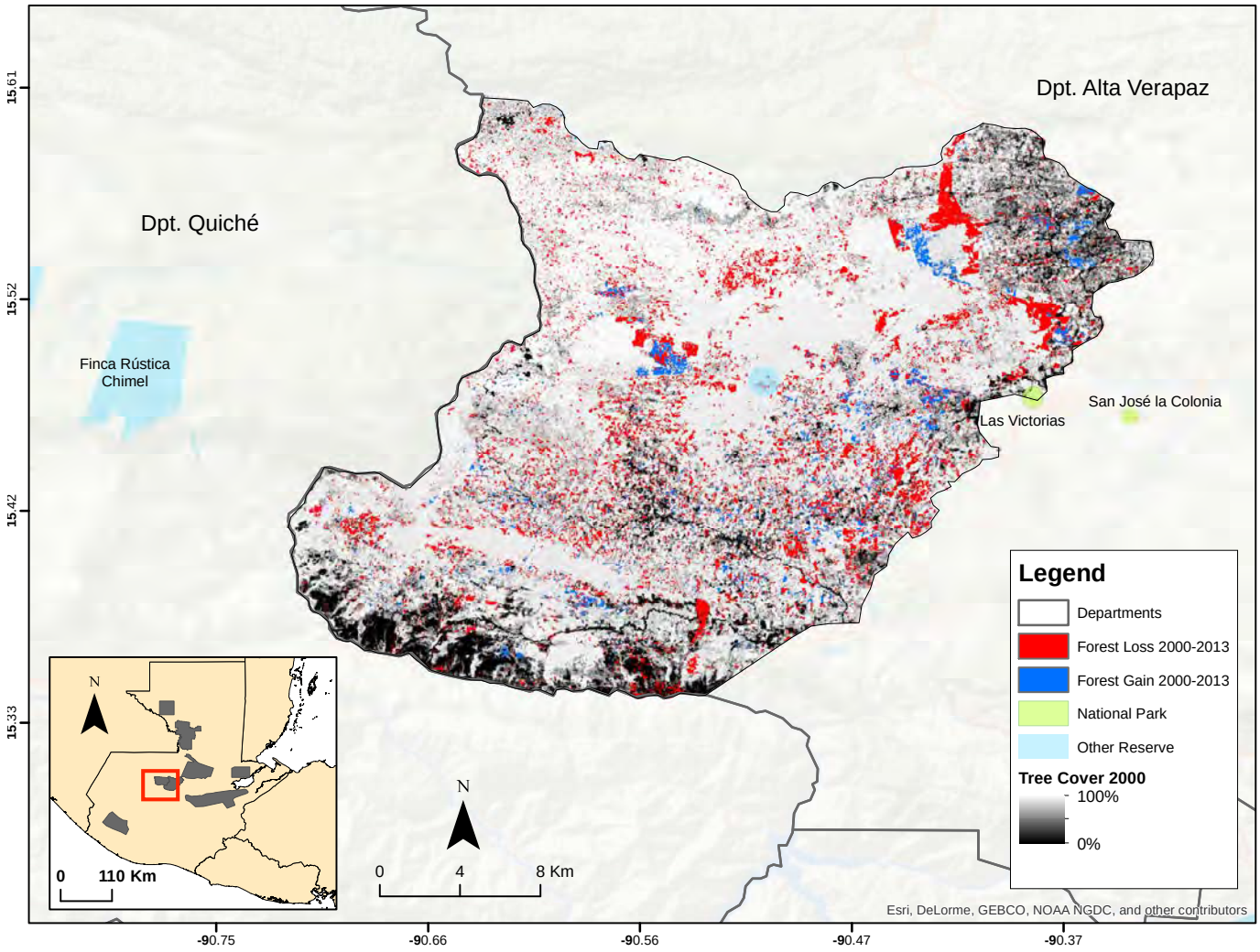
We hope that these maps will allow conservation action to target areas with recent and ongoing deforestation within the protected area boundaries. These maps can also aid conservation practitioners to identify the largest areas of remaining forest, which should be a priority for immediate conservation activities.

Maps are currently compiled in an attached PDF document due to large size.

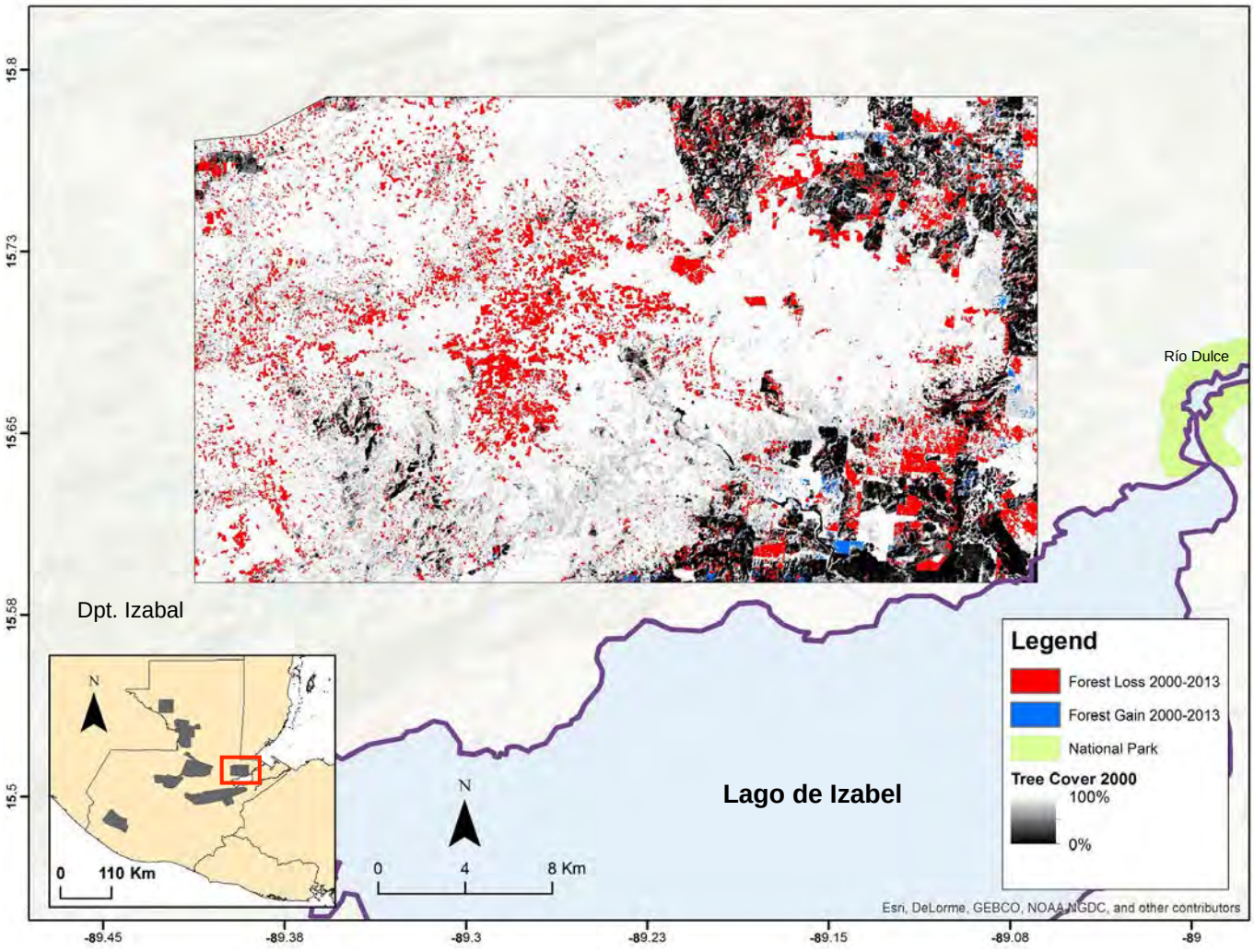
Guatemala: GU01 – Sacranix IBA



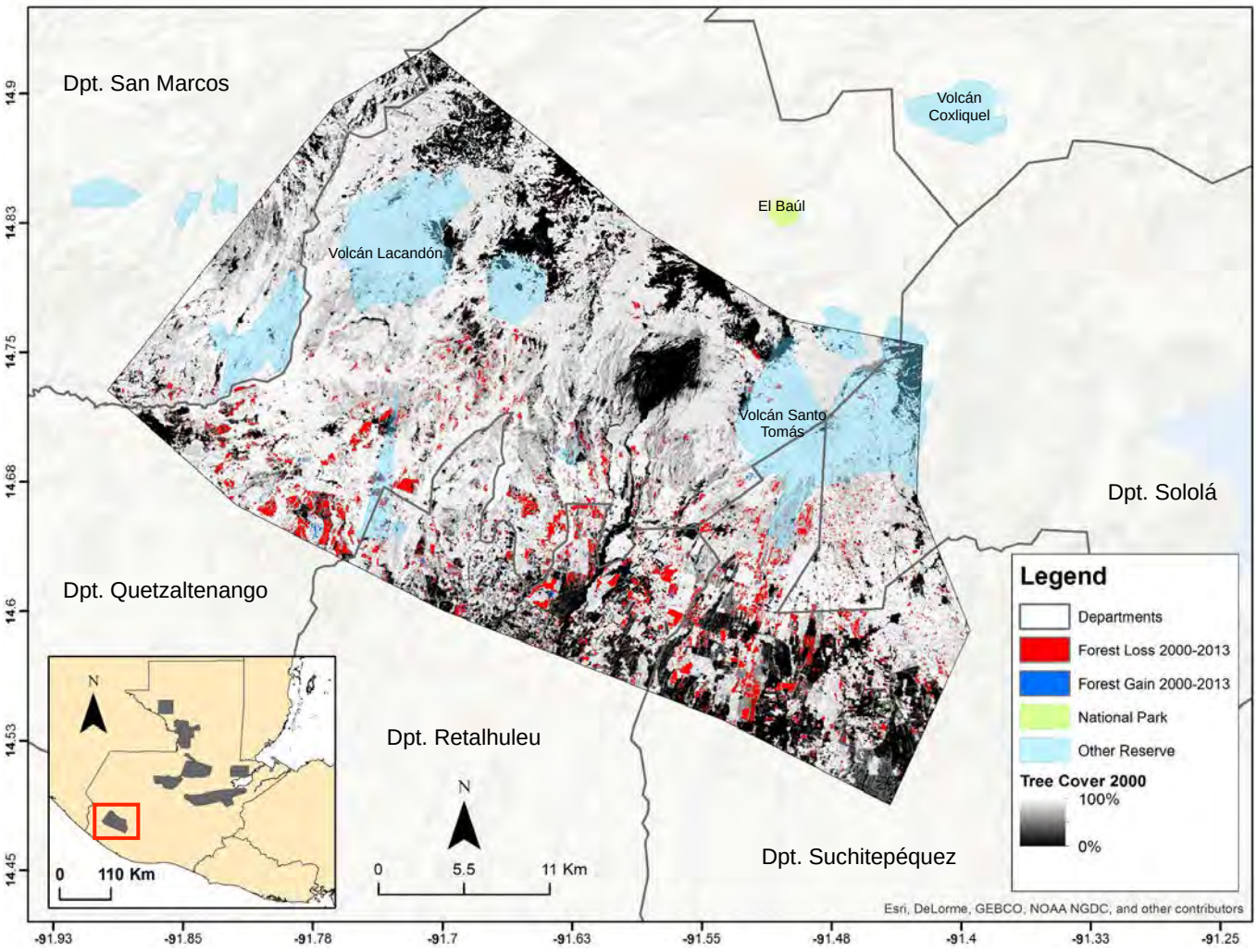
Guatemala: GU02 - Cerro El Amay



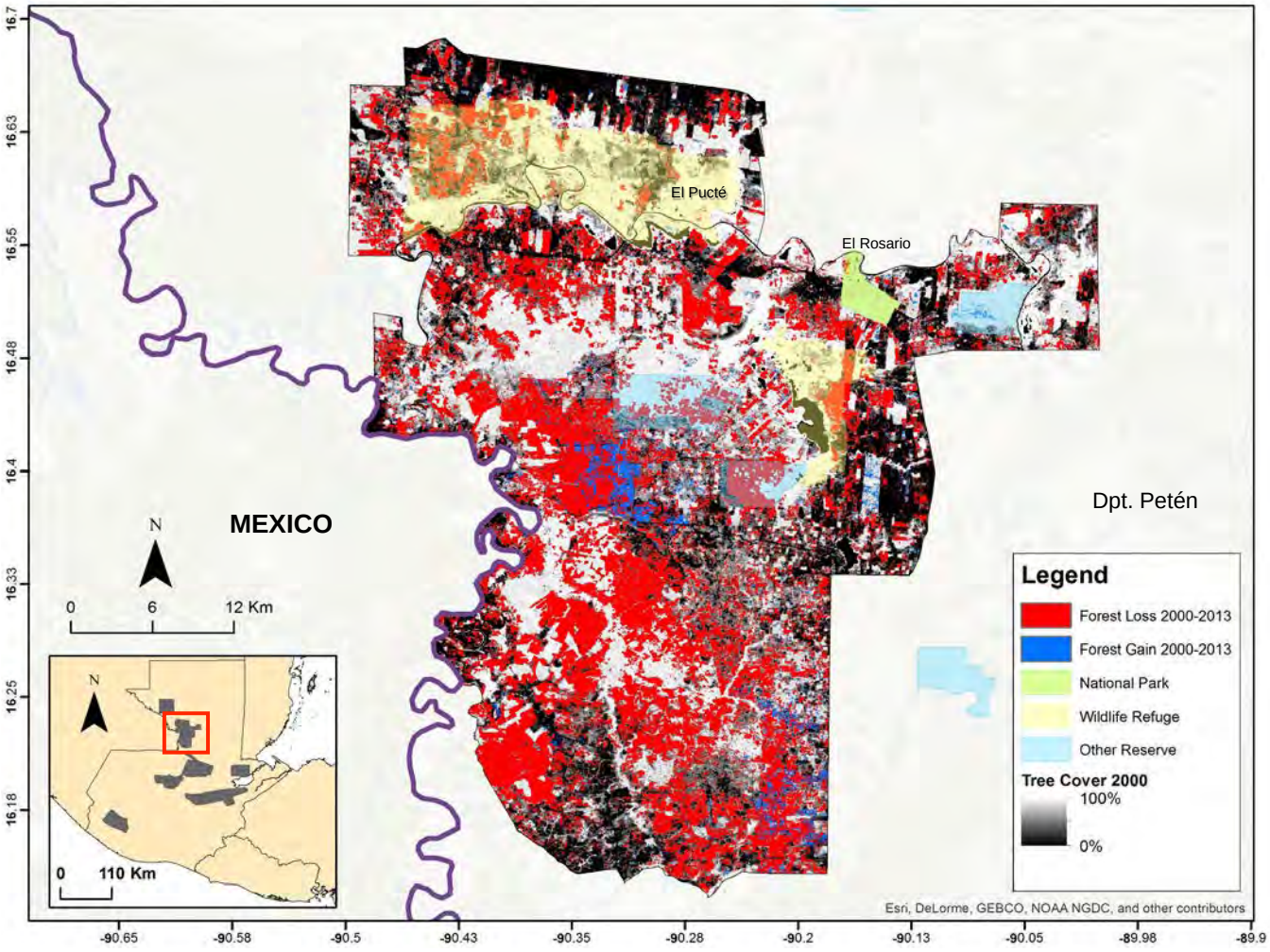
Guatemala: GU03 - Sierra Santa Cruz



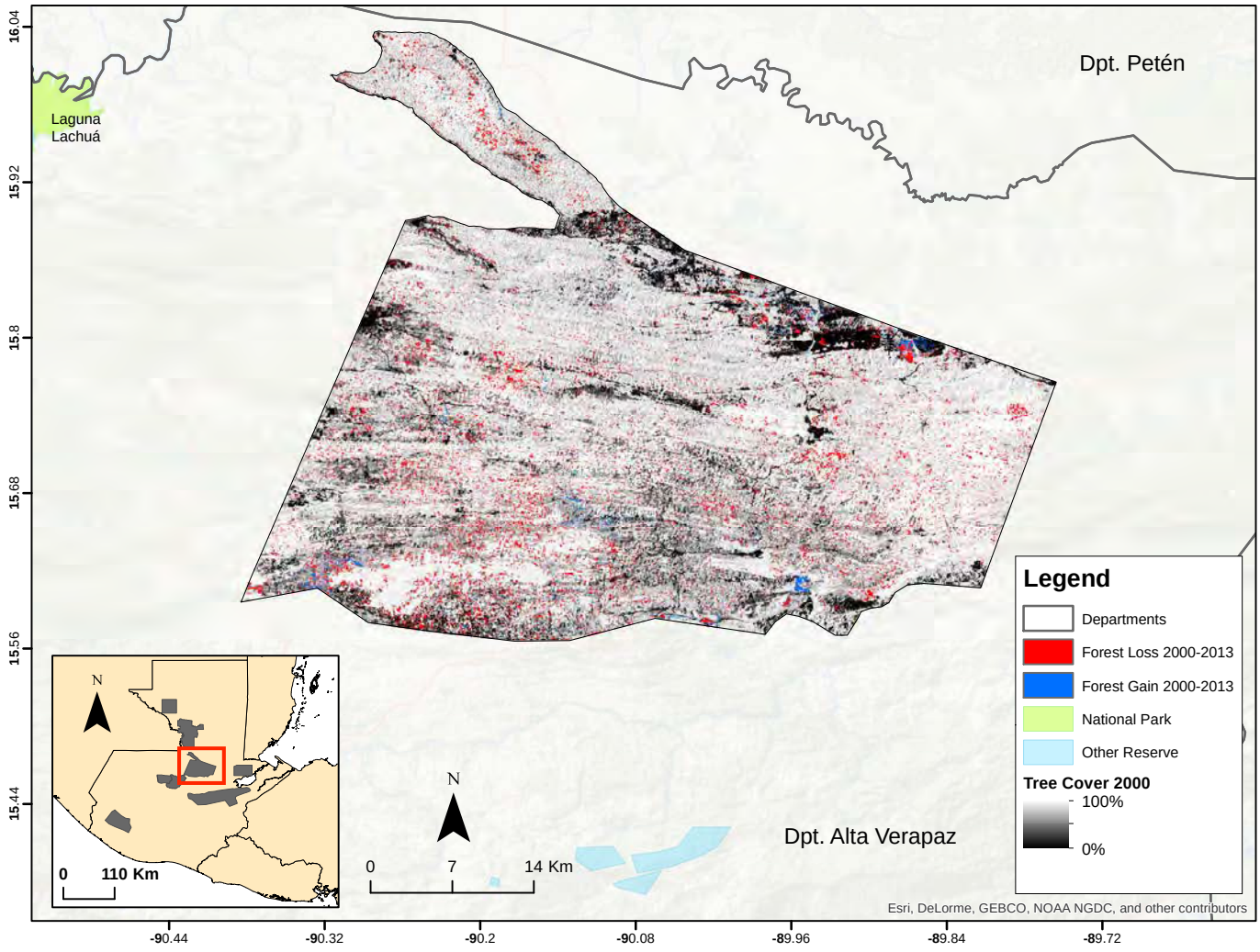
Guatemala: GU04 - Volcán Santiguito: Ladera Sur



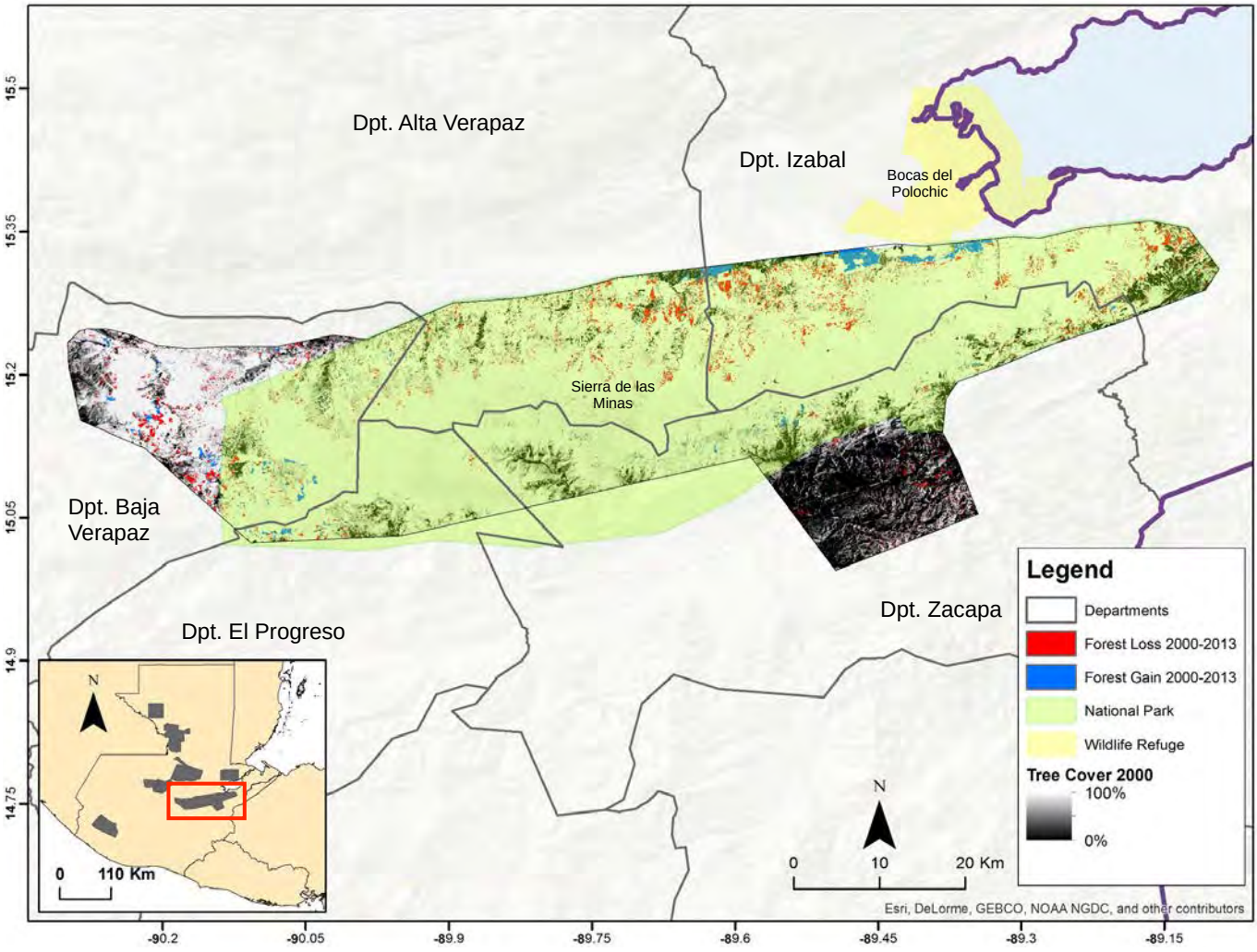
Guatemala: GU05 - Petén: Areas Protegidas del Sur-oeste



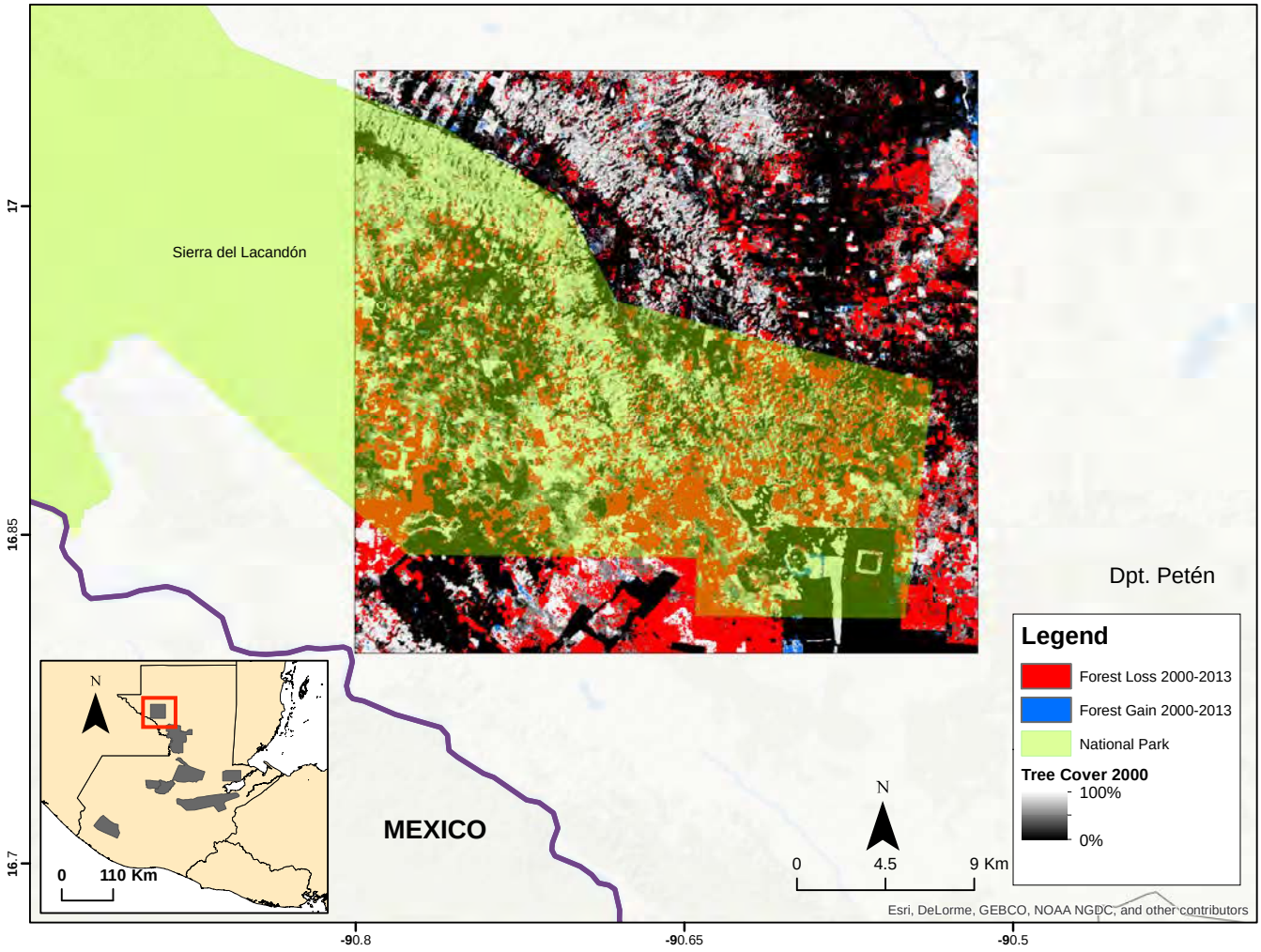
Guatemala: GU06 - Candelaria-Campur IBA



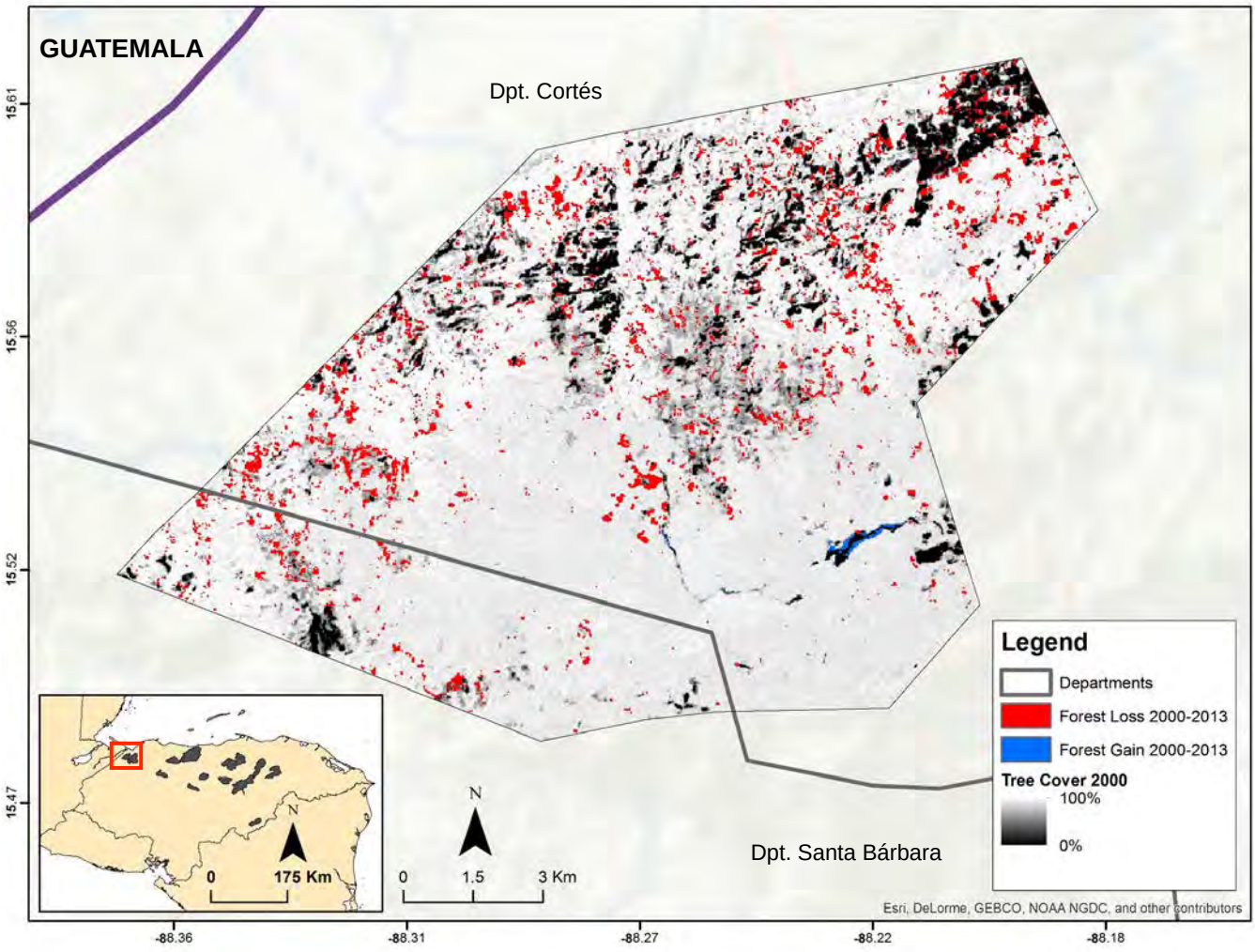
Guatemala: GU07 - Sierra de Las Minas



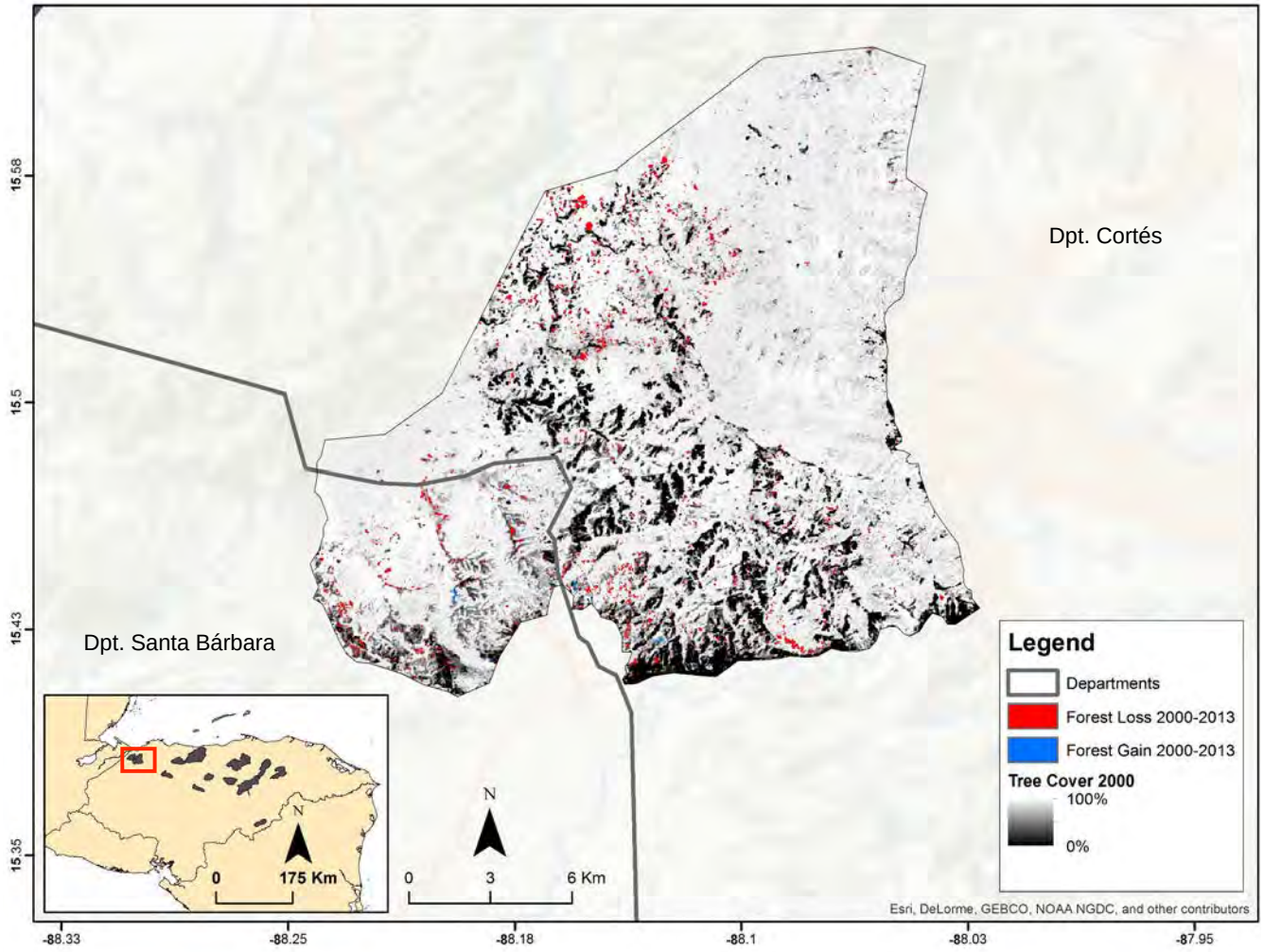
Guatemala: GU08 - Sierra Del Lacandón



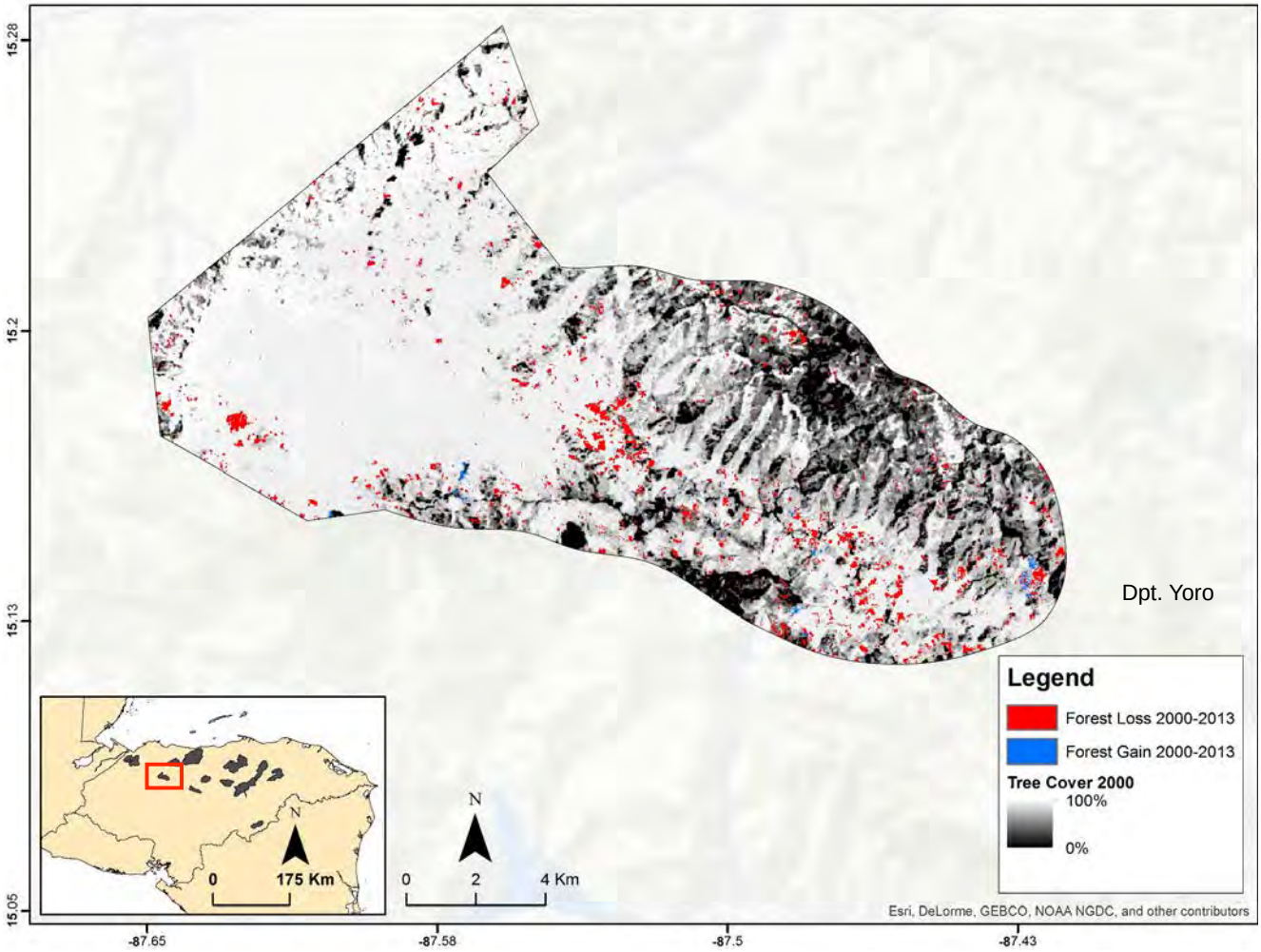
Honduras: HO01 – Cusuco



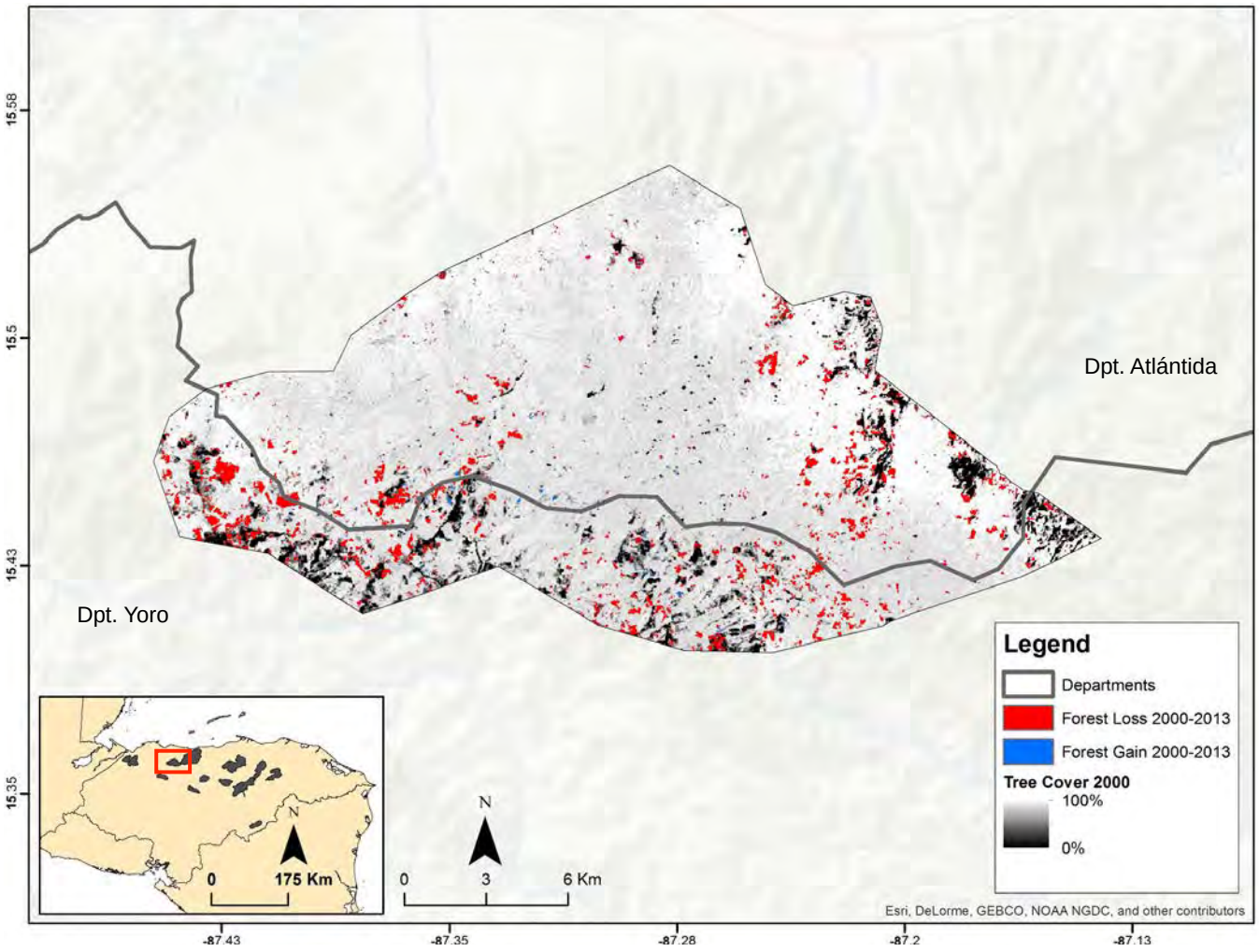
Honduras: HO02 - El Merendón: Area de Producción de Agua



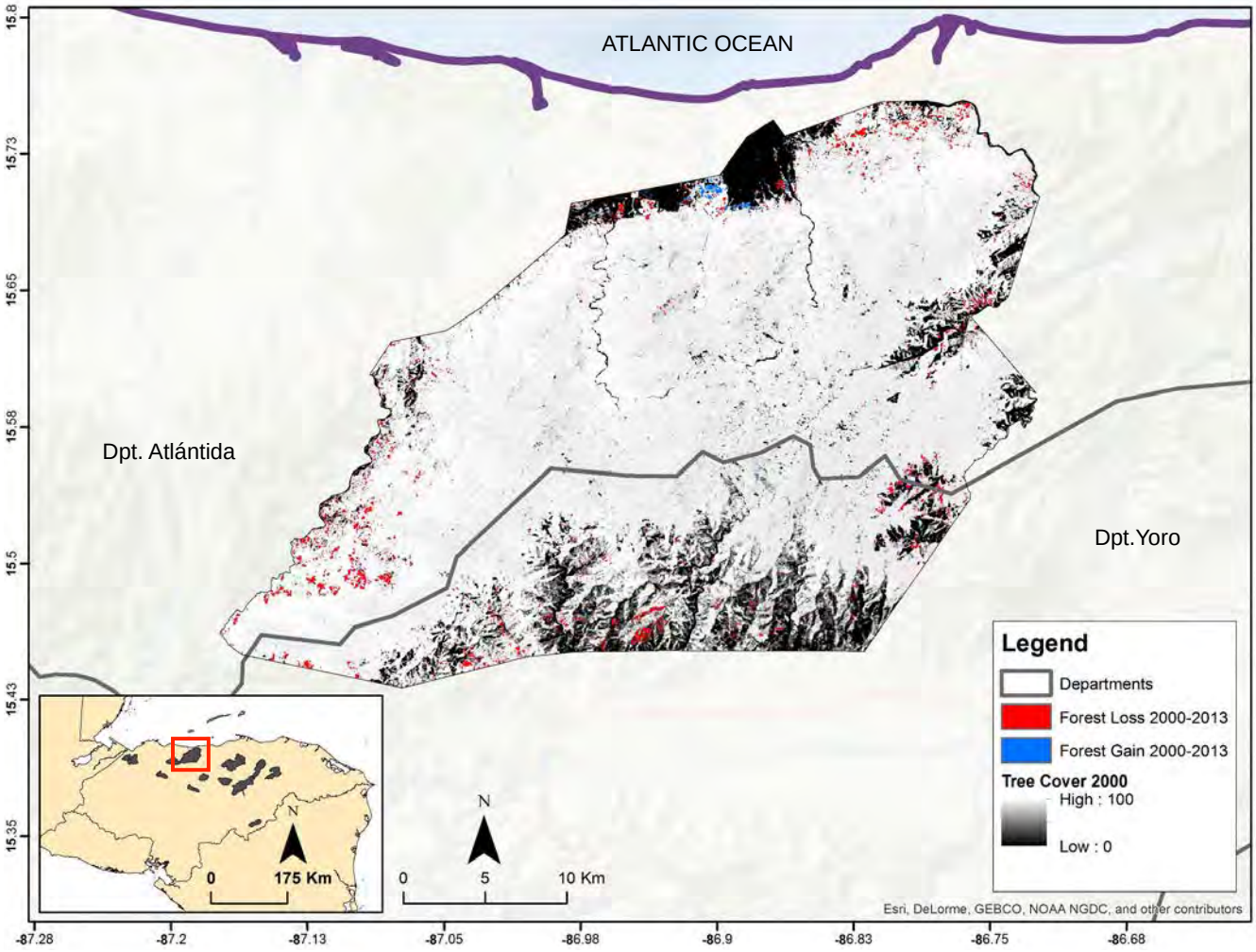
Honduras: HO03 - Pico Pijol: Zona Nucleo y Alrededores



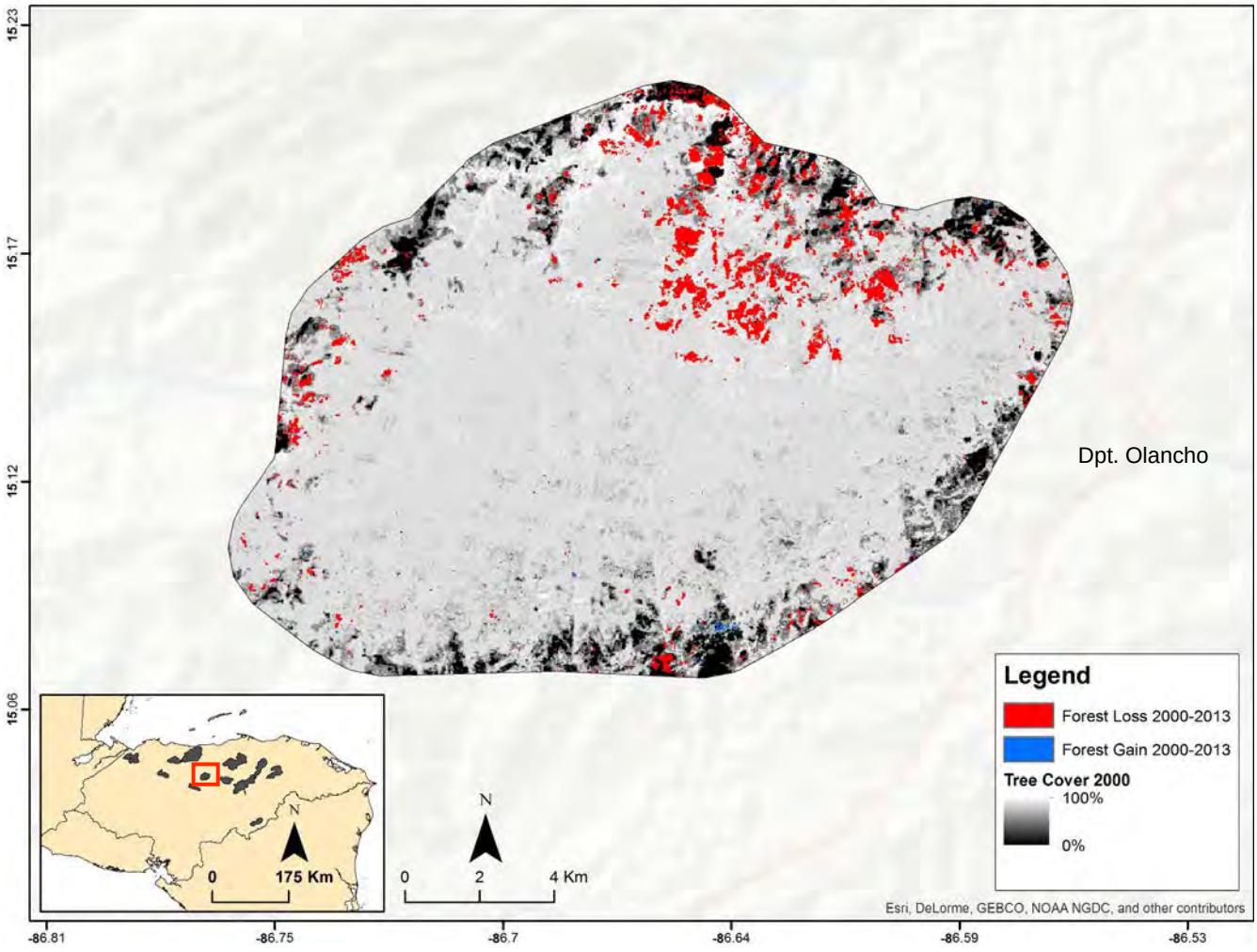
Honduras: HO04 - Texiguat: Zona Nucleo



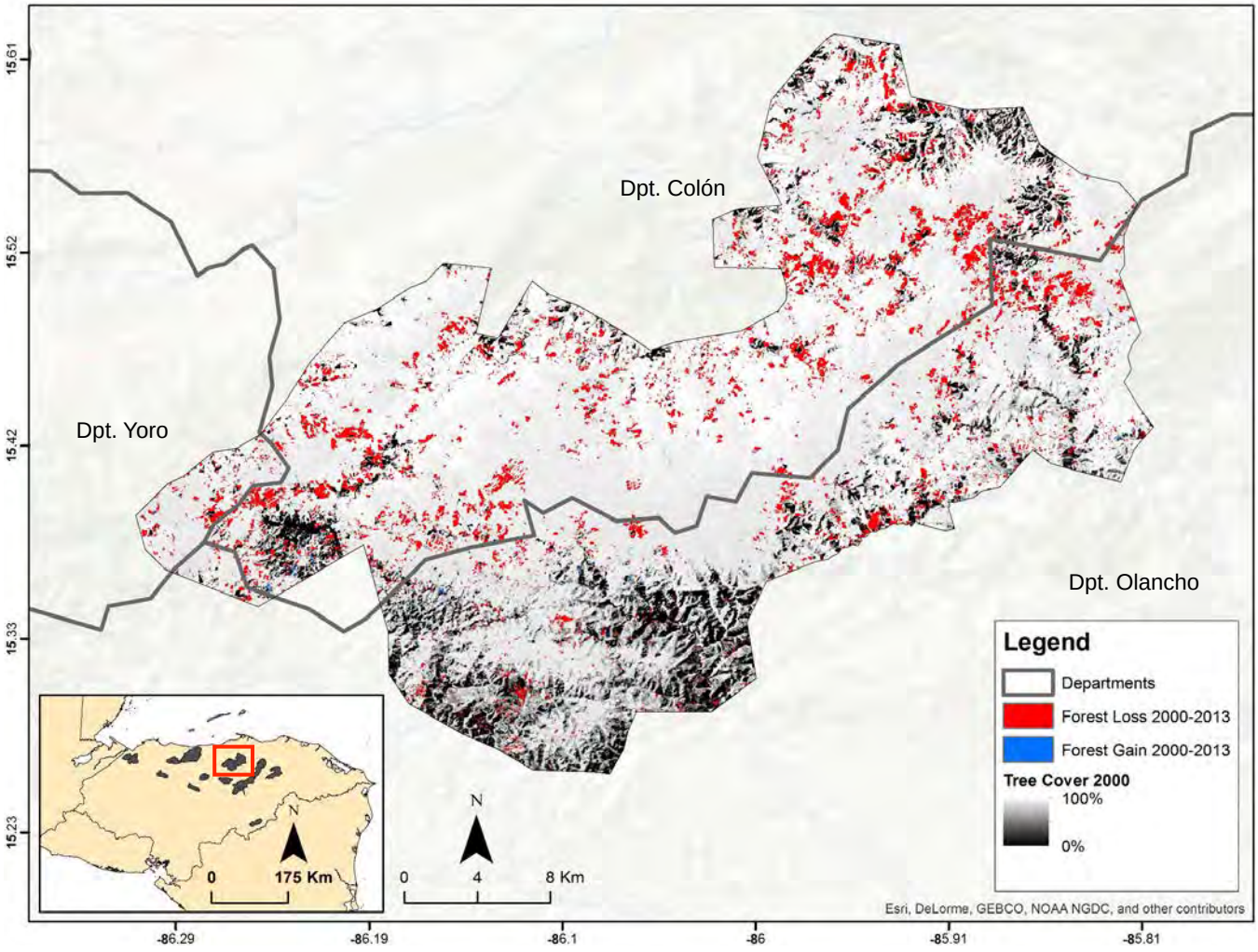
Honduras: HO05 - Pico Bonito: Zona Amortiguamiento y Nucleo



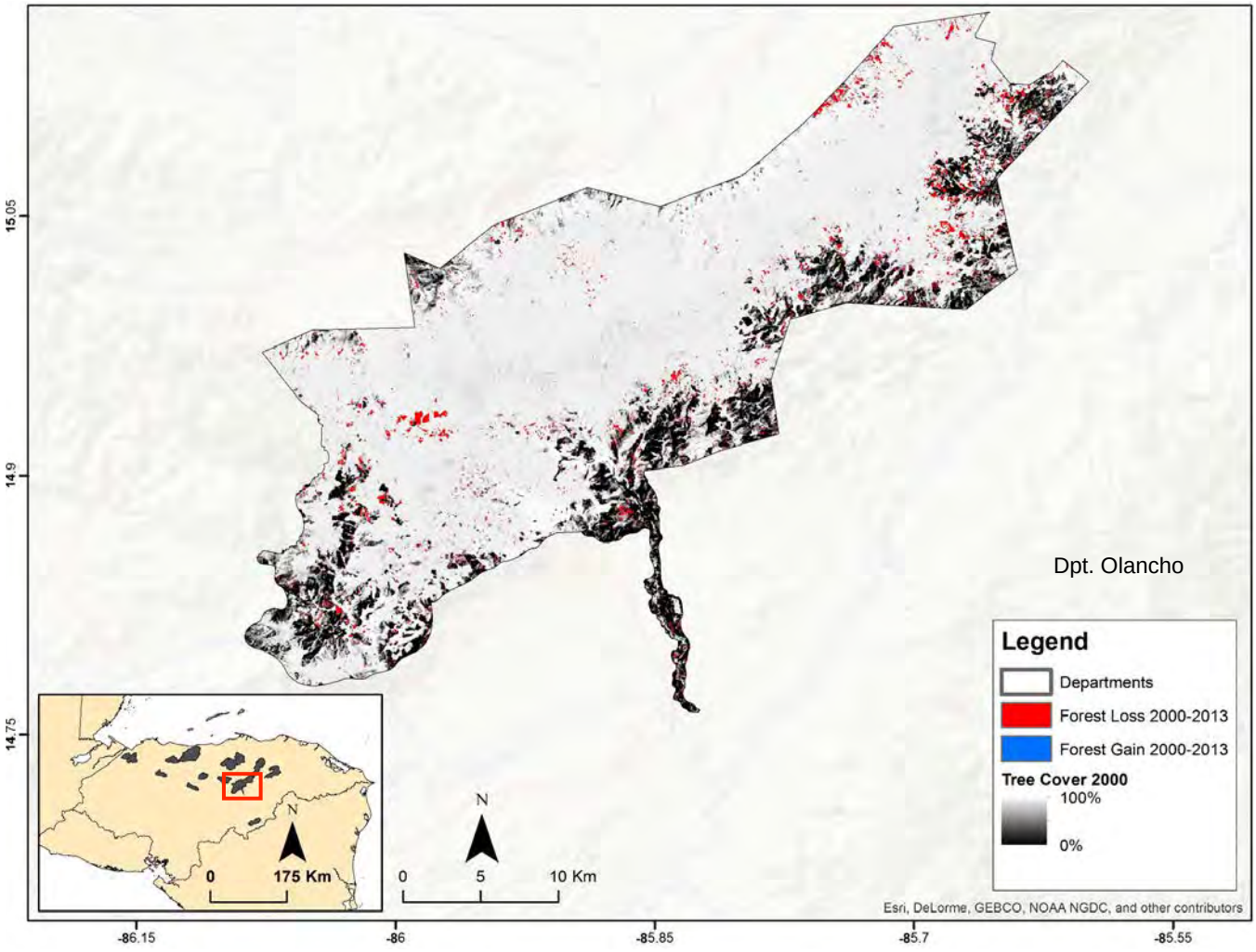
Honduras: HO06 - La Muralla: Zona Amortiguamiento y Nucleo



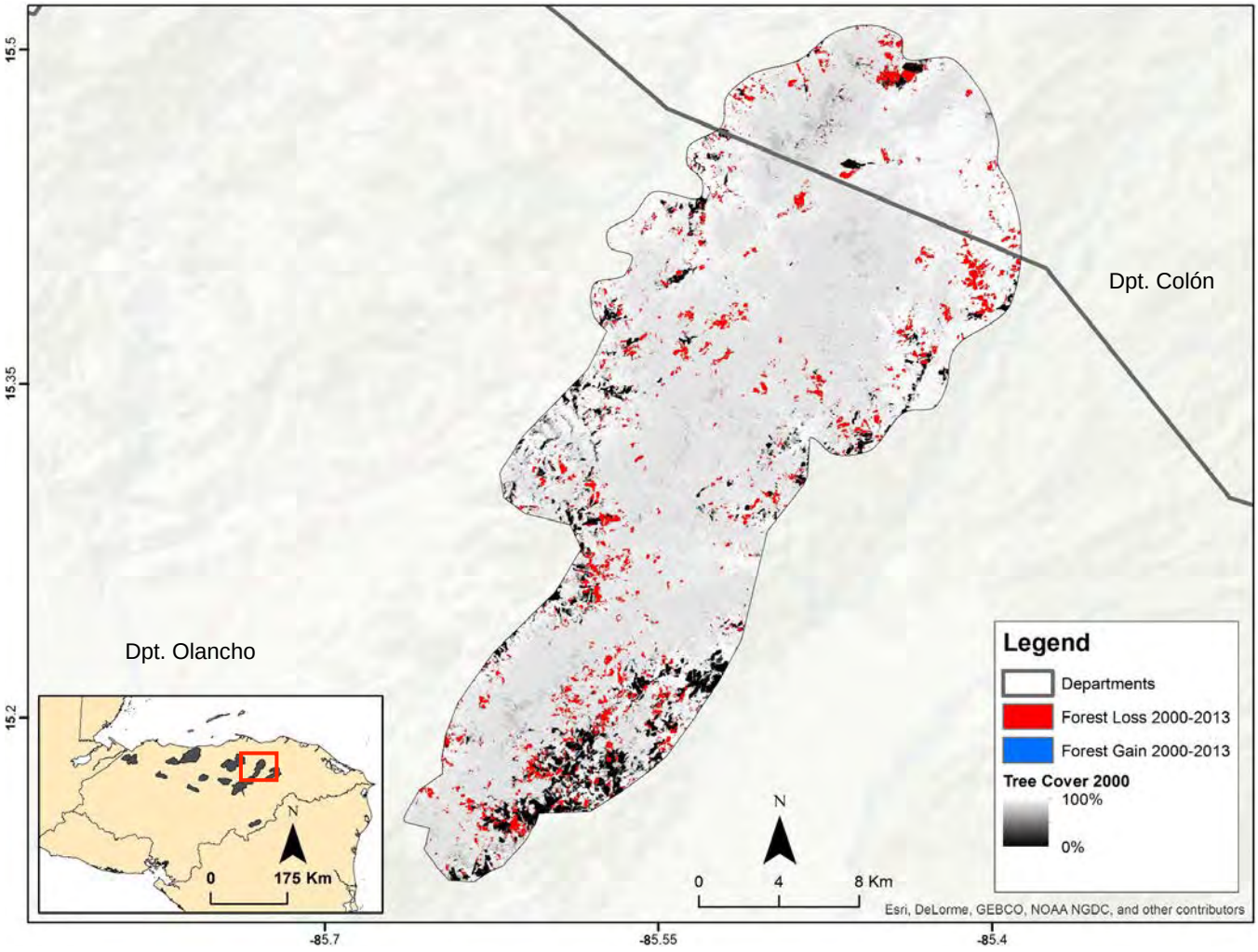
Honduras: HO07 - Montaña de Botaderos: Zona Amortiguamiento y Nucleo



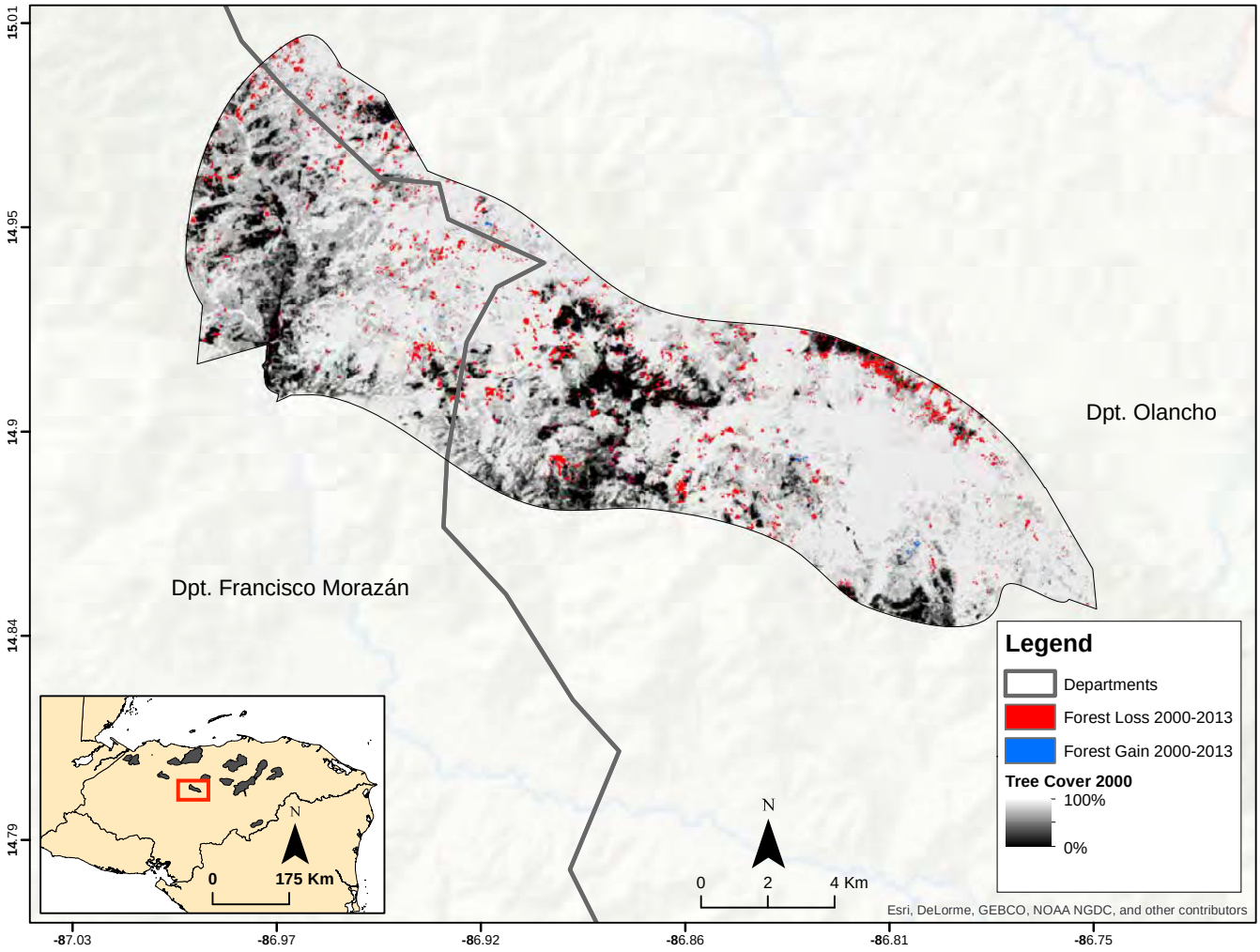
Honduras: HO08 - Sierra de Agalta y El Boqueron



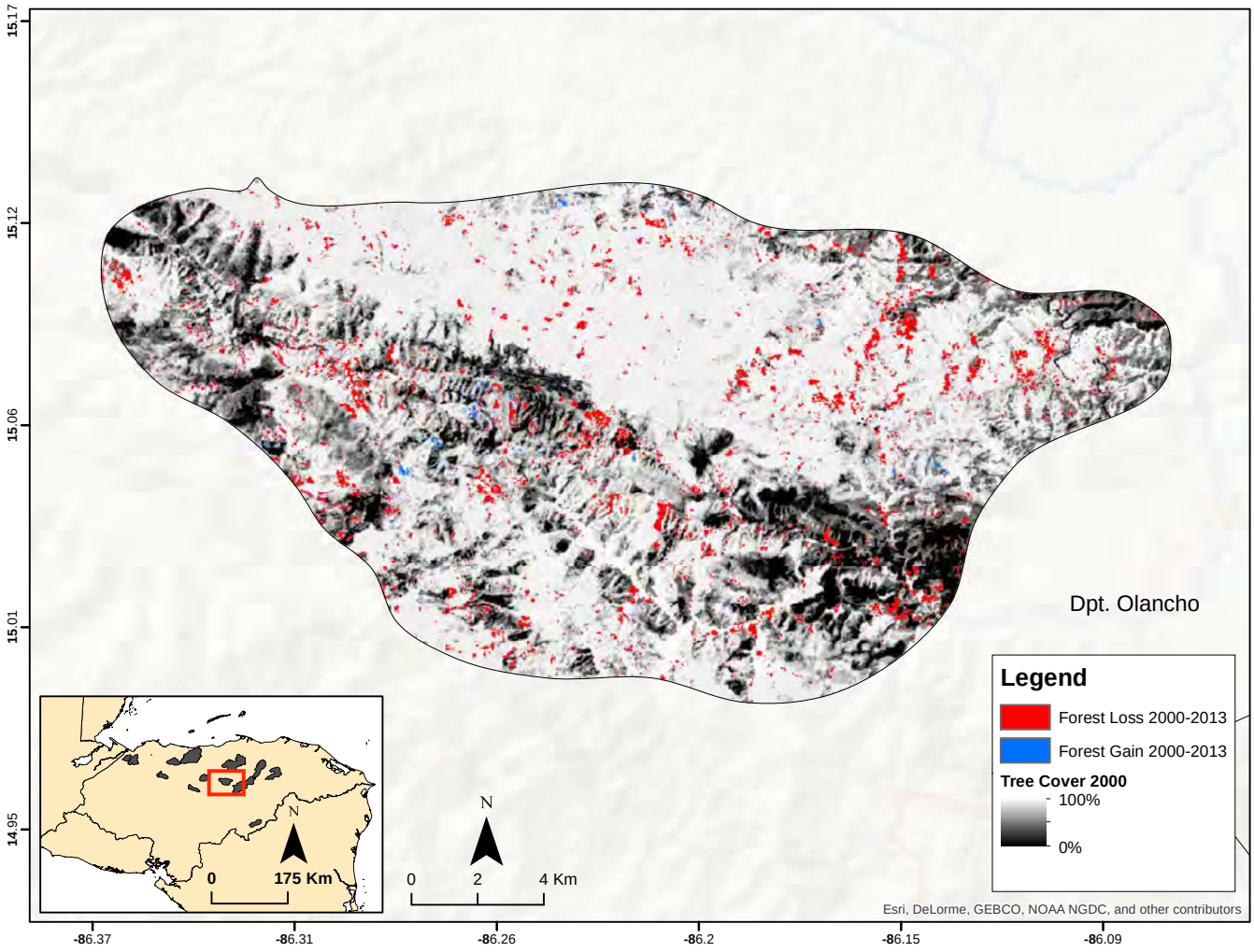
Honduras: HO09 - El Carbon



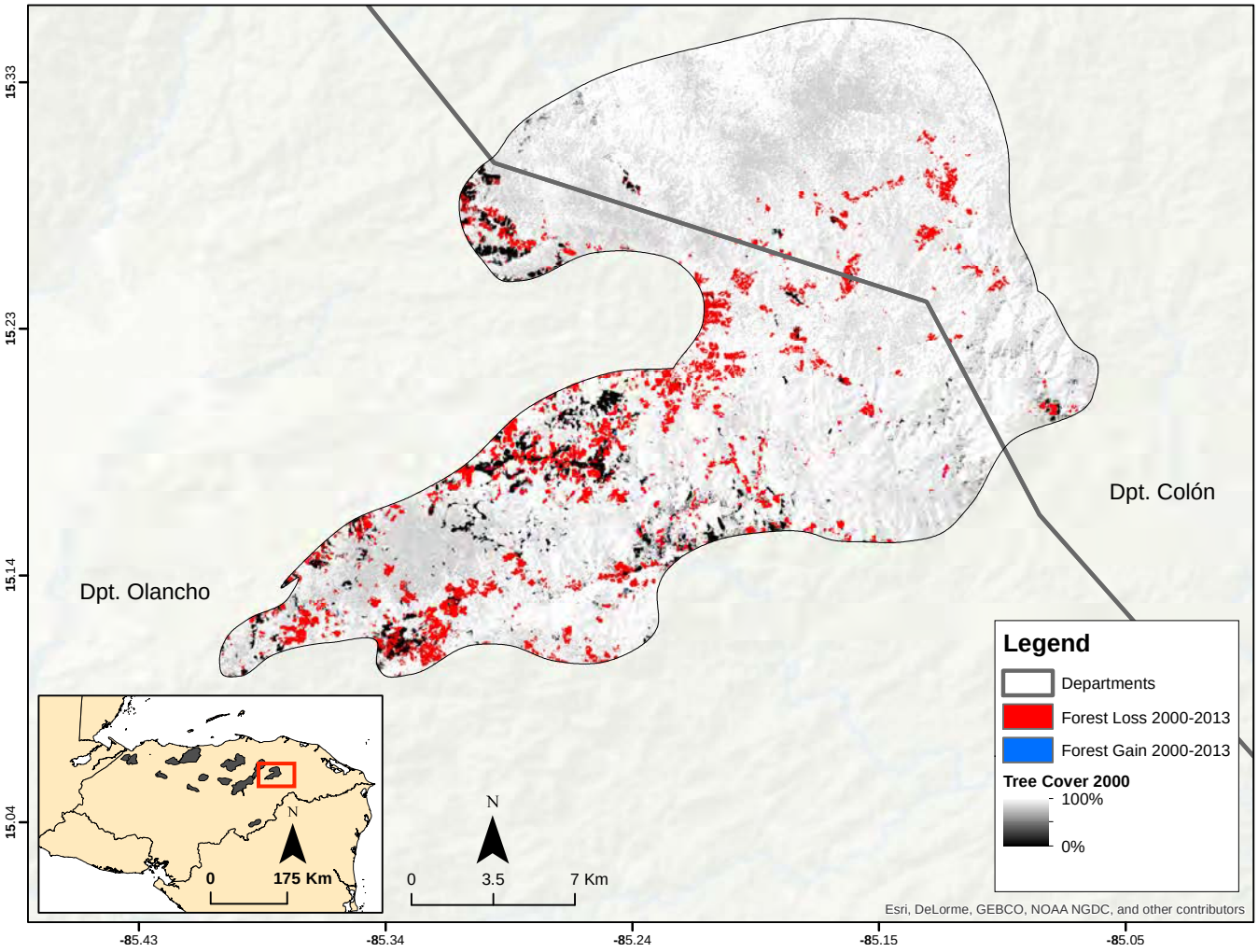
Honduras: HO10 - El Armado y Montana de la Flor



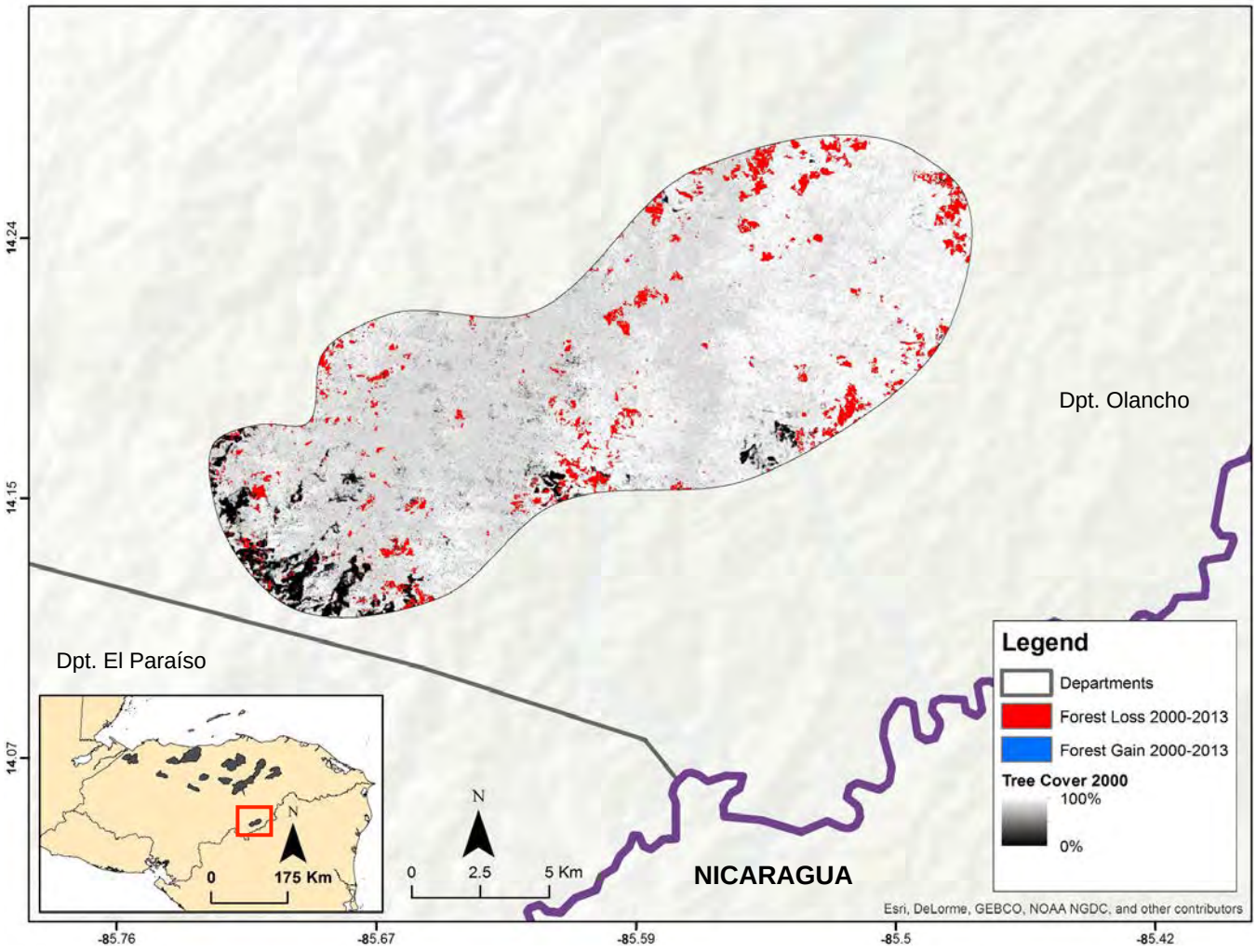
Honduras: HO11 - El Tablon



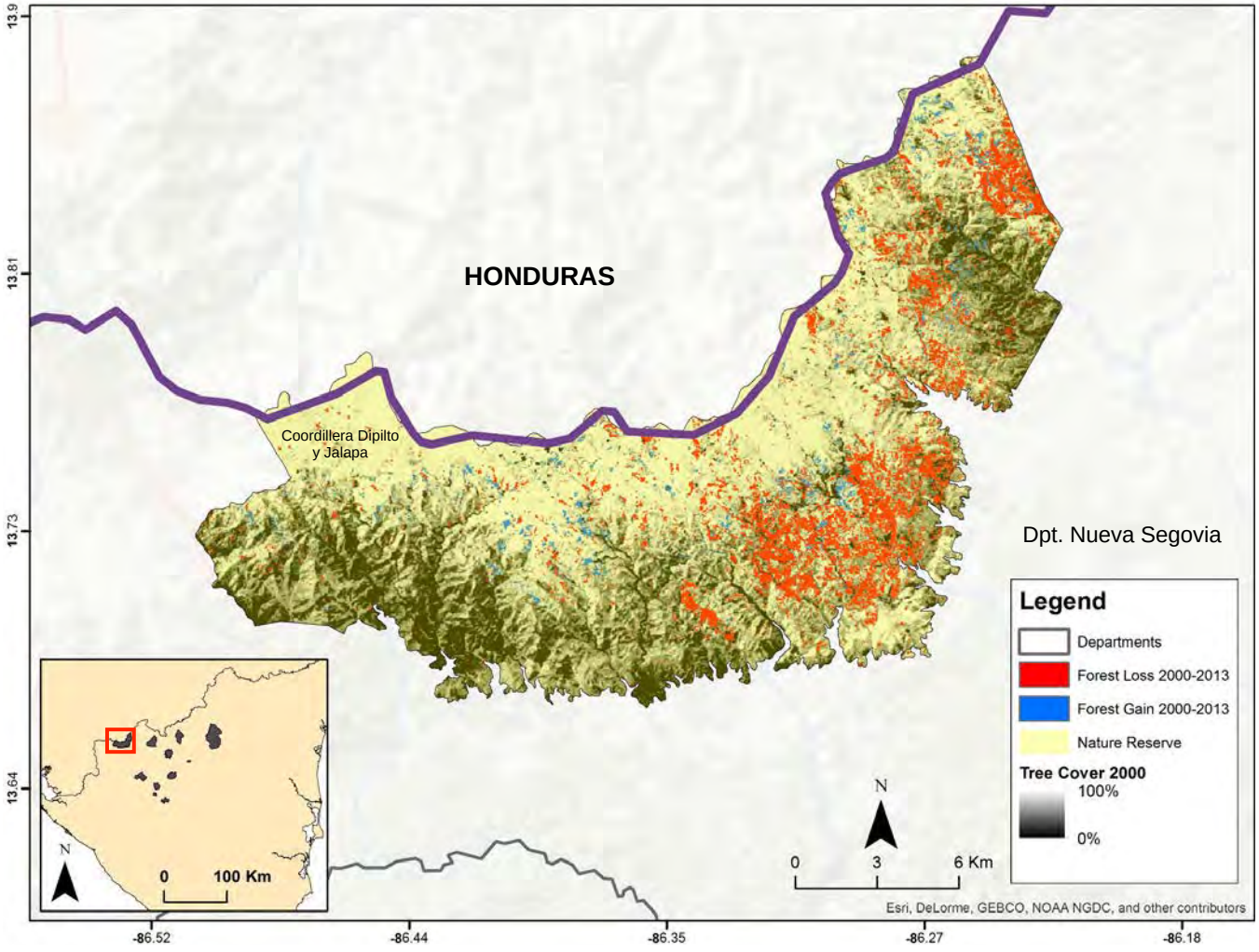
Honduras: HO12 - Zona Sur: Biosfera del Rio Platano



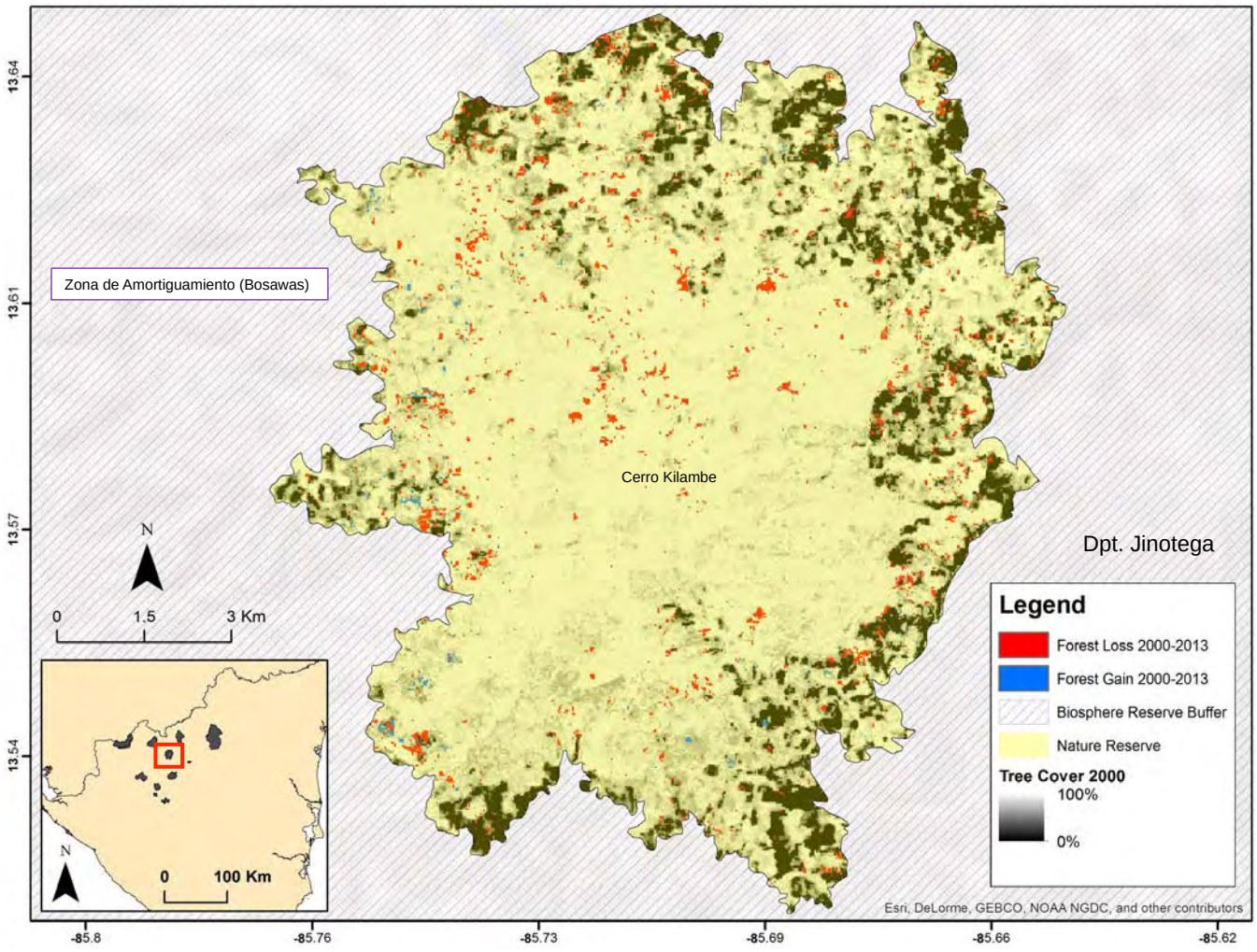
Honduras: HO13 - Cordillera Entre Rios: Parque Nacional Patuca



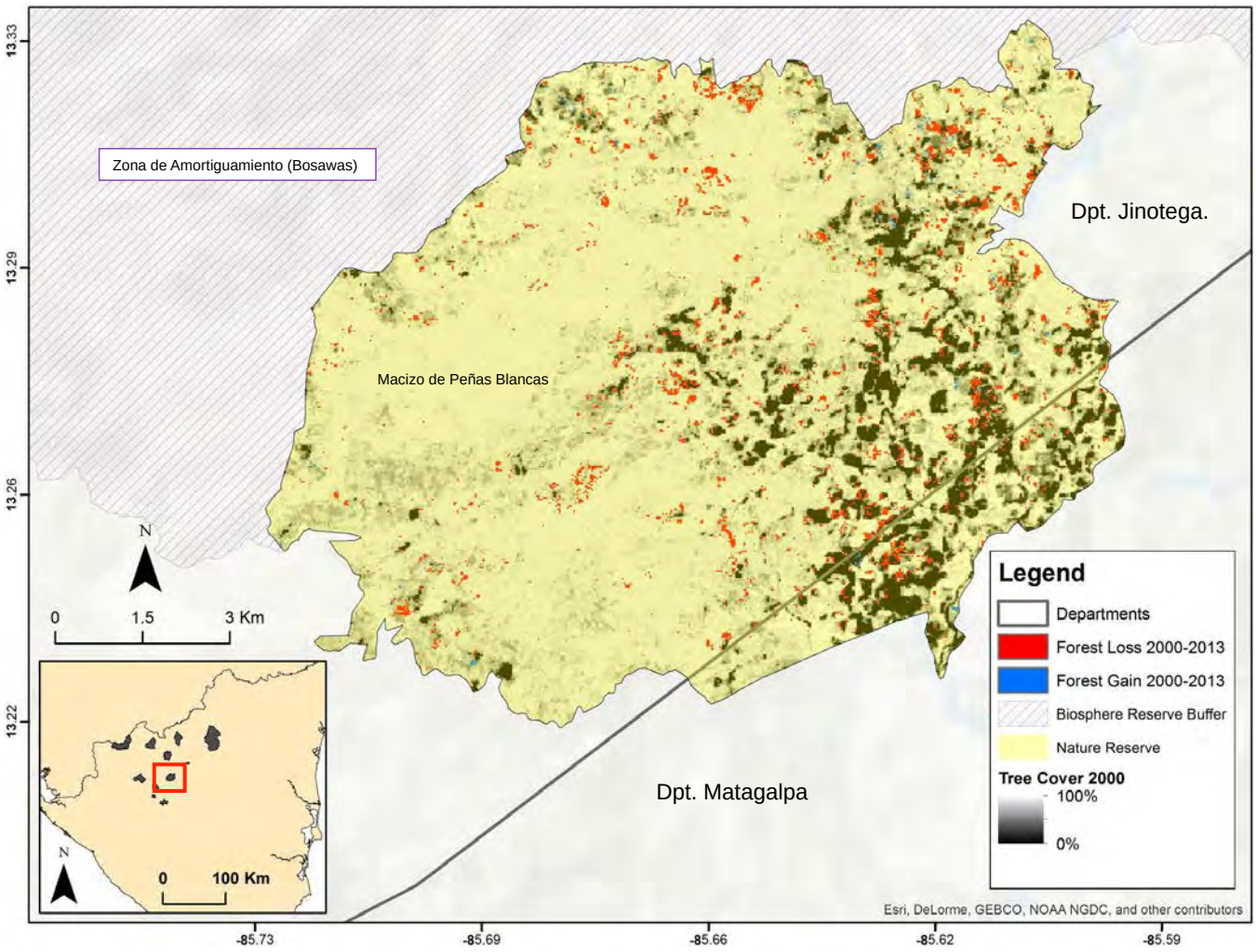
Nicaragua: NI01 - Coordillera Dipilto y Jalapa



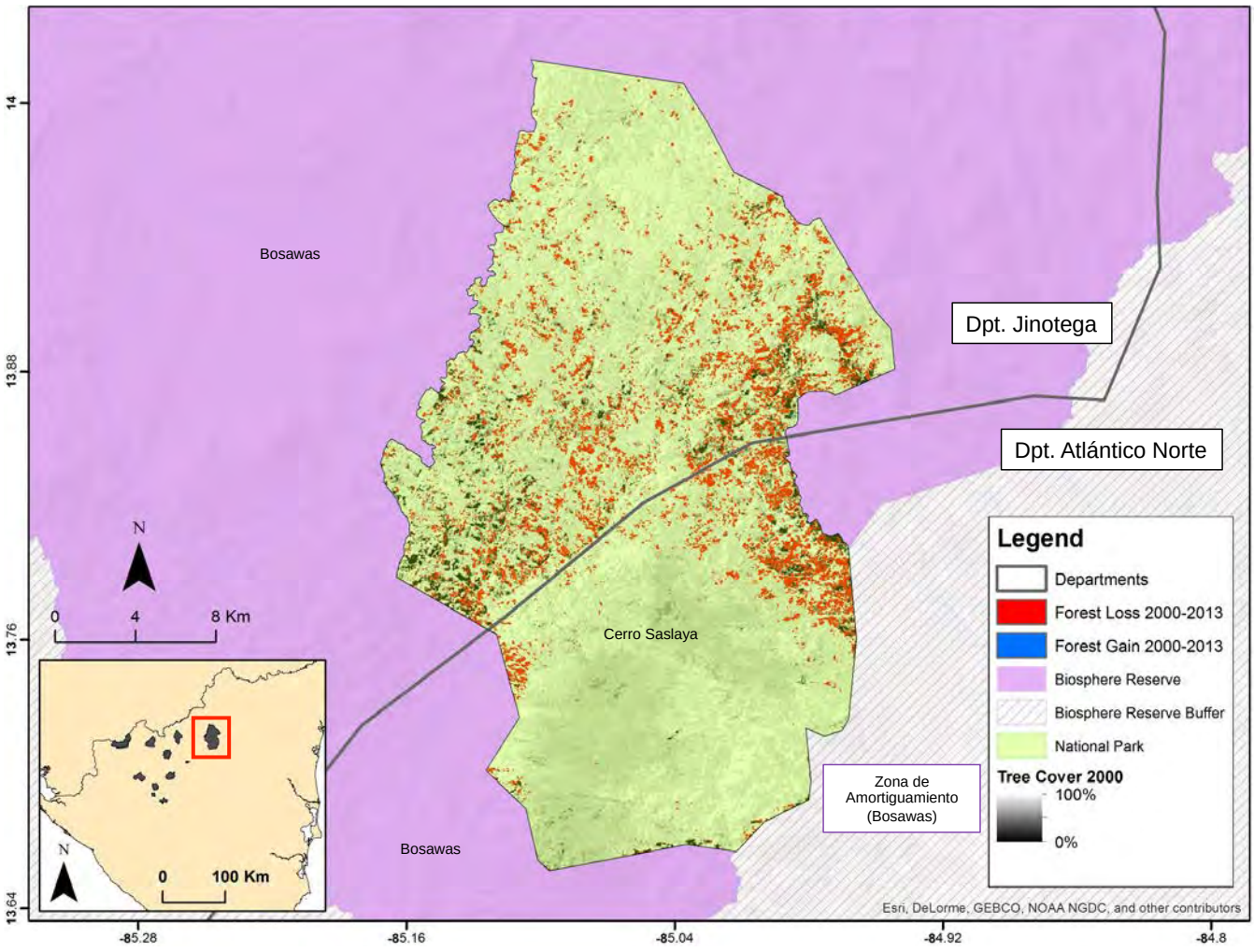
Nicaragua: NI02 - Cerro Kilambe



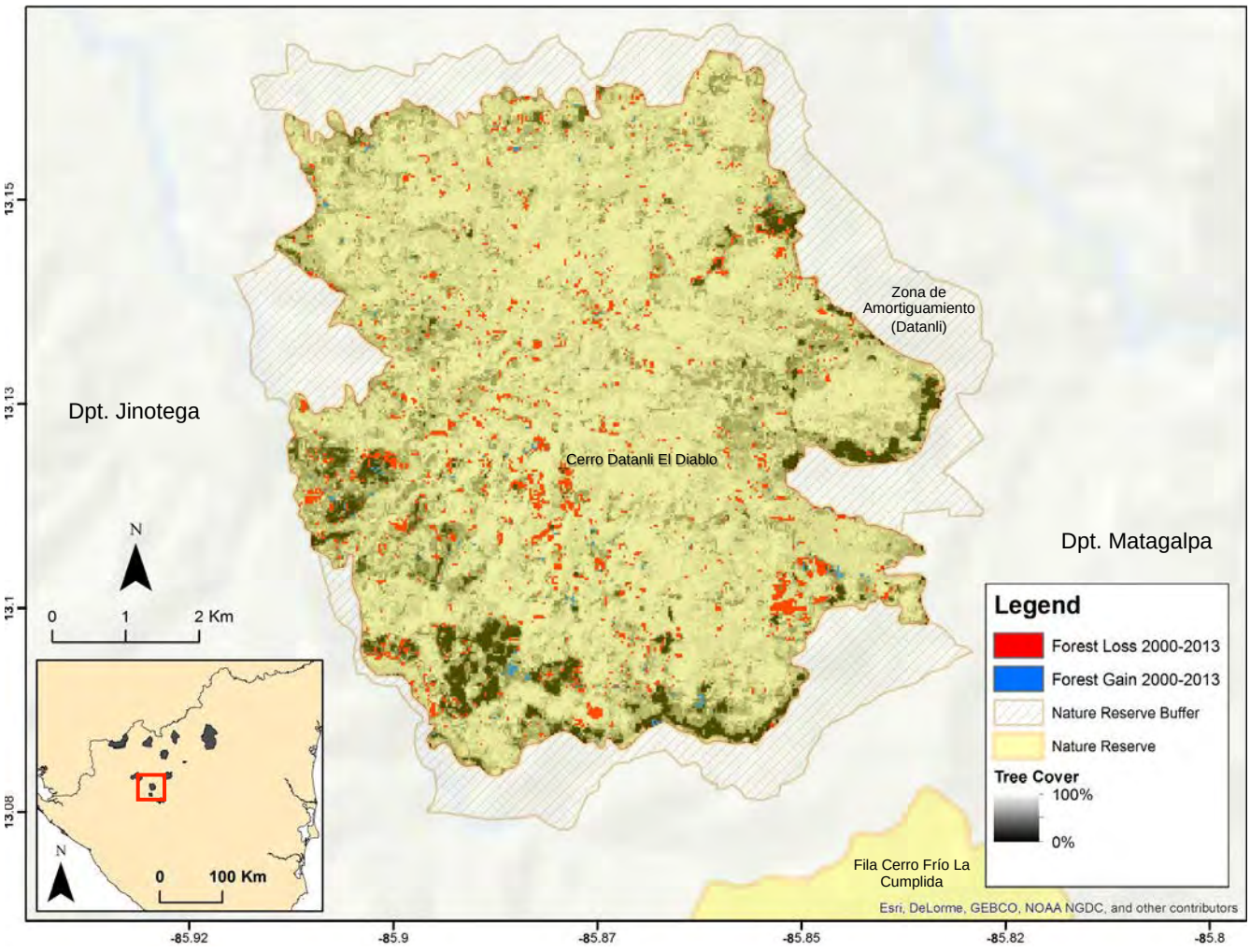
Nicaragua: NI03 - Macizo de Peñas Blancas



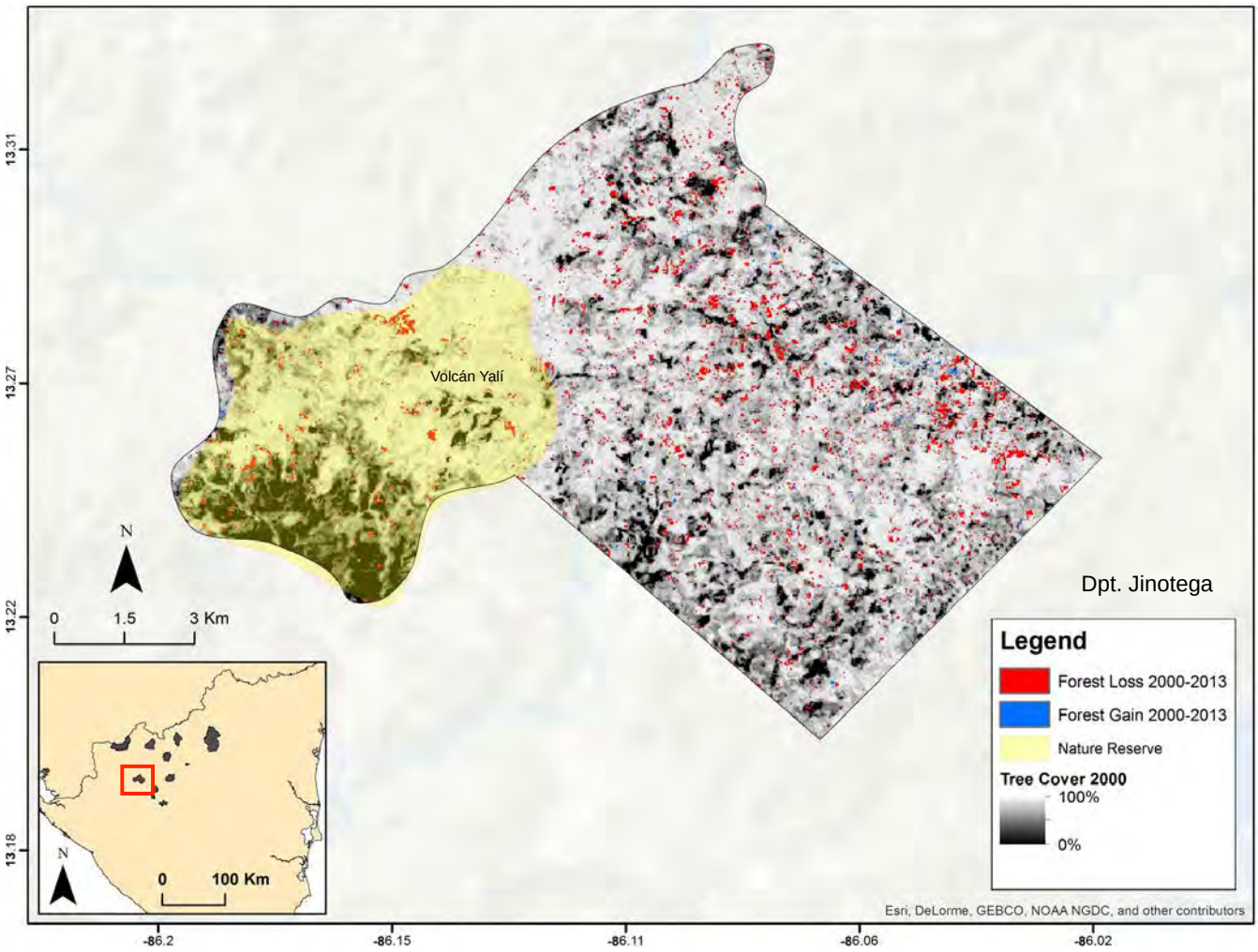
Nicaragua: NI04 - Cerro Saslaya



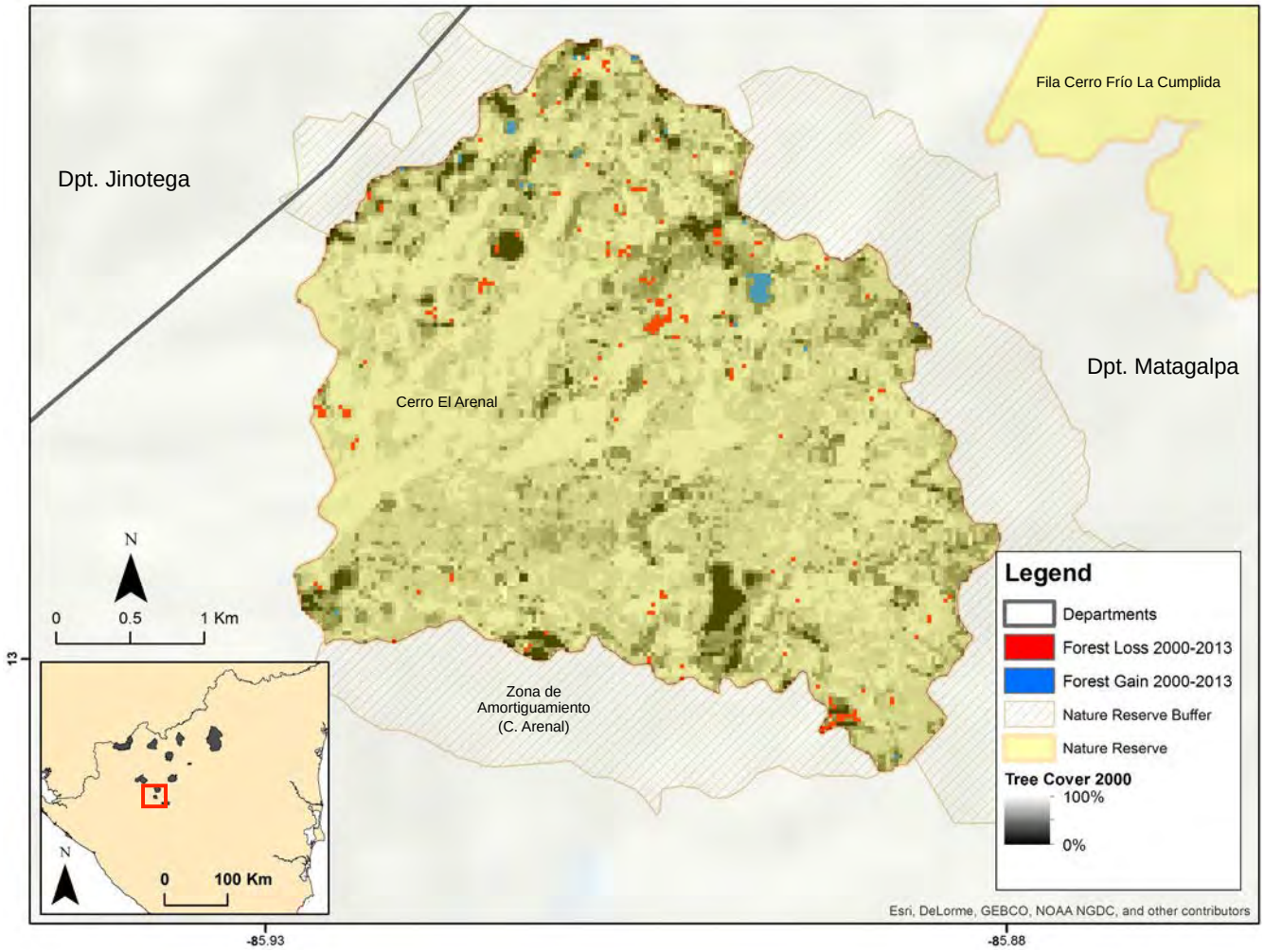
Nicaragua: NI05 - Cerro Datanli-El Diablo



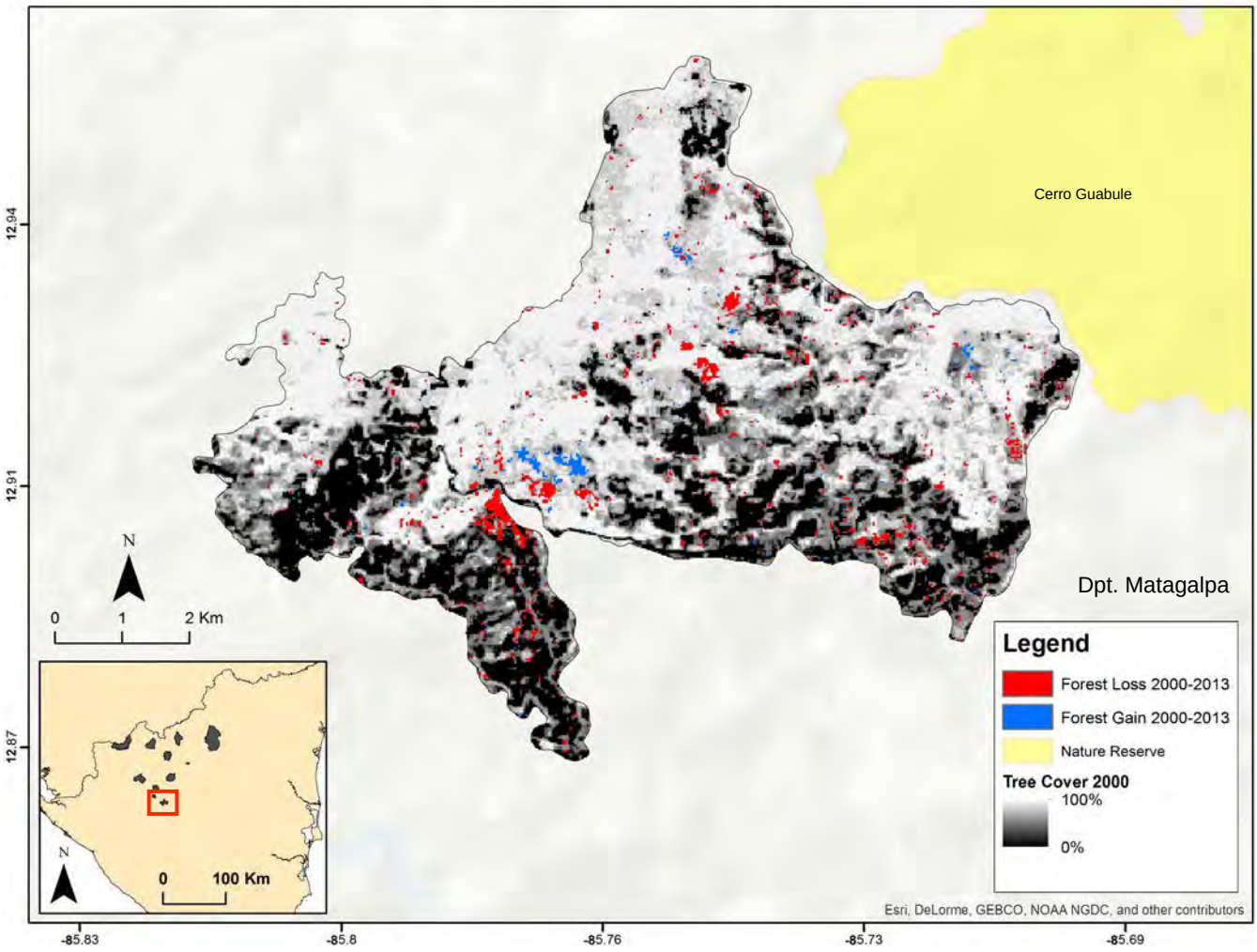
Nicaragua: NI06 - Yali, El Jaguar, y el corredor entre ellos



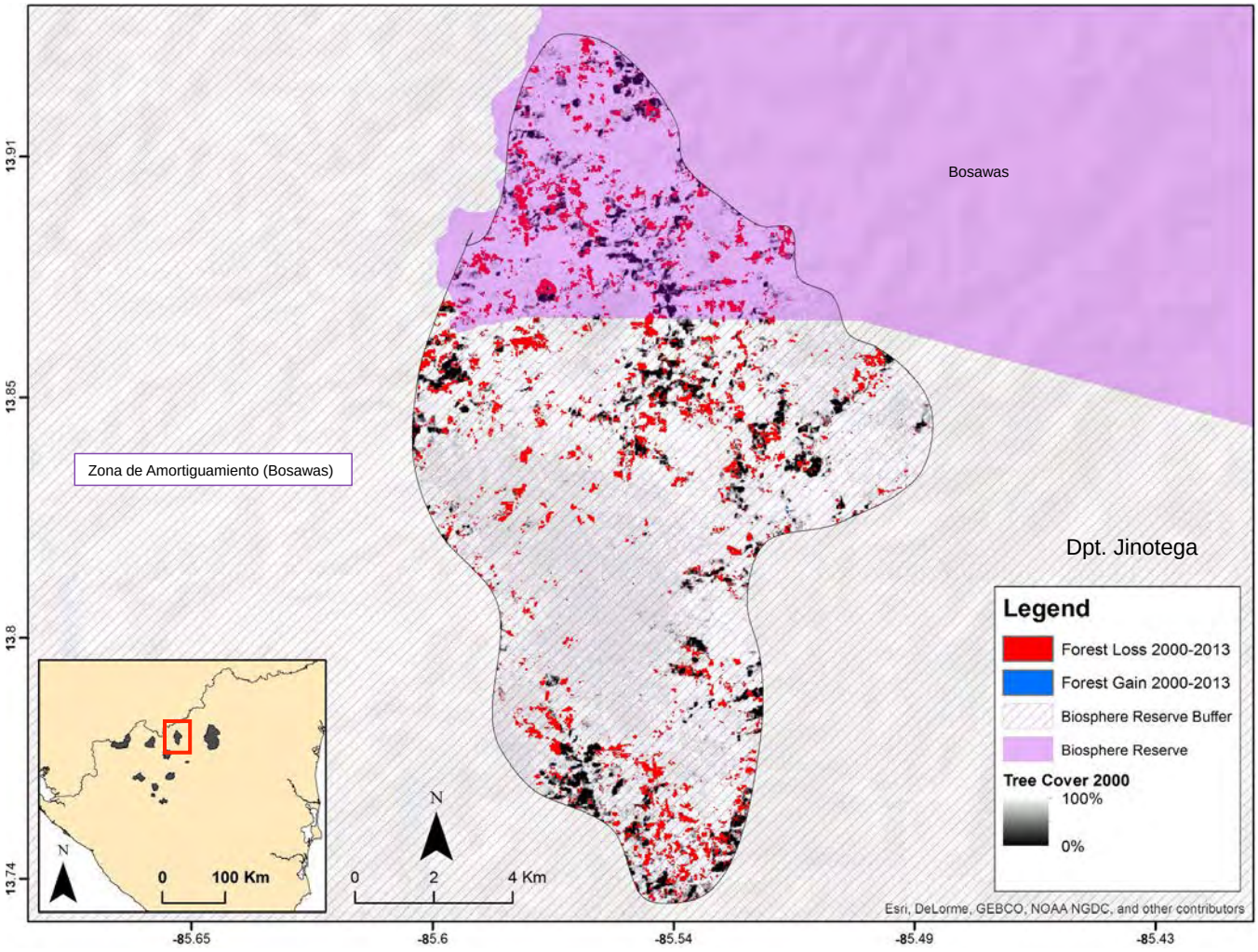
Nicaragua: NI07 - Cerro El Arenal



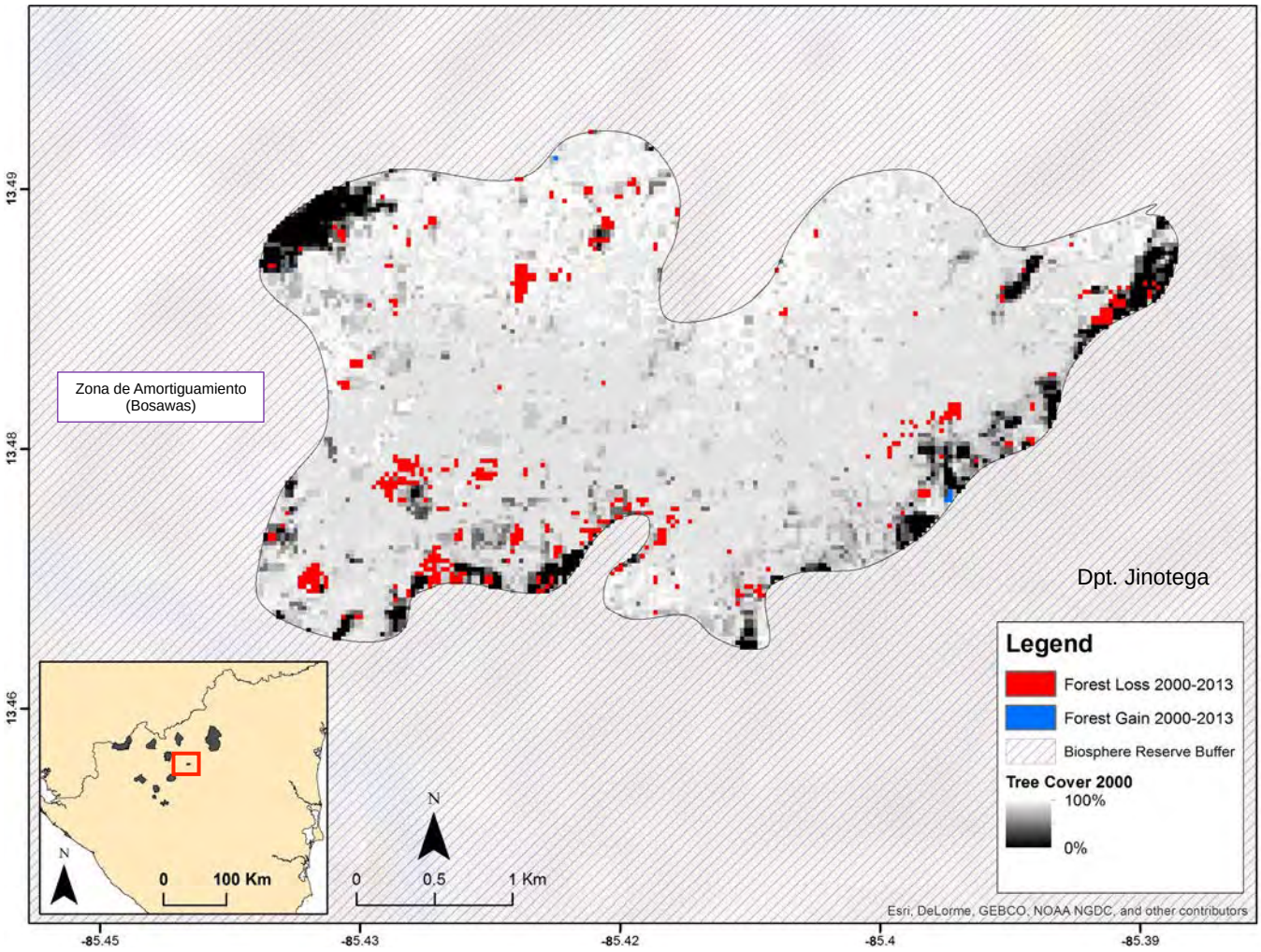
Nicaragua: NI08 – Yucul



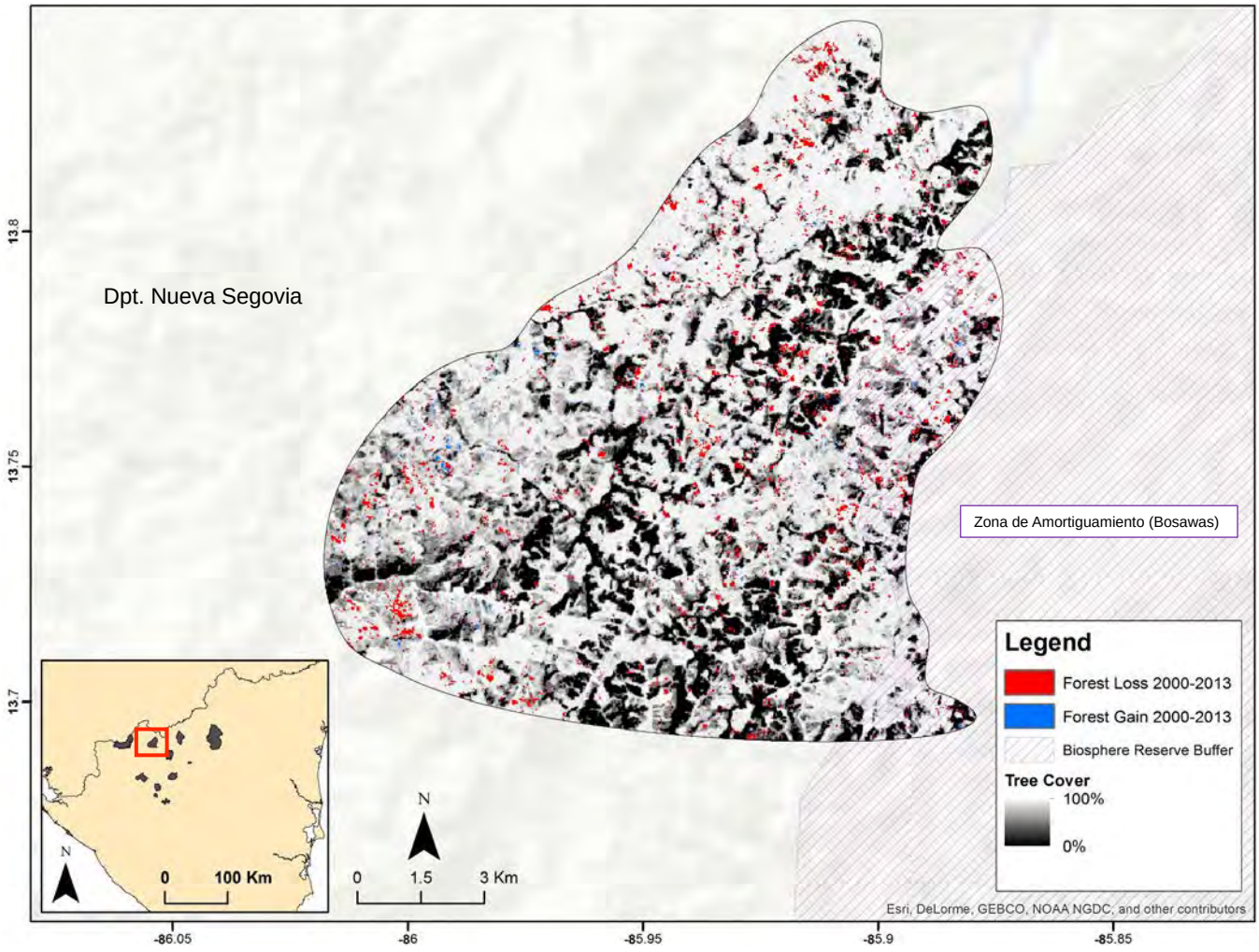
Nicaragua: NI09 – Kinuias



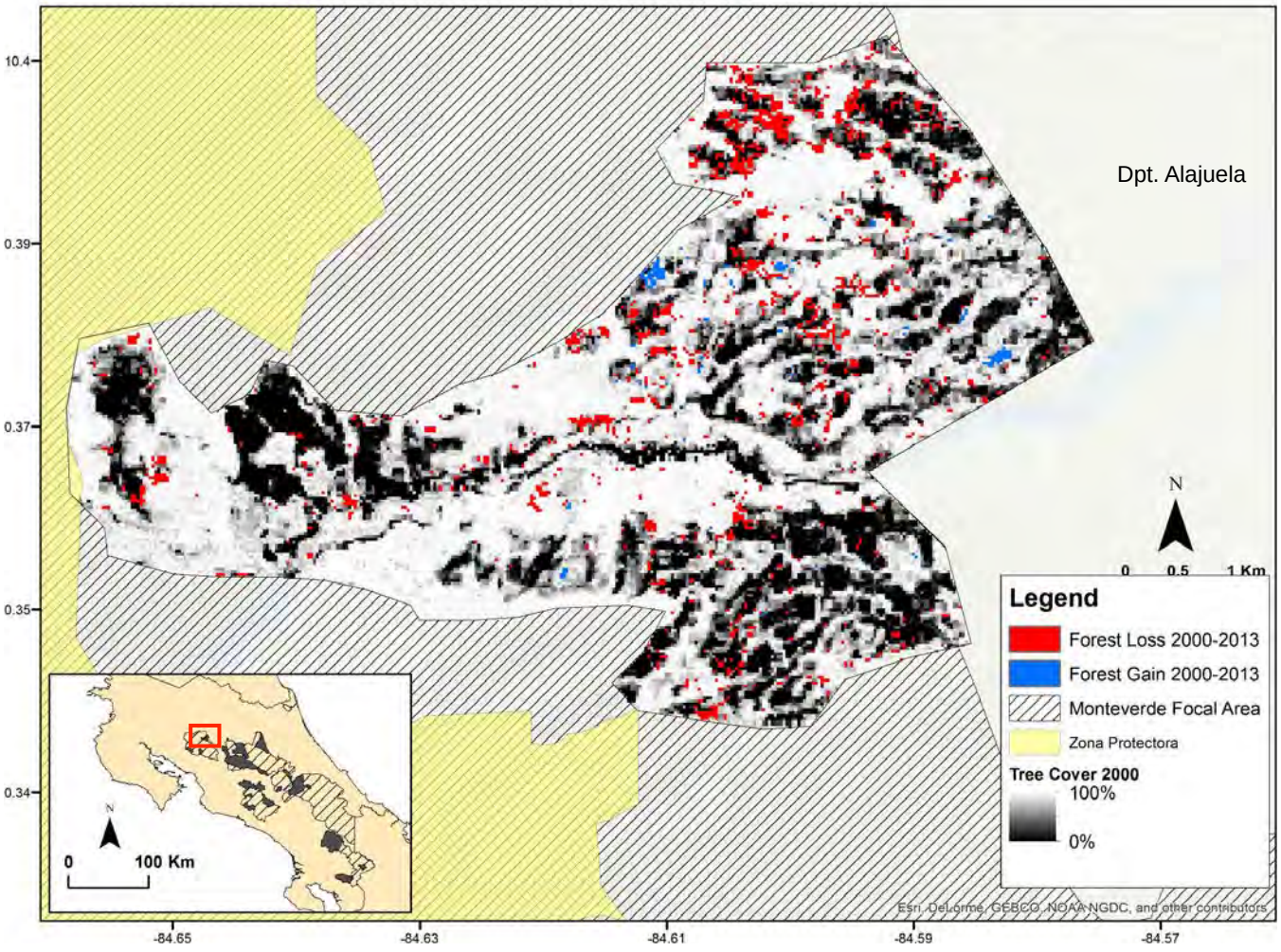
Nicaragua: NI10 - La Murra



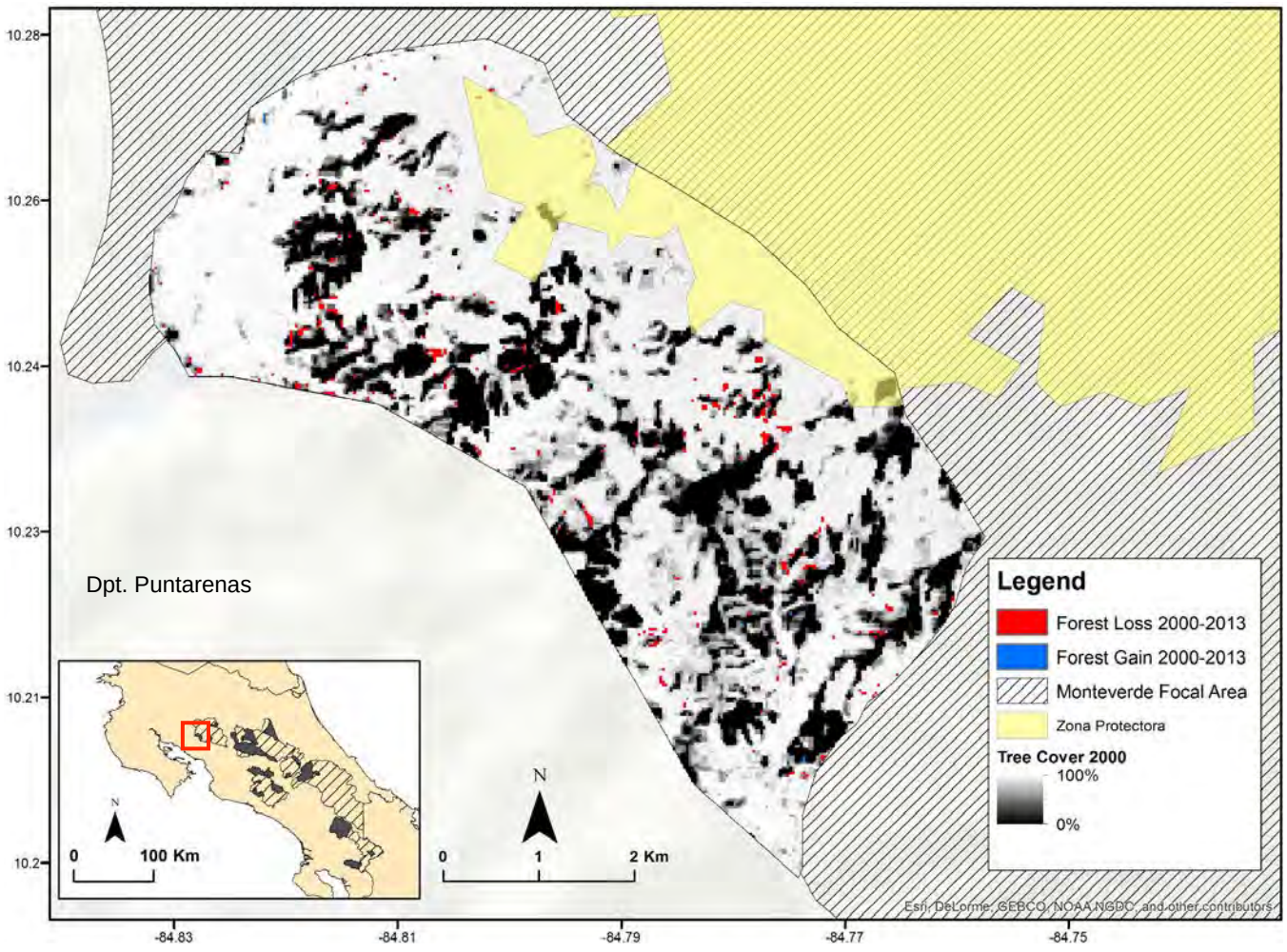
Nicaragua: NI11 – Kubali



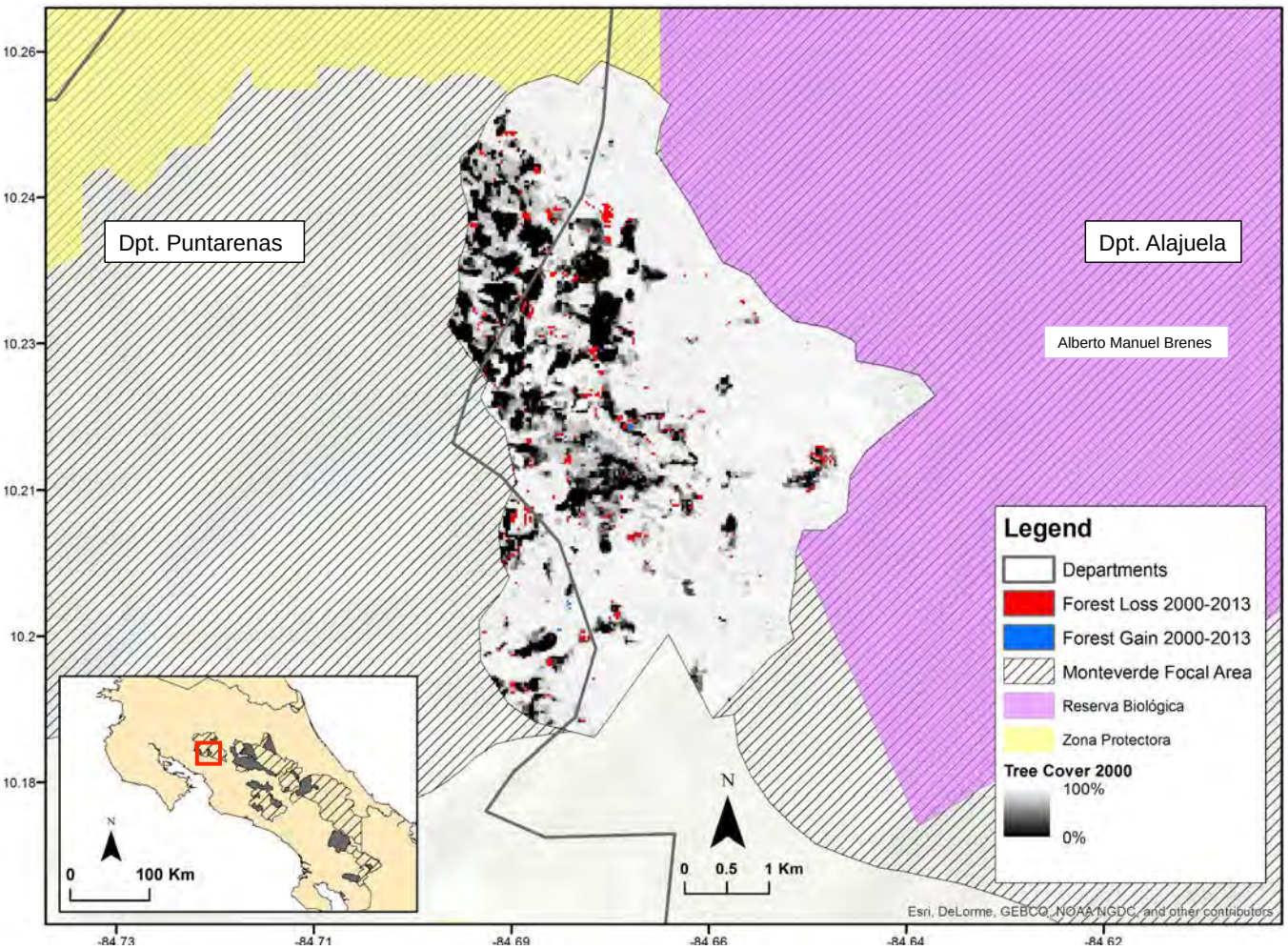
Costa Rica: CR1-1 - Monteverde: Pocosol



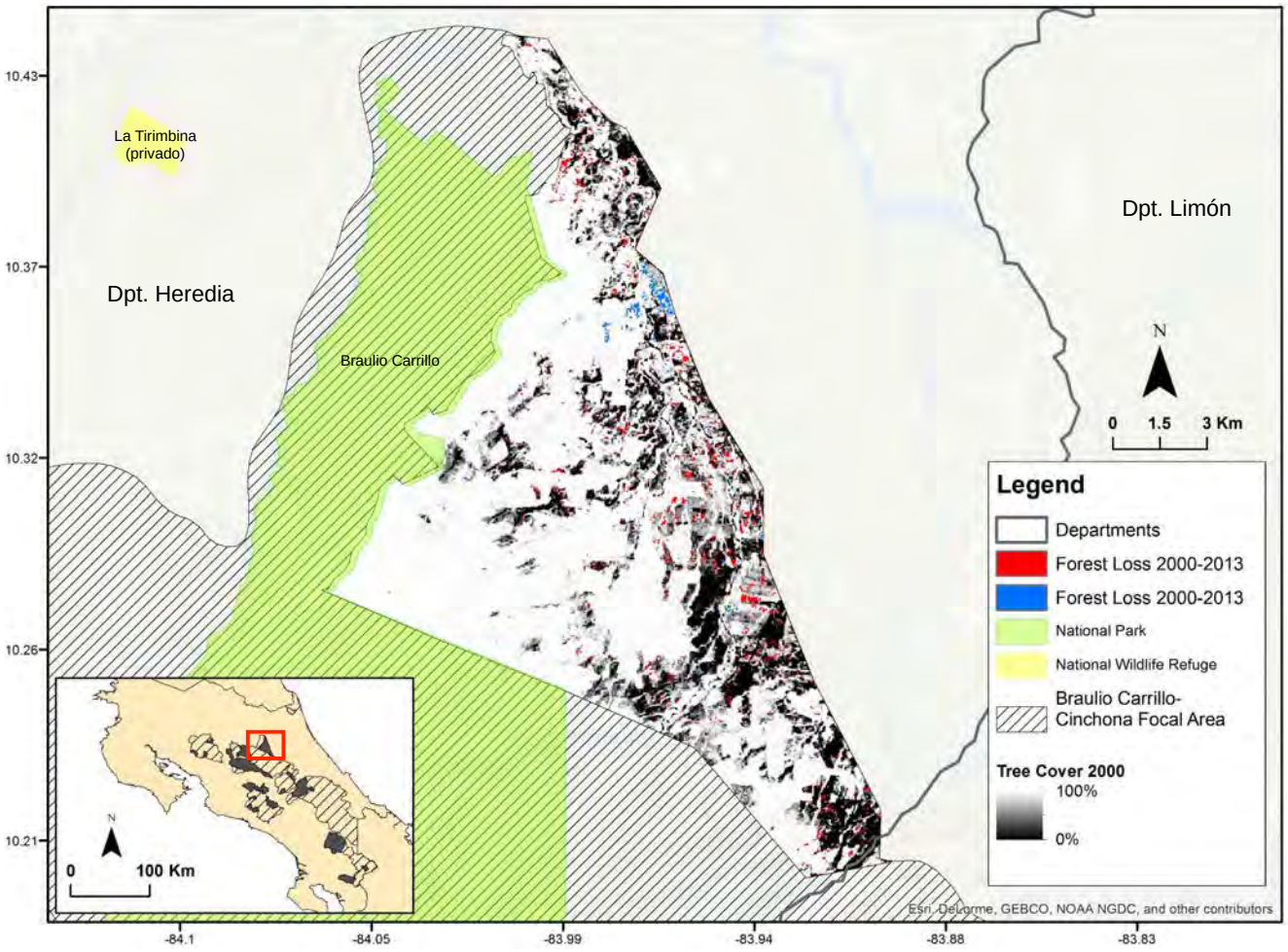
Costa Rica: CR1-2 - Monteverde: San Luis



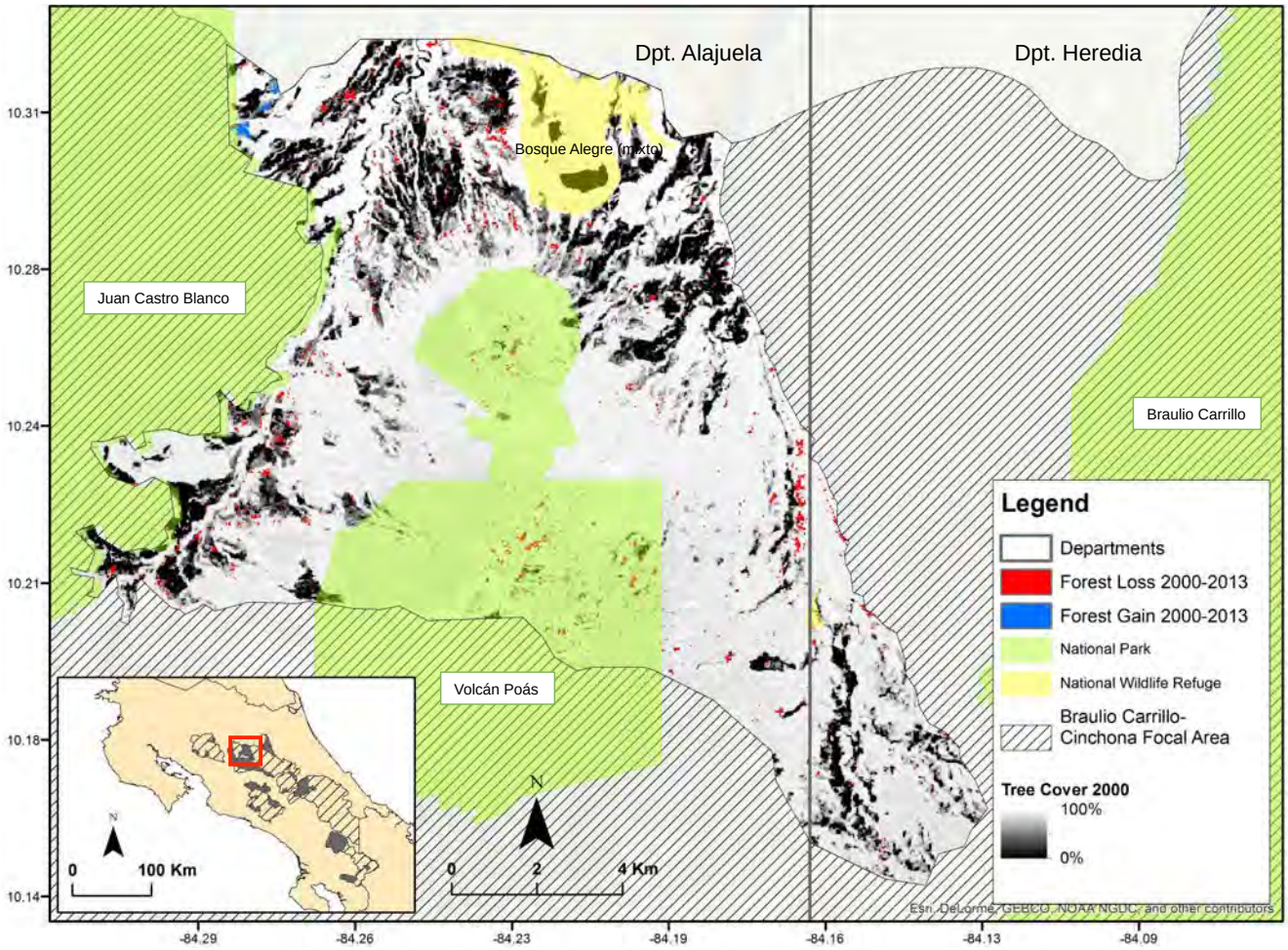
Costa Rica: CR1-3 - Monteverde: Cedral



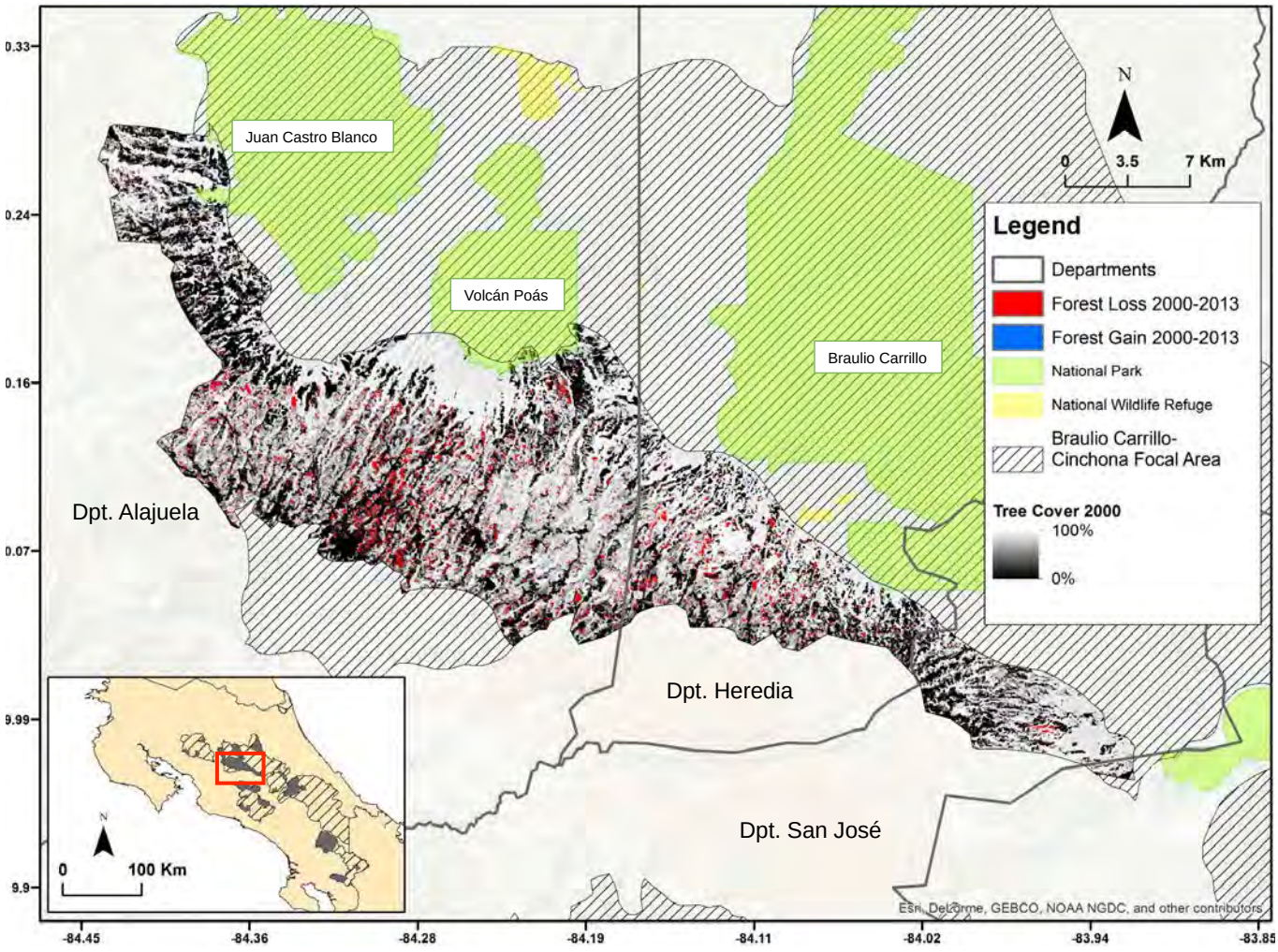
Costa Rica: CR2-1 - Braulio Carrillo-Cinchona: Horquetas de Sarapiquí



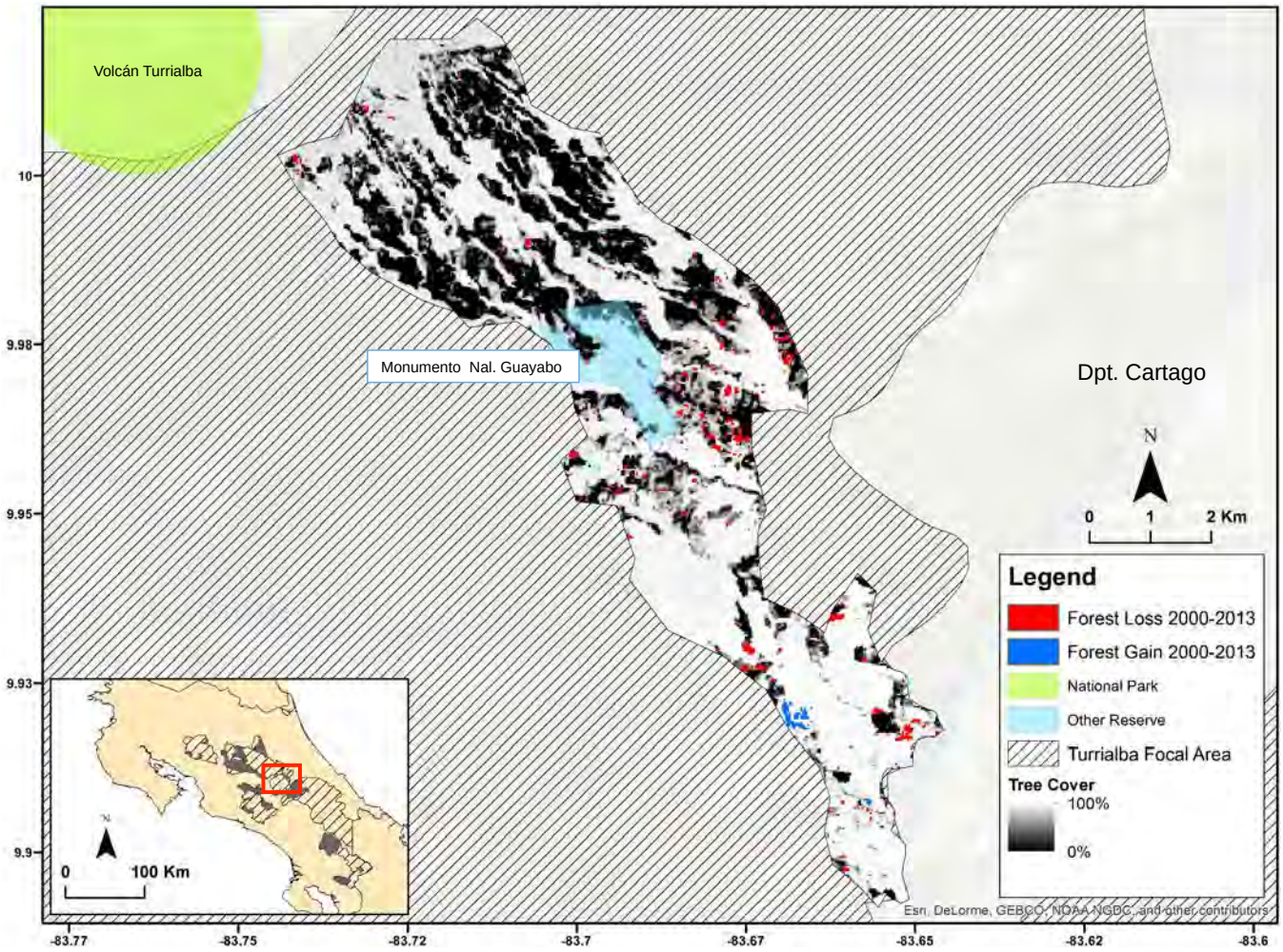
Costa Rica: CR2-2 - Braulio Carrillo-Cinchona: Poás-Barva



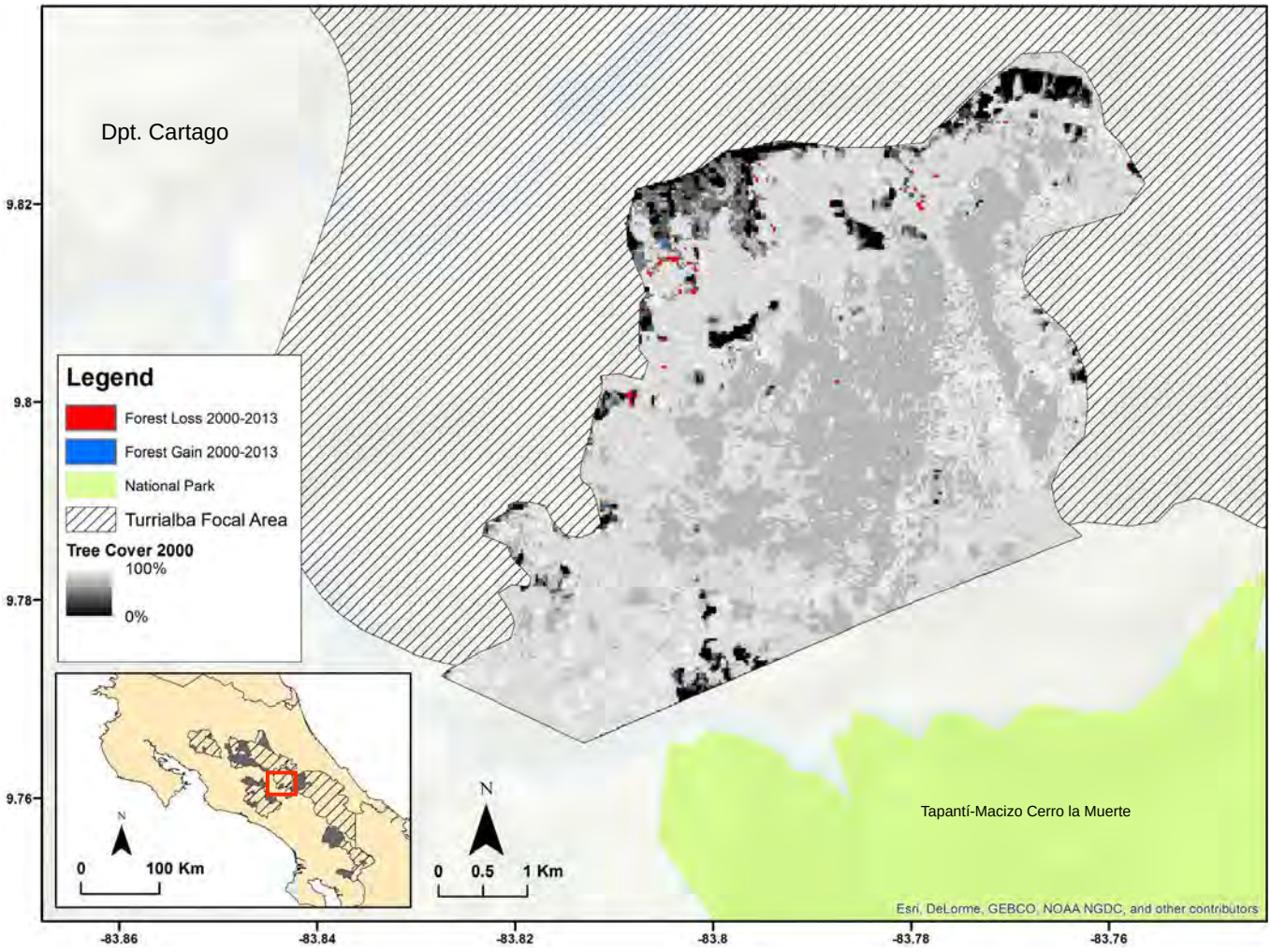
Costa Rica: CR2-3 - Braulio Carrillo-Cinchona: Río Cuarto-San Miguel



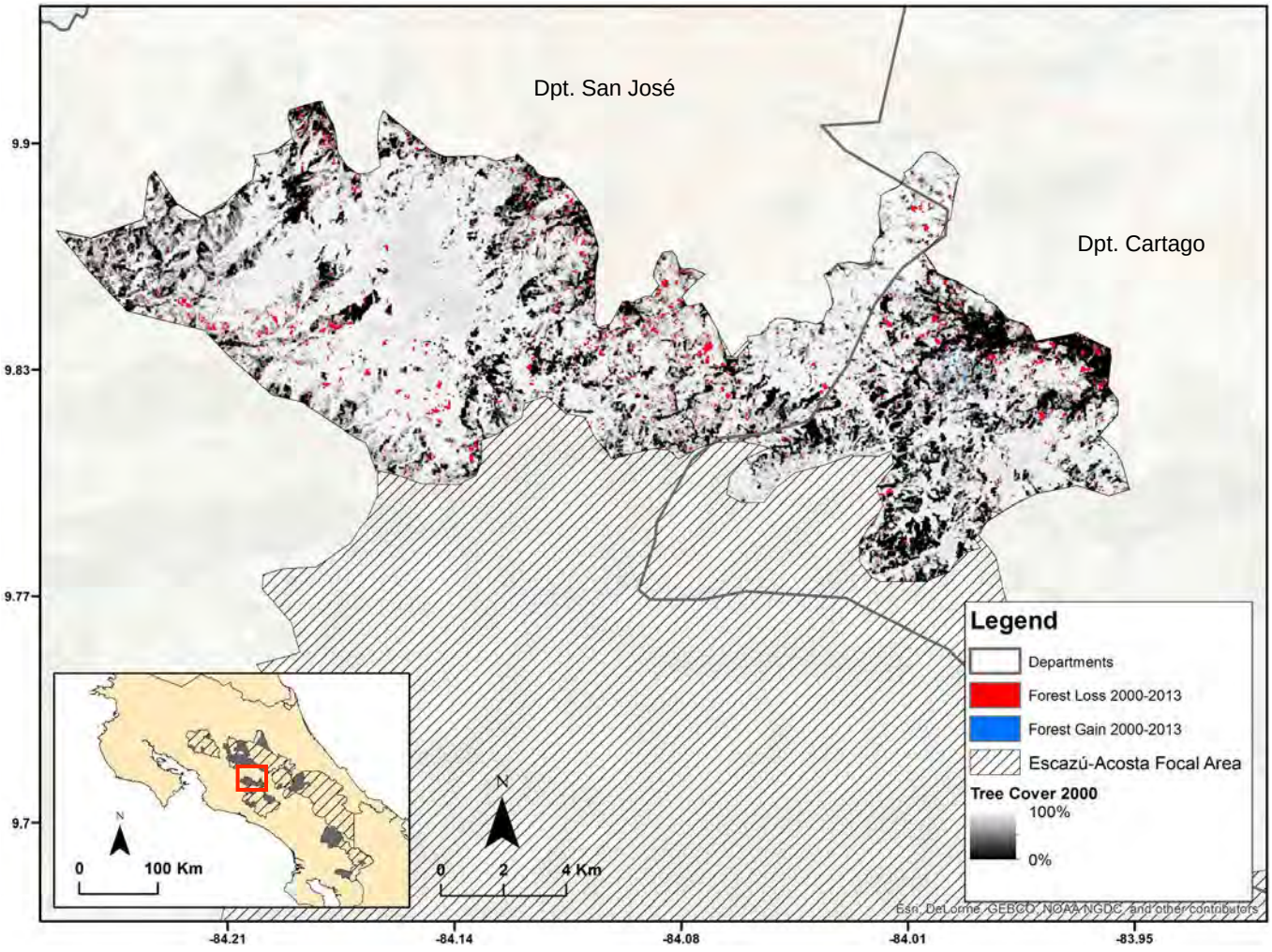
Costa Rica: CR3-1 - Turrialba: Guayabo



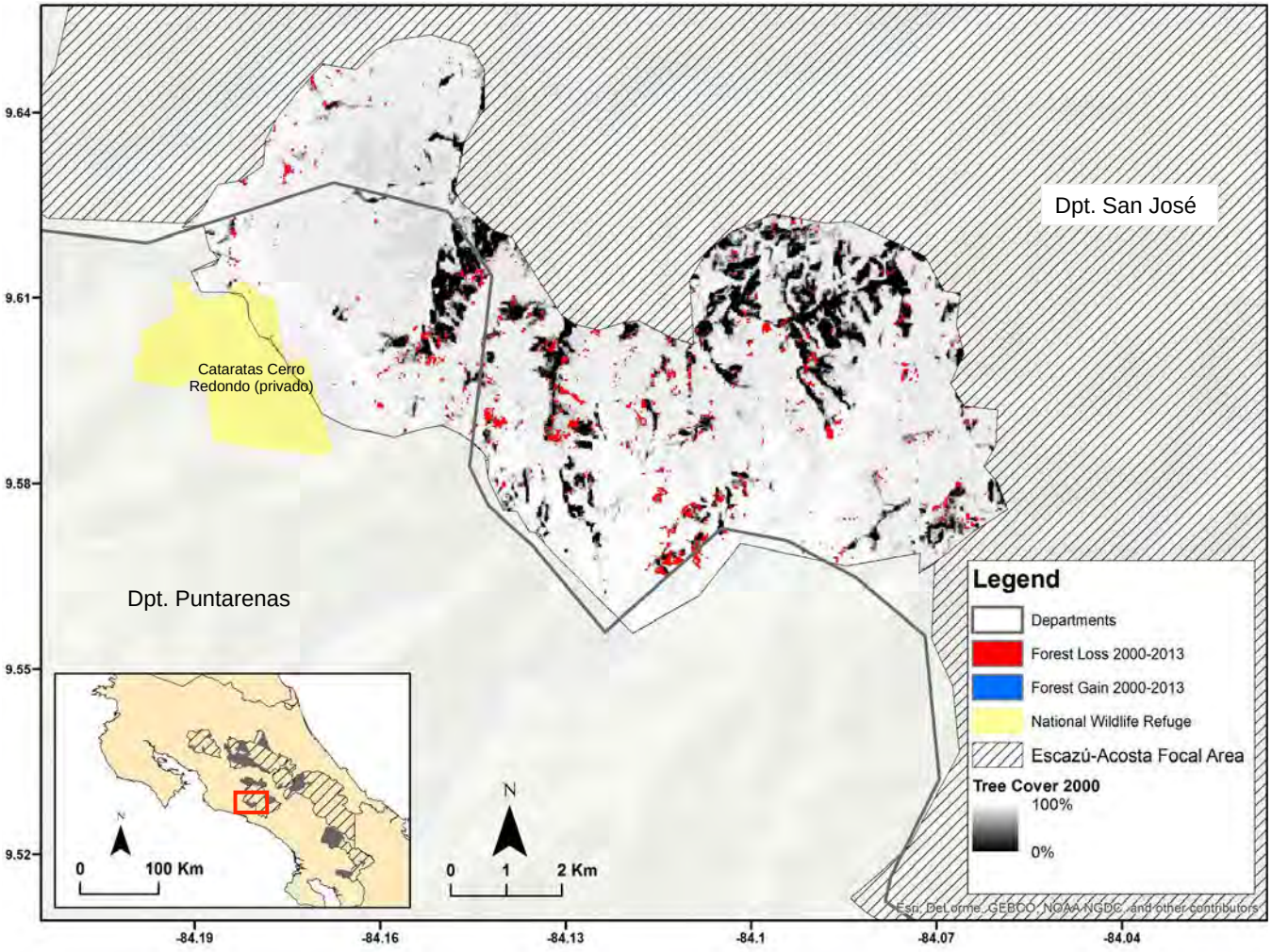
Costa Rica: CR3-2 - Turriabla: Cachí



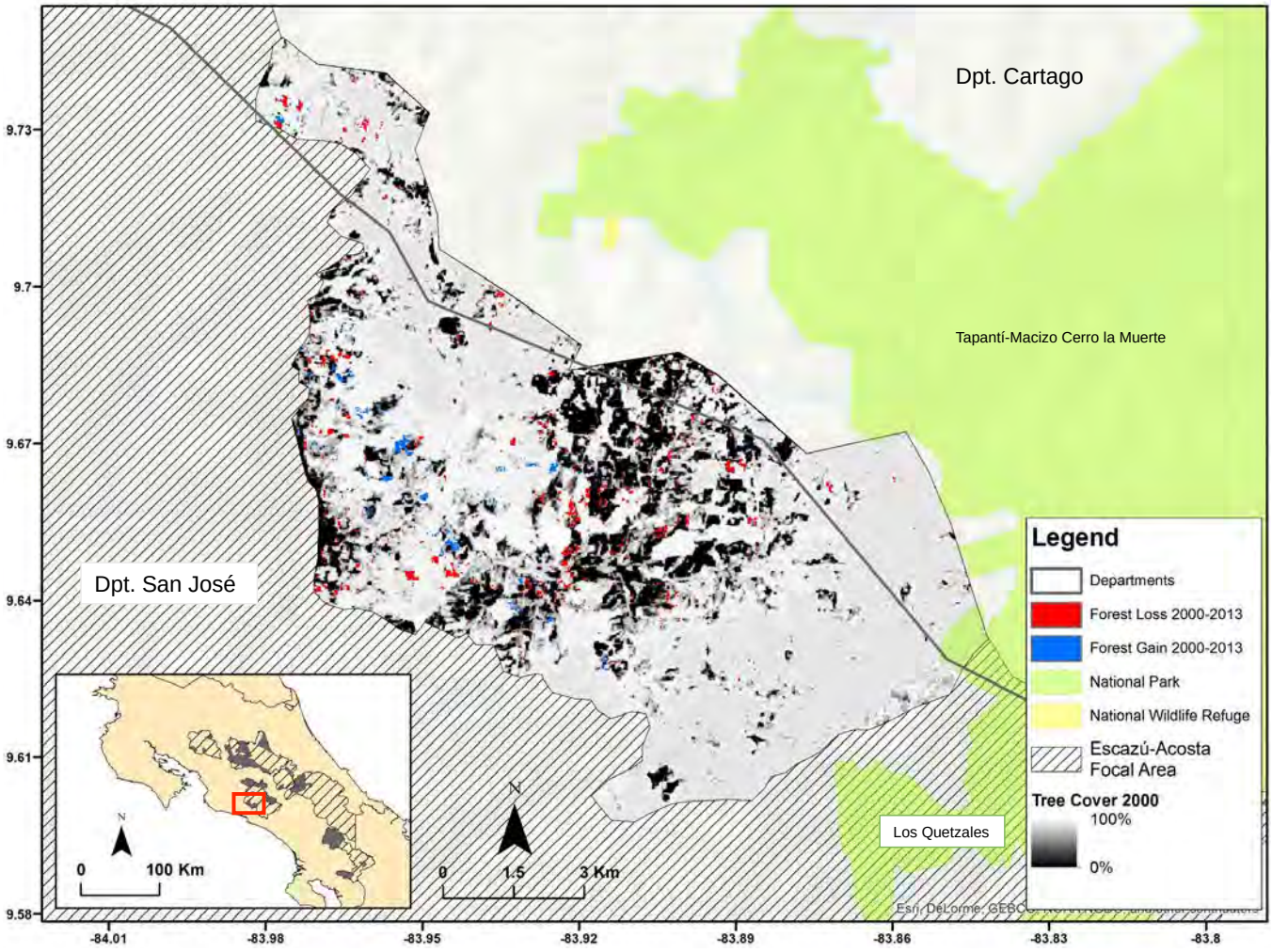
Costa Rica: CR4-1 - Escazú-Acosta: Cerros de Escazú-El Guarco



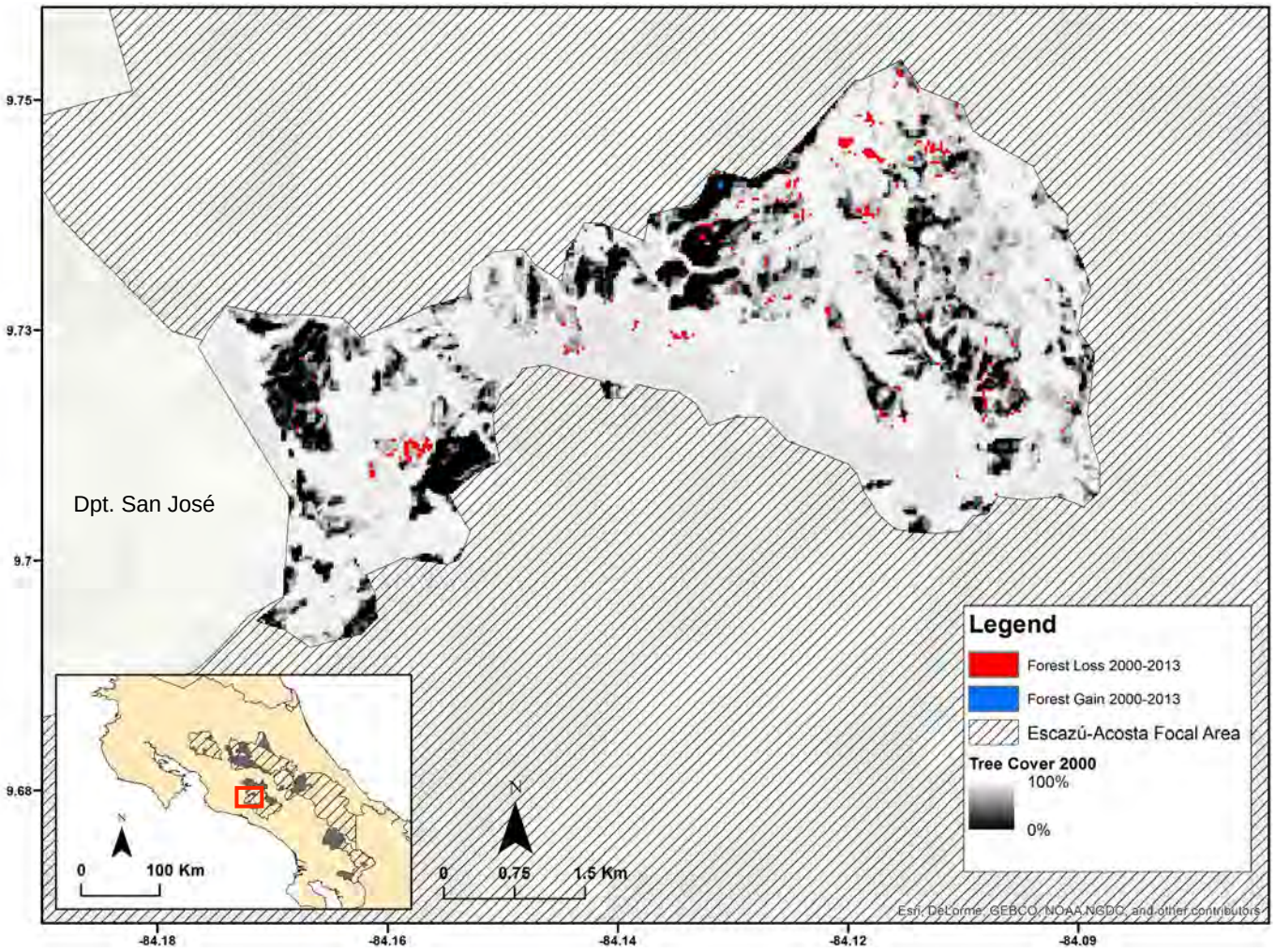
Costa Rica: CR4-2 - Escazú-Acosta: Tarrazu



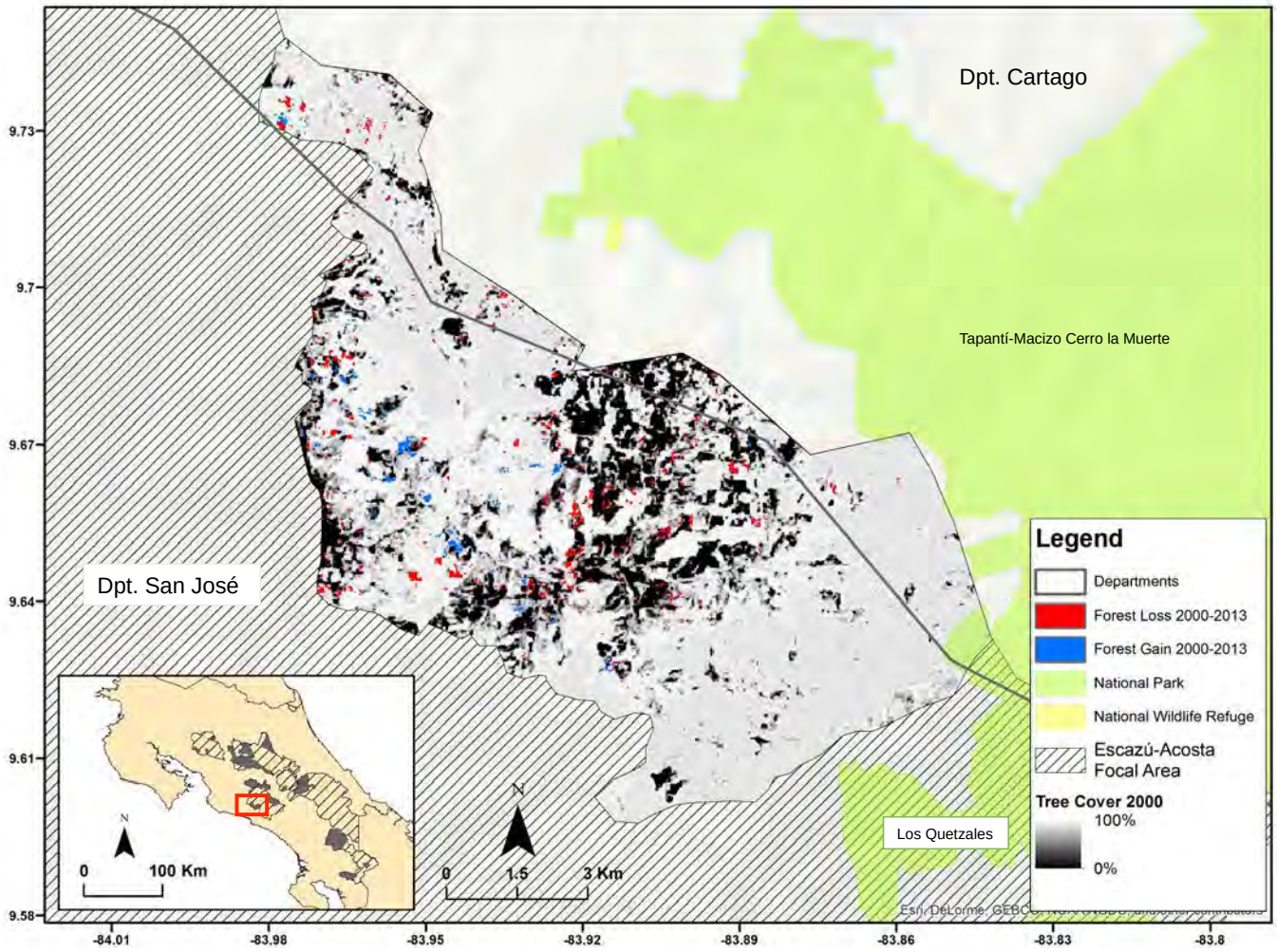
Costa Rica: CR4-3 - Escazú-Acosta: Dota-Cerro de la Muerte



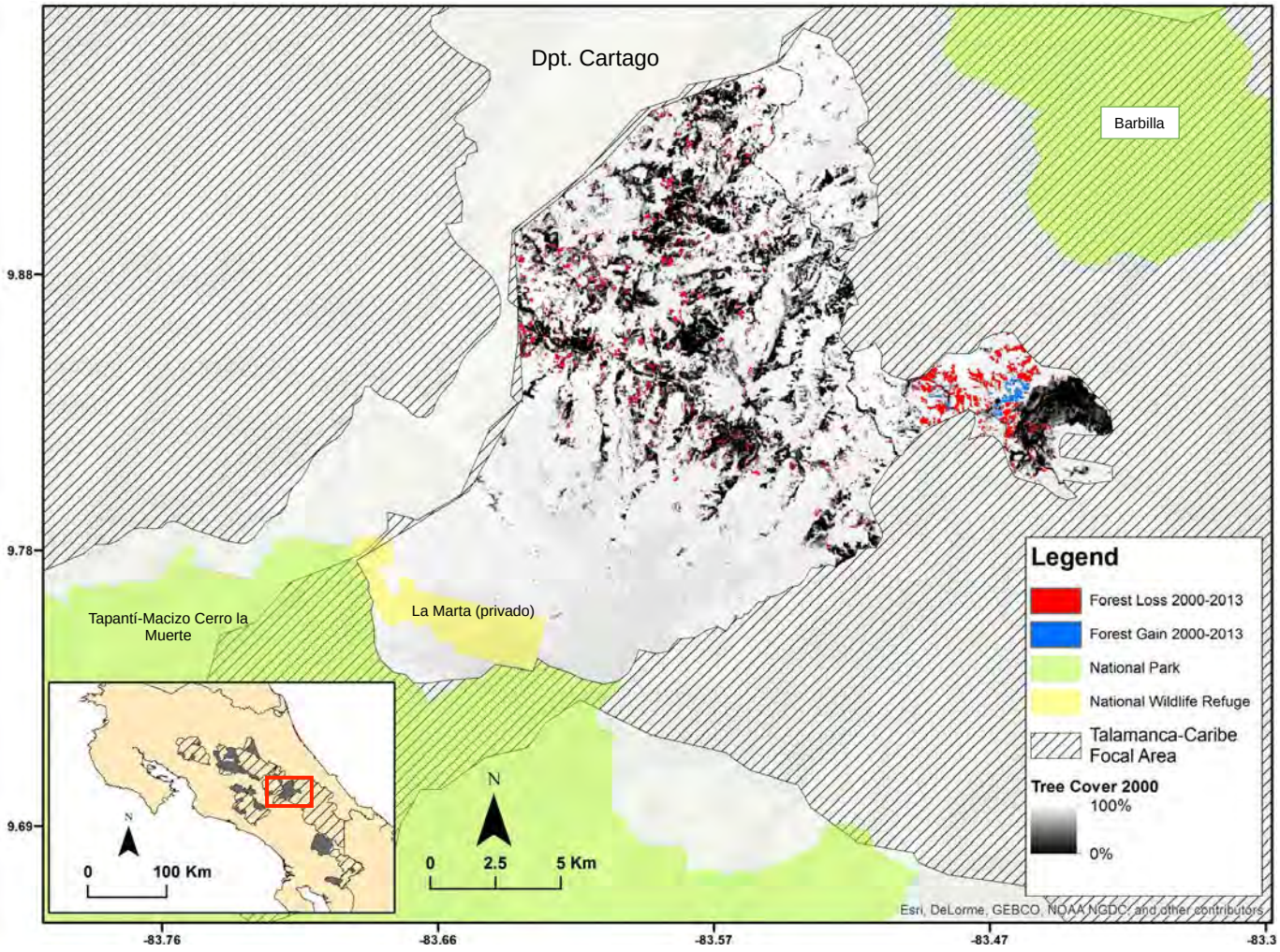
Costa Rica: CR4-4 - Escazú-Acosta: Aserri



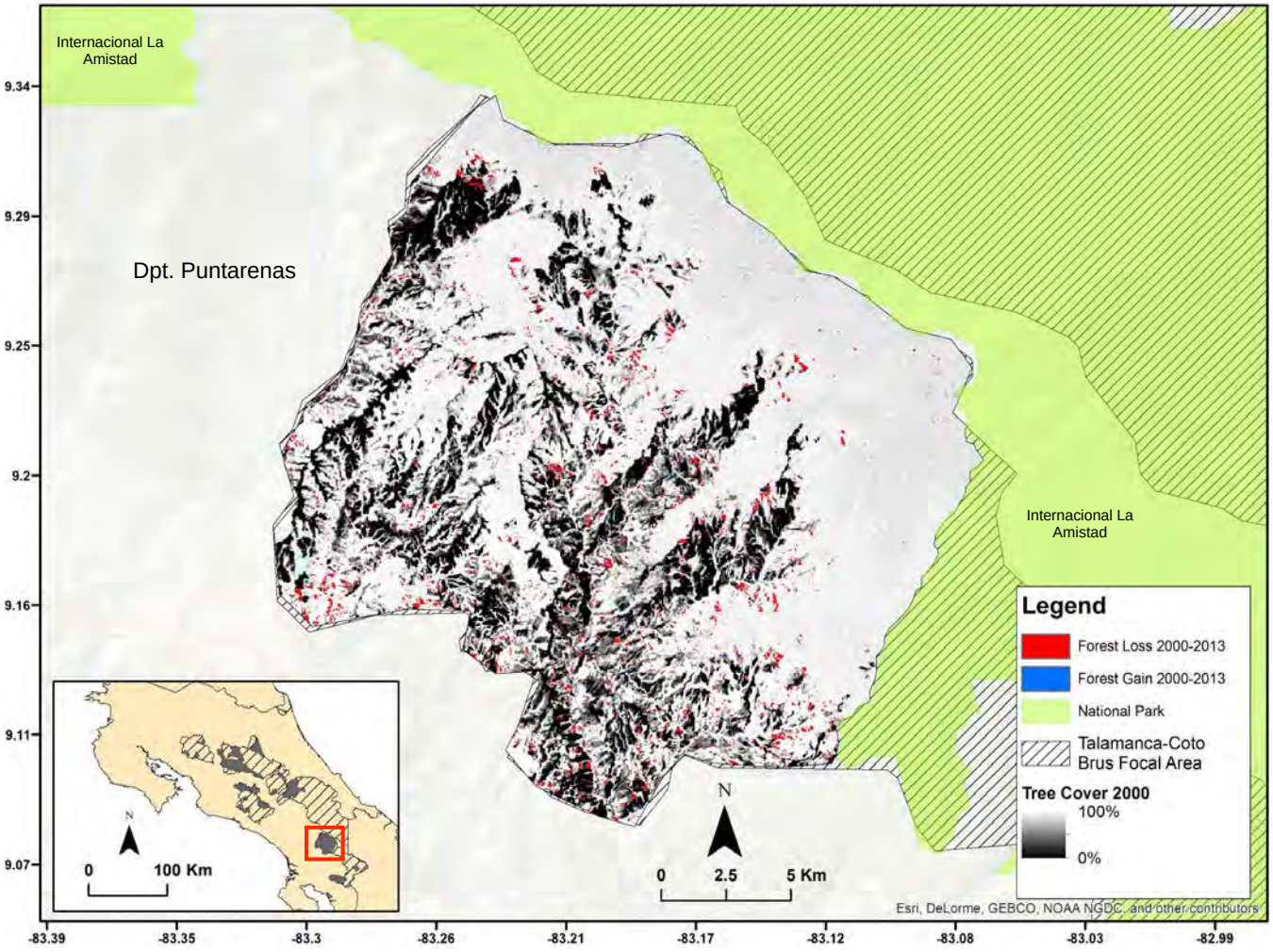
Costa Rica: CR5-1 - Talamanca-Caribe: Pacuare



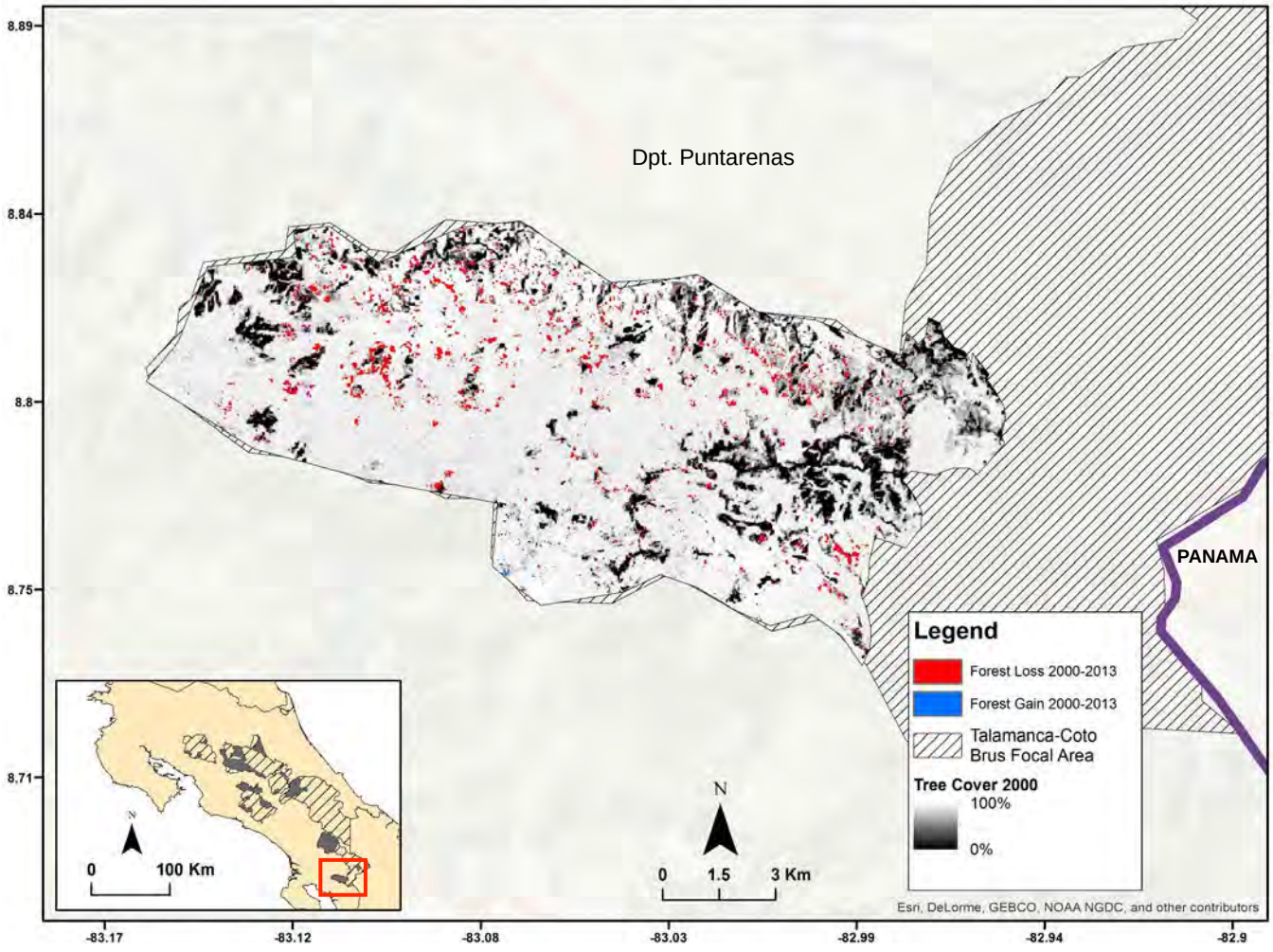
Costa Rica: CR6-1 - Talamanca-Coto Brus: Buenos Aires



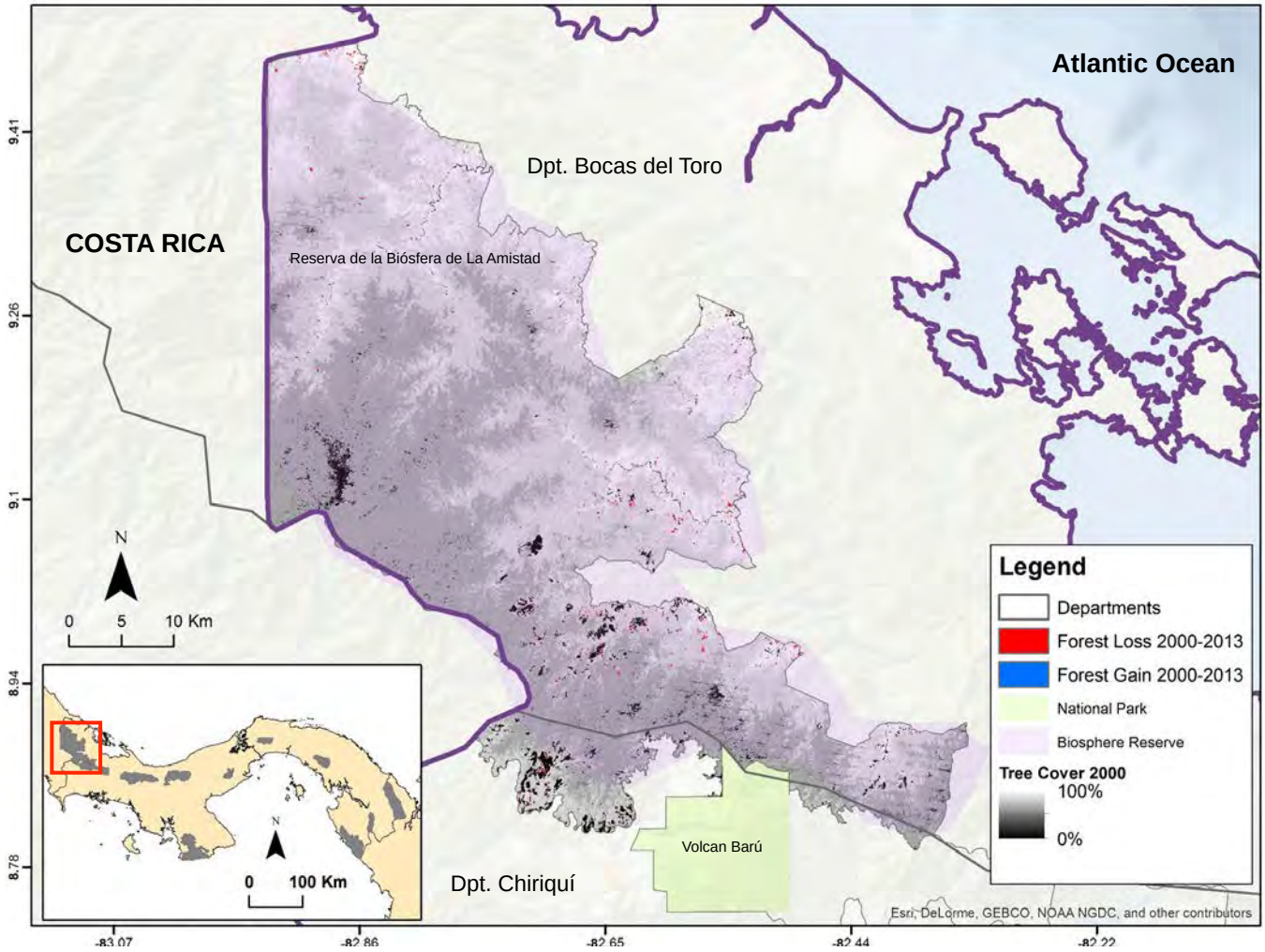
Costa Rica: CR6-2 - Talamanca-Coto Brus: San Vito de Coto Brus



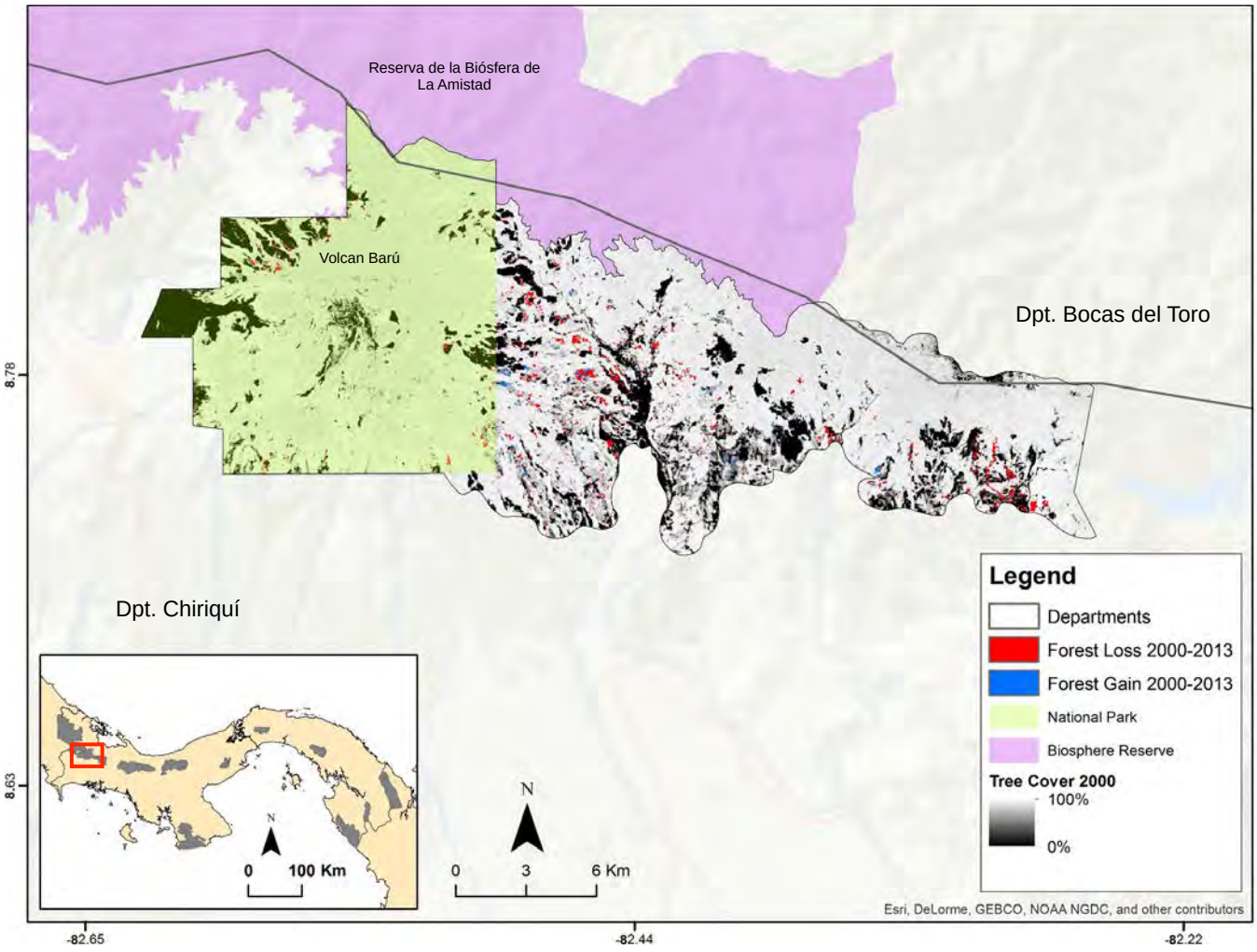
Costa Rica: CR6-3 - Talamanca-Coto Brus: Las Alturas



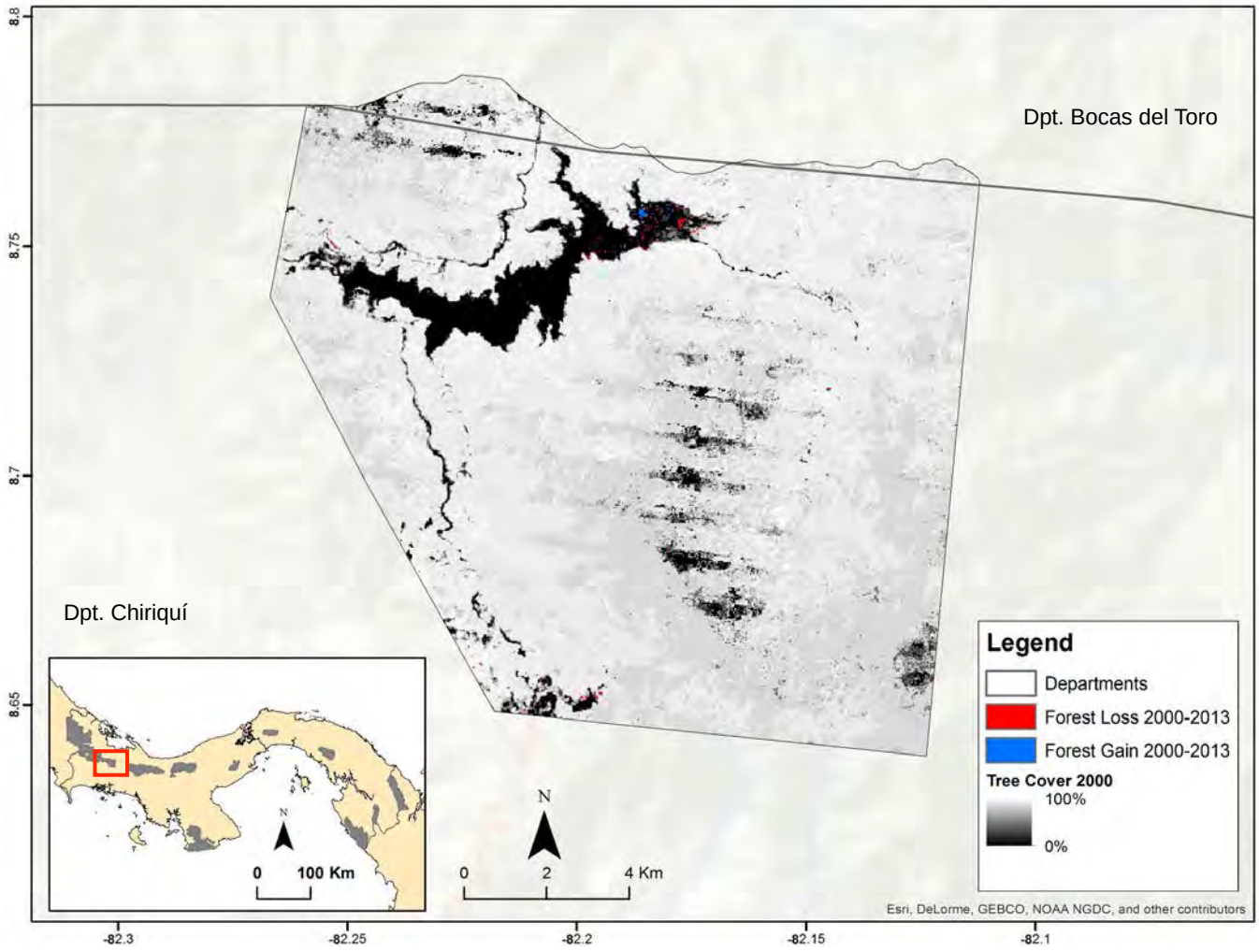
Panama: PA01 - La Amistad



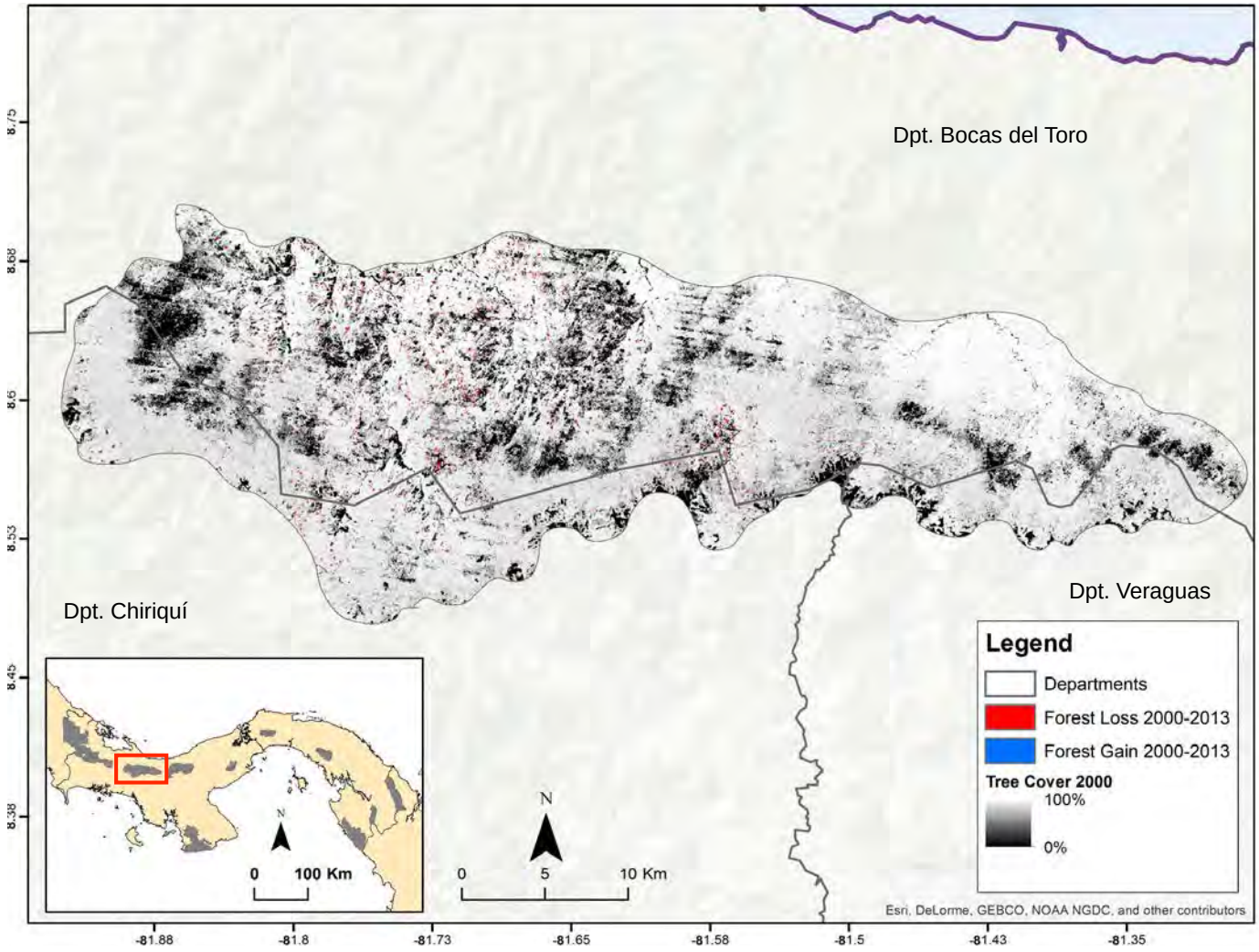
Panama: PA02 – Boquete



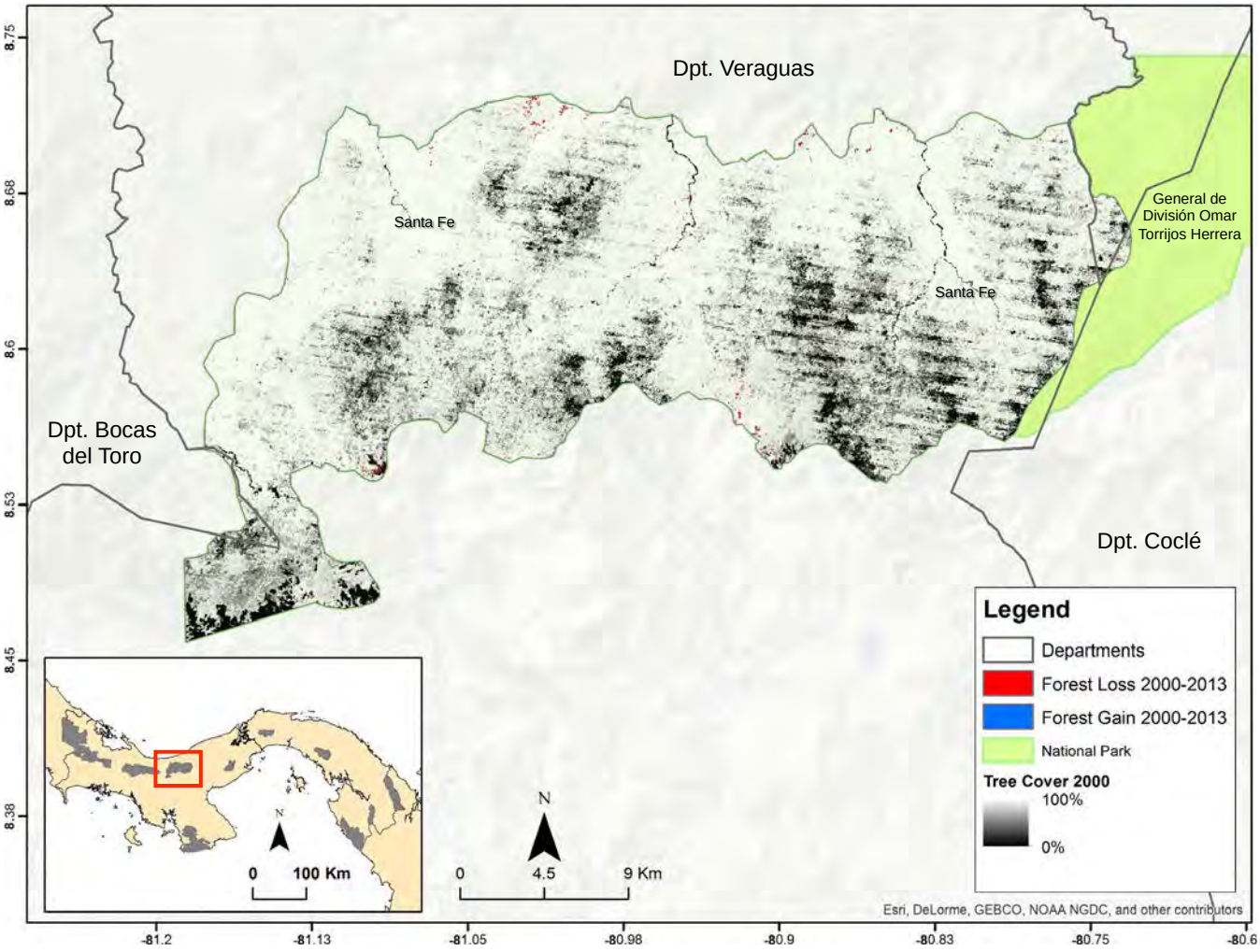
Panama: PA03 – Fortuna



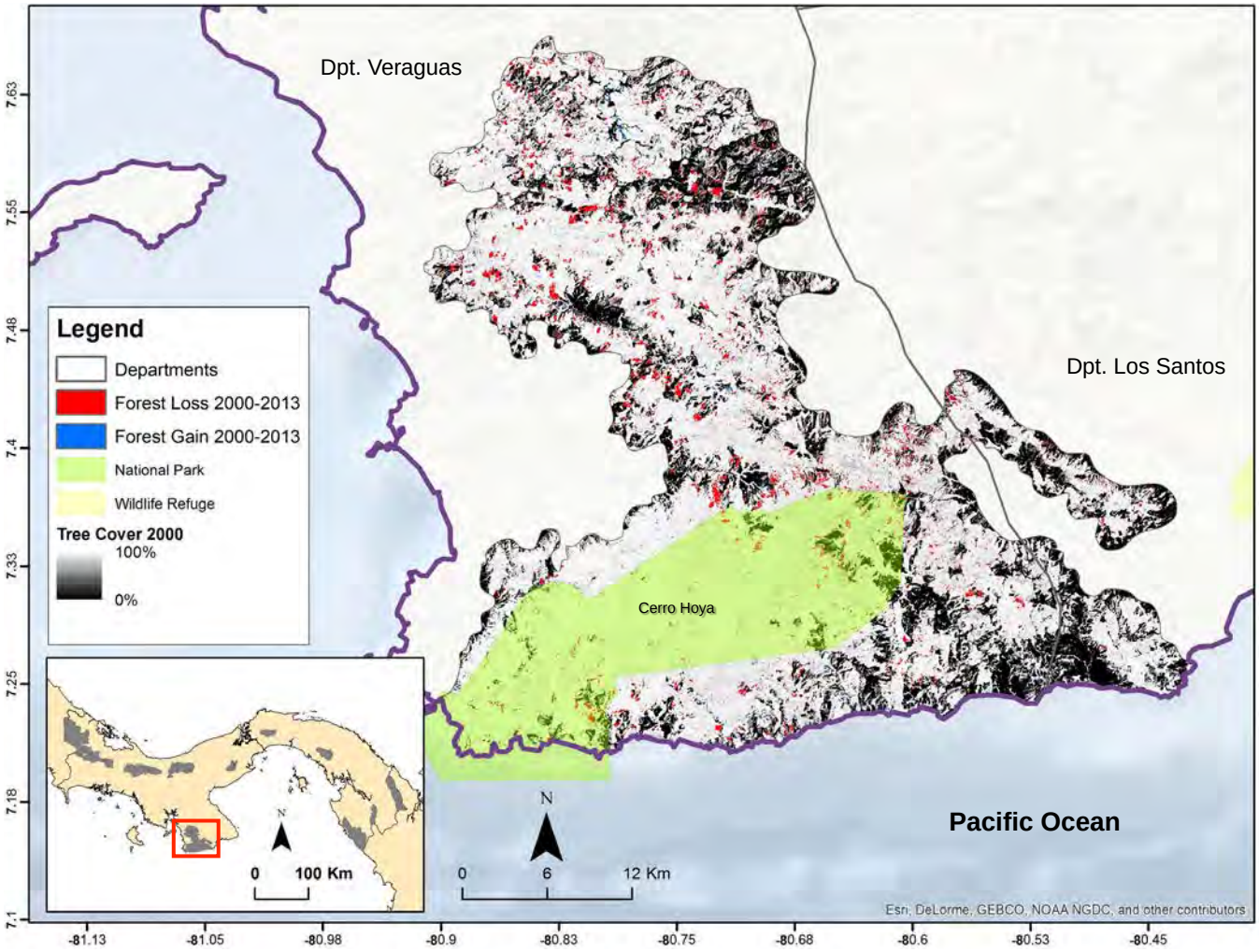
Panama: PA04 - Ngobe Bugle Highlands



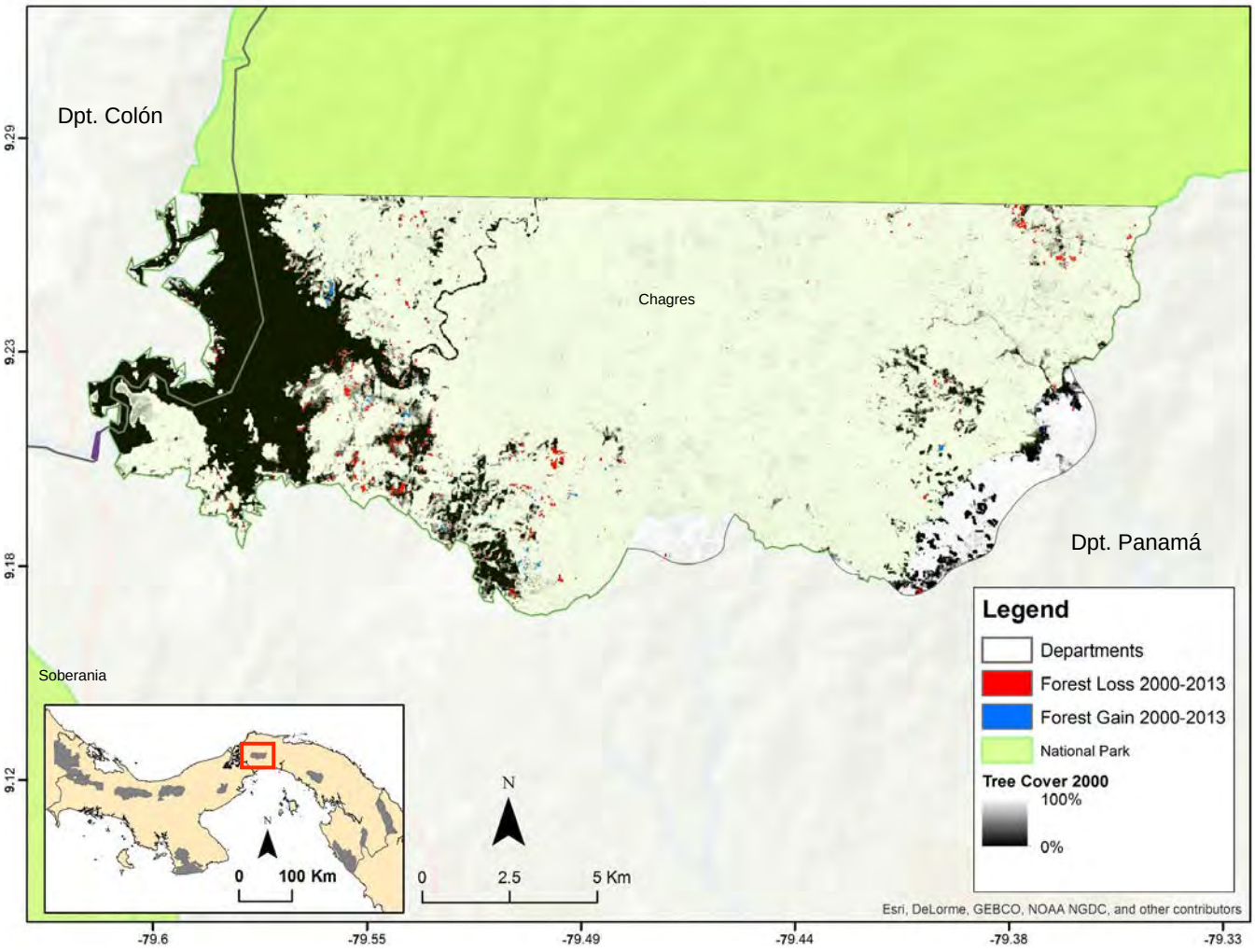
Panama: PA05 - Santa Fe



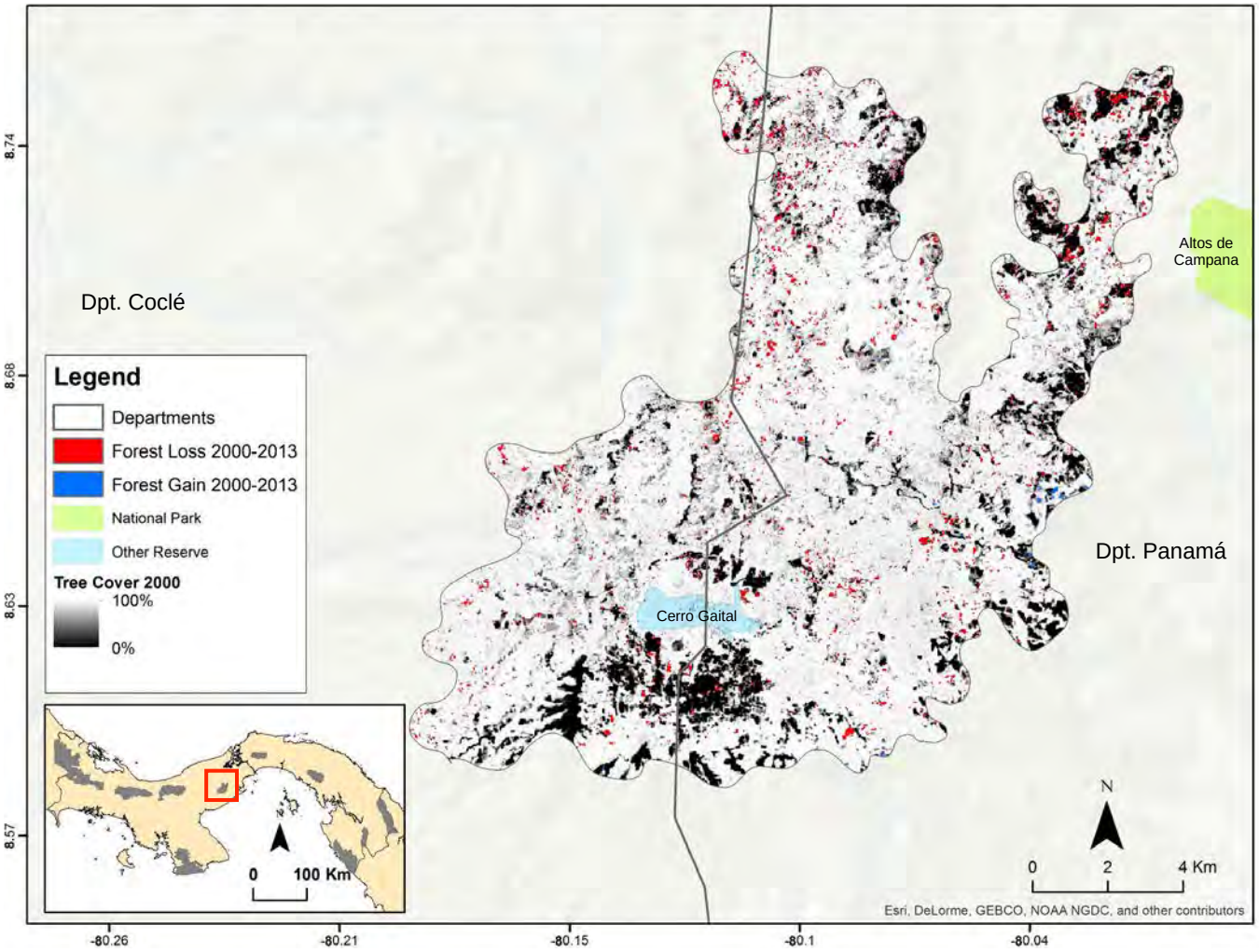
Panama: PA06 - Cerro Hoya



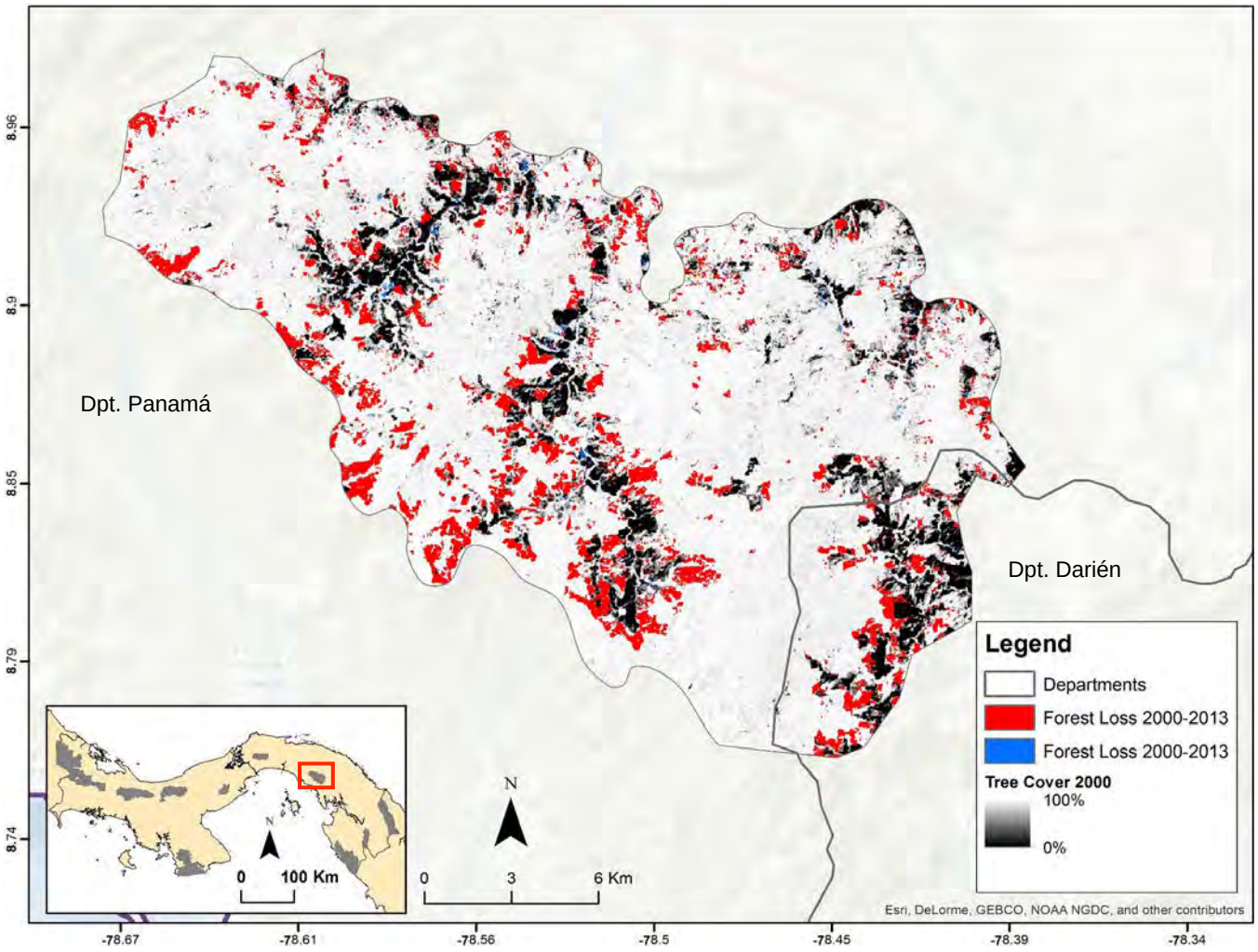
Panama: PA07 - Valle de Antón



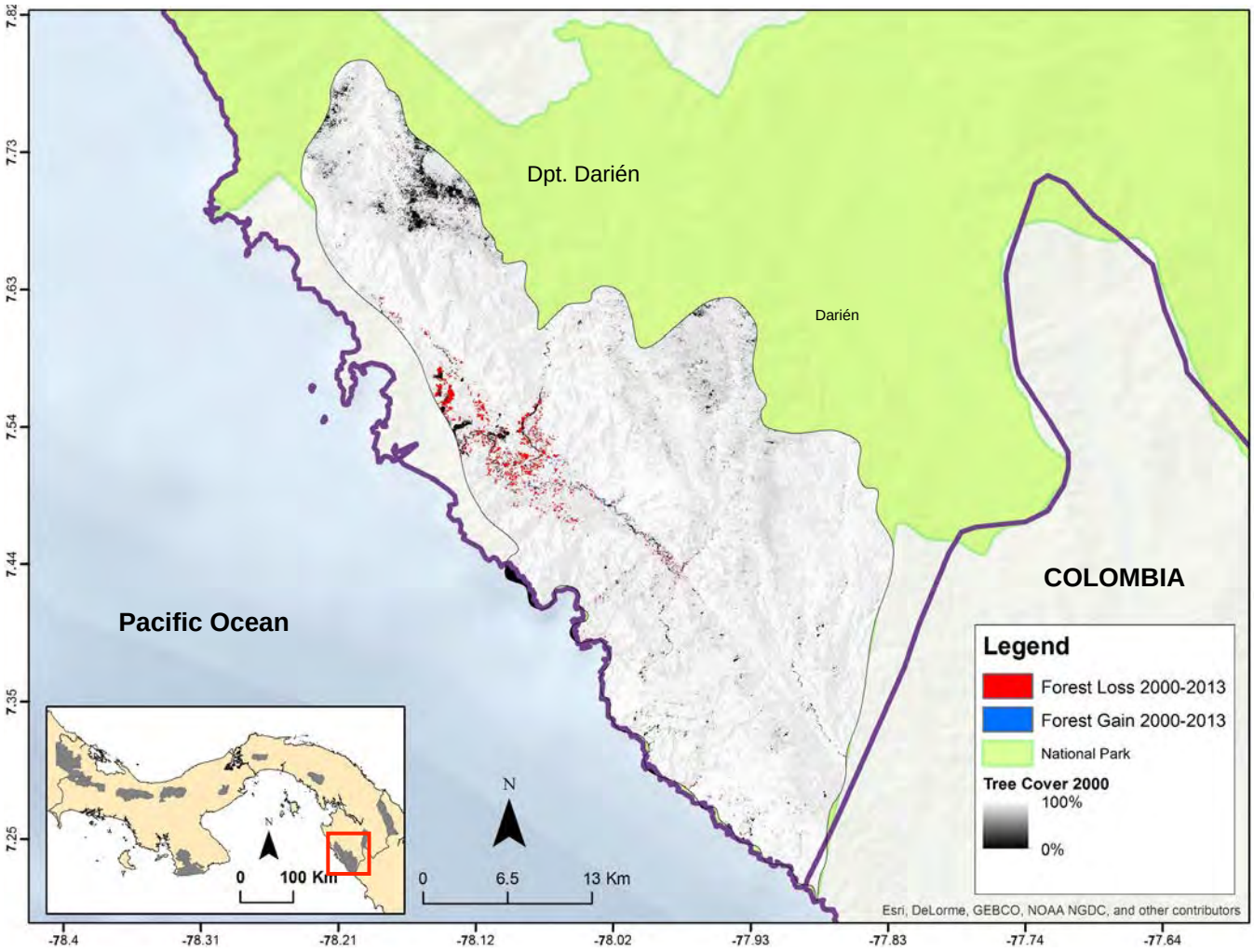
Panama: PA08 – Chagres



Panama: PA09 – Chucanti



Panama: PA10 - Cordillera de Jurado



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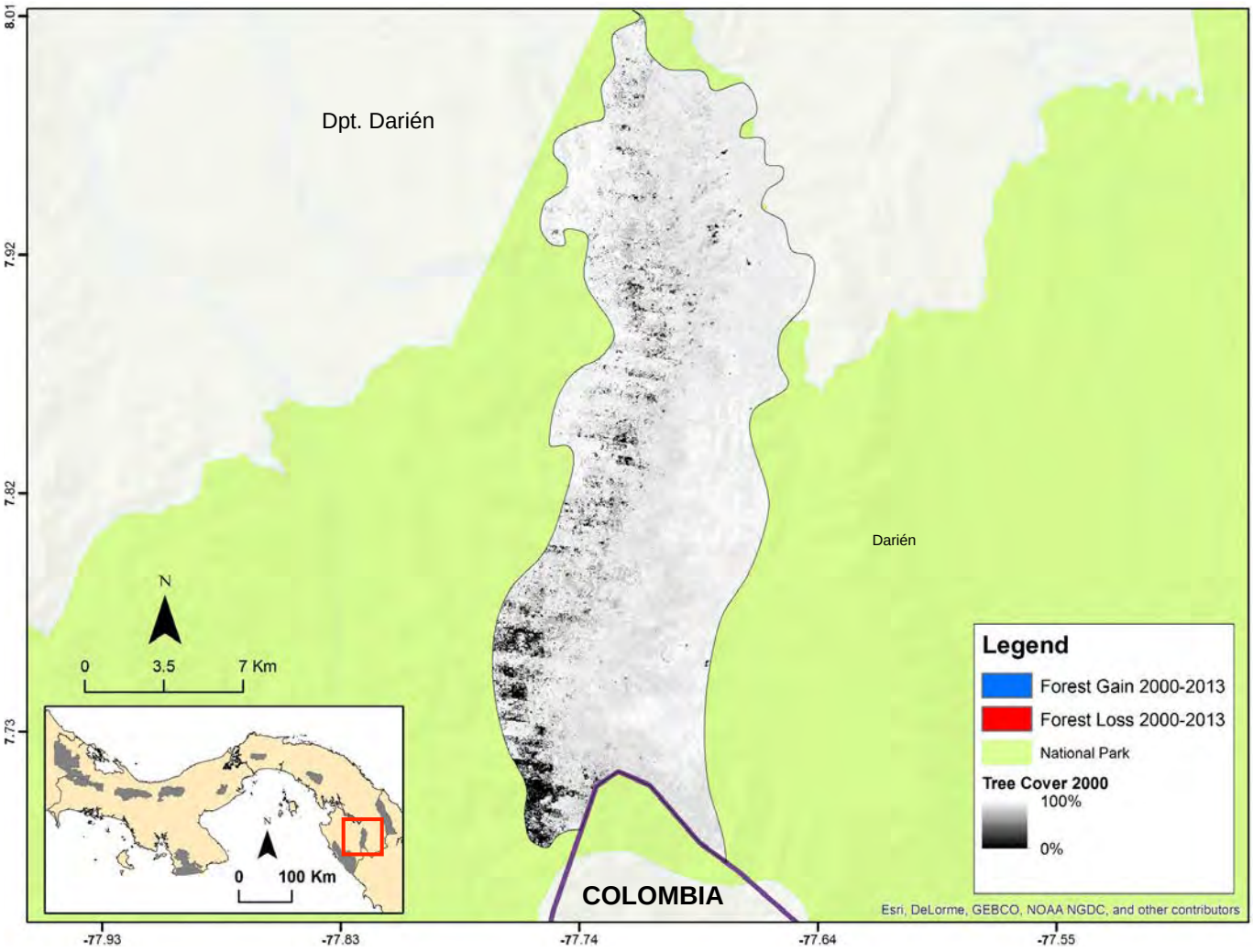

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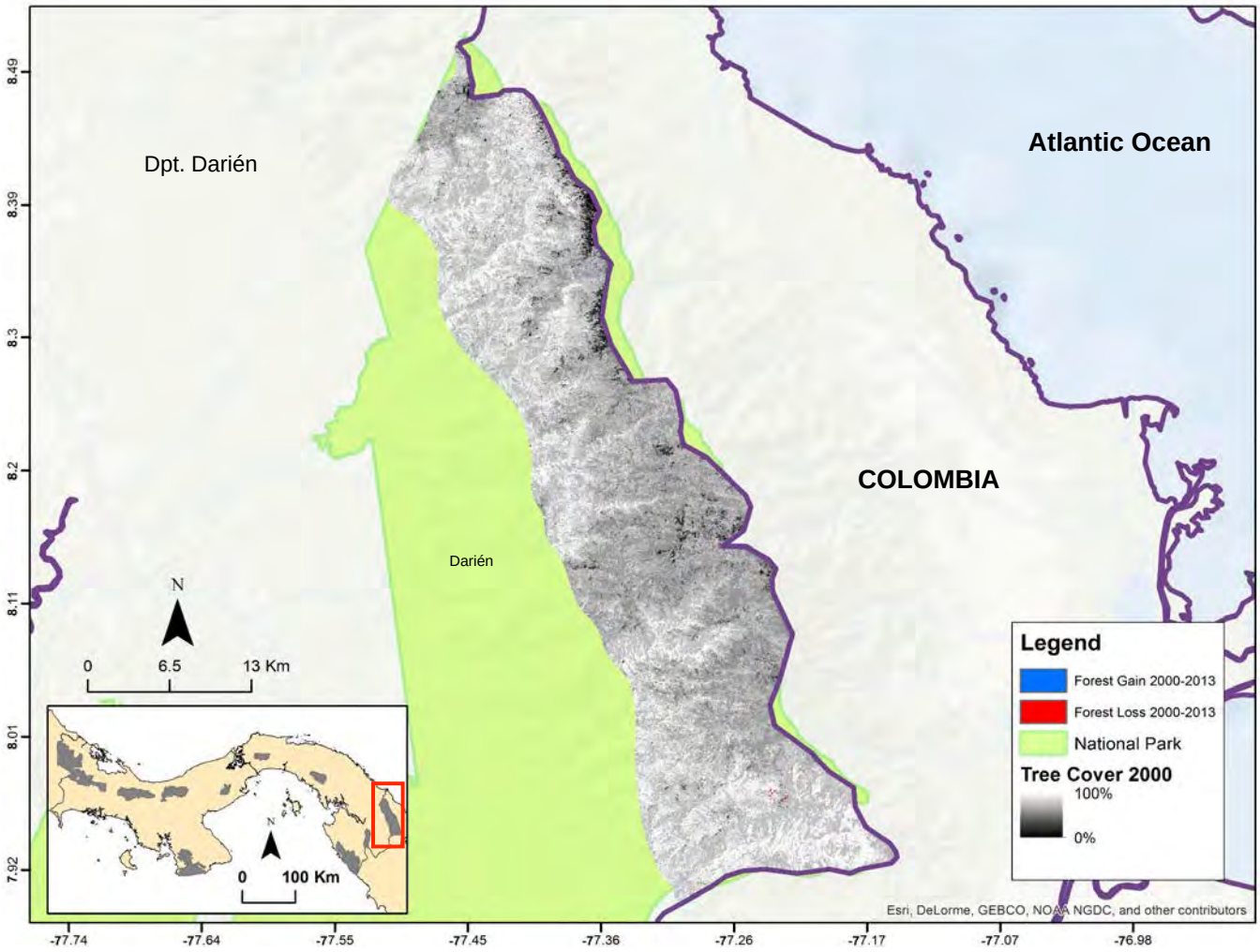

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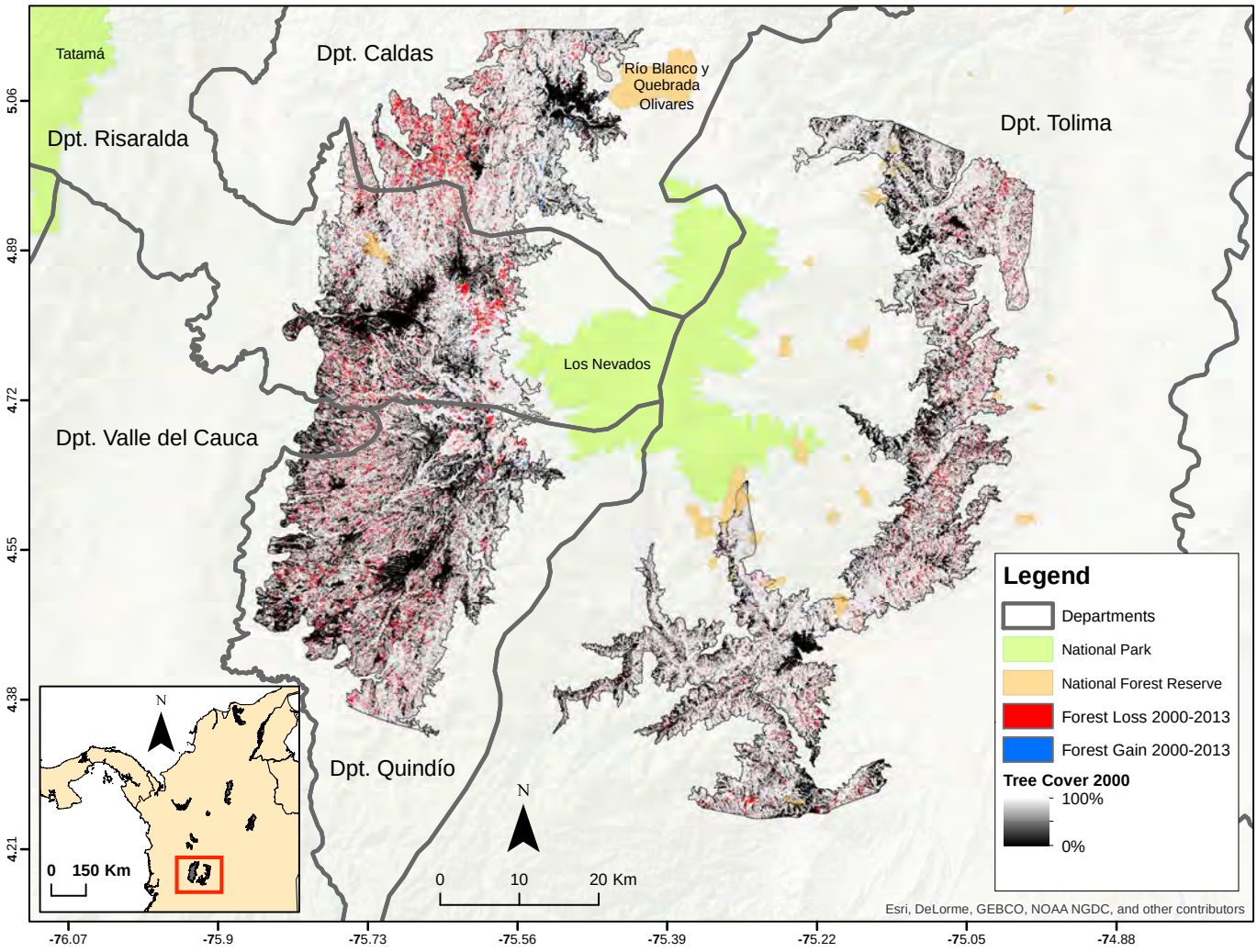

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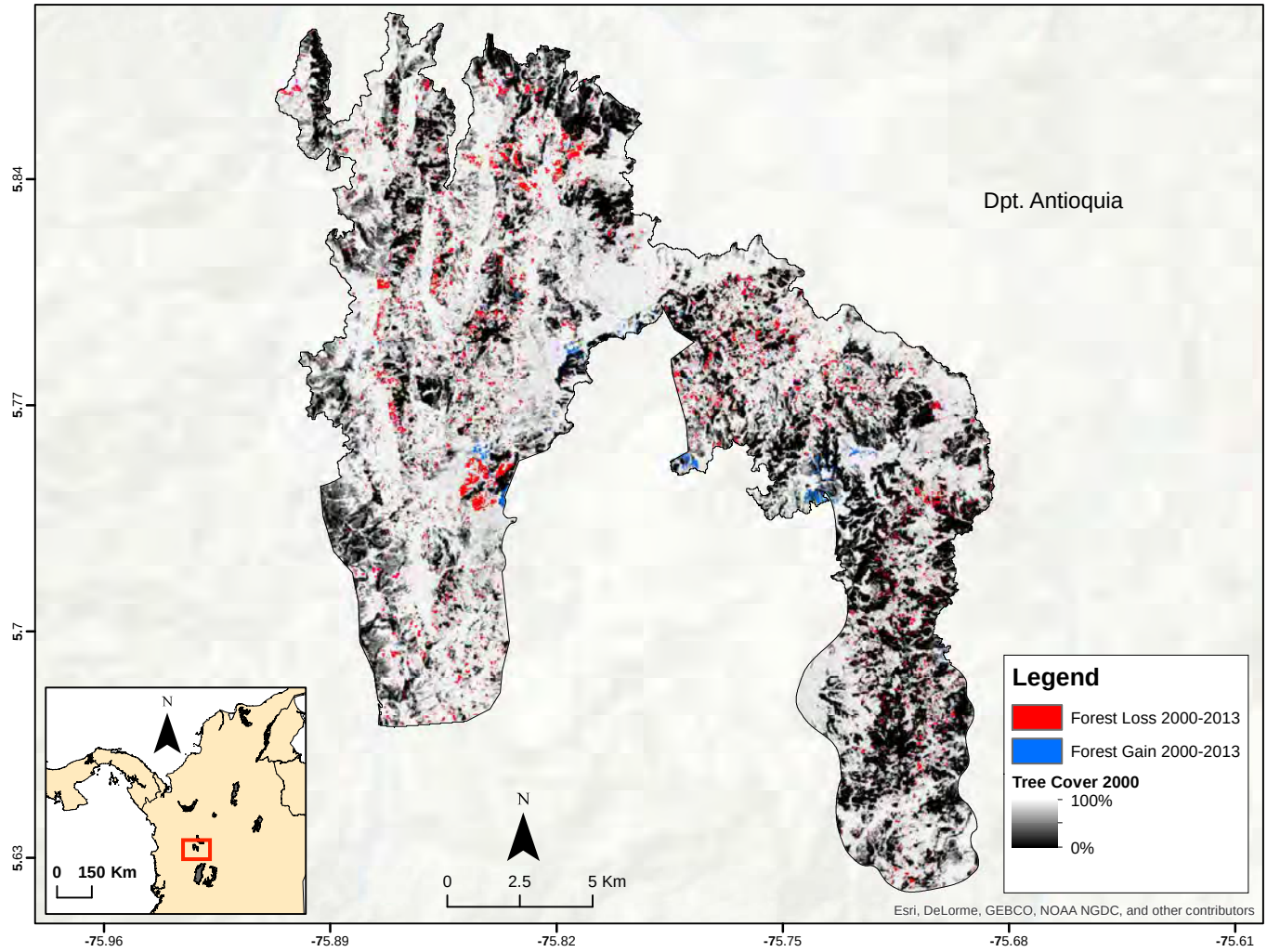

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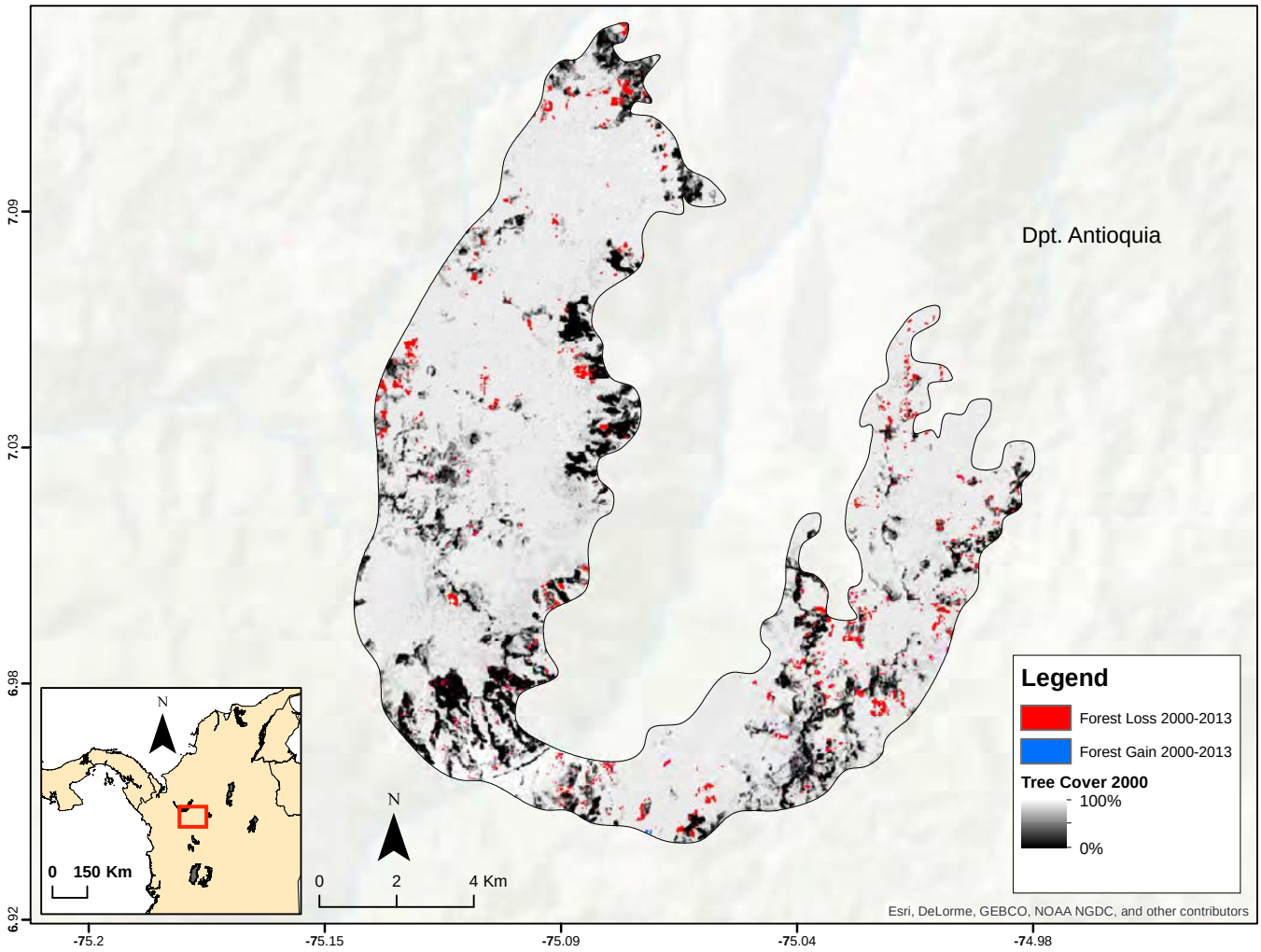

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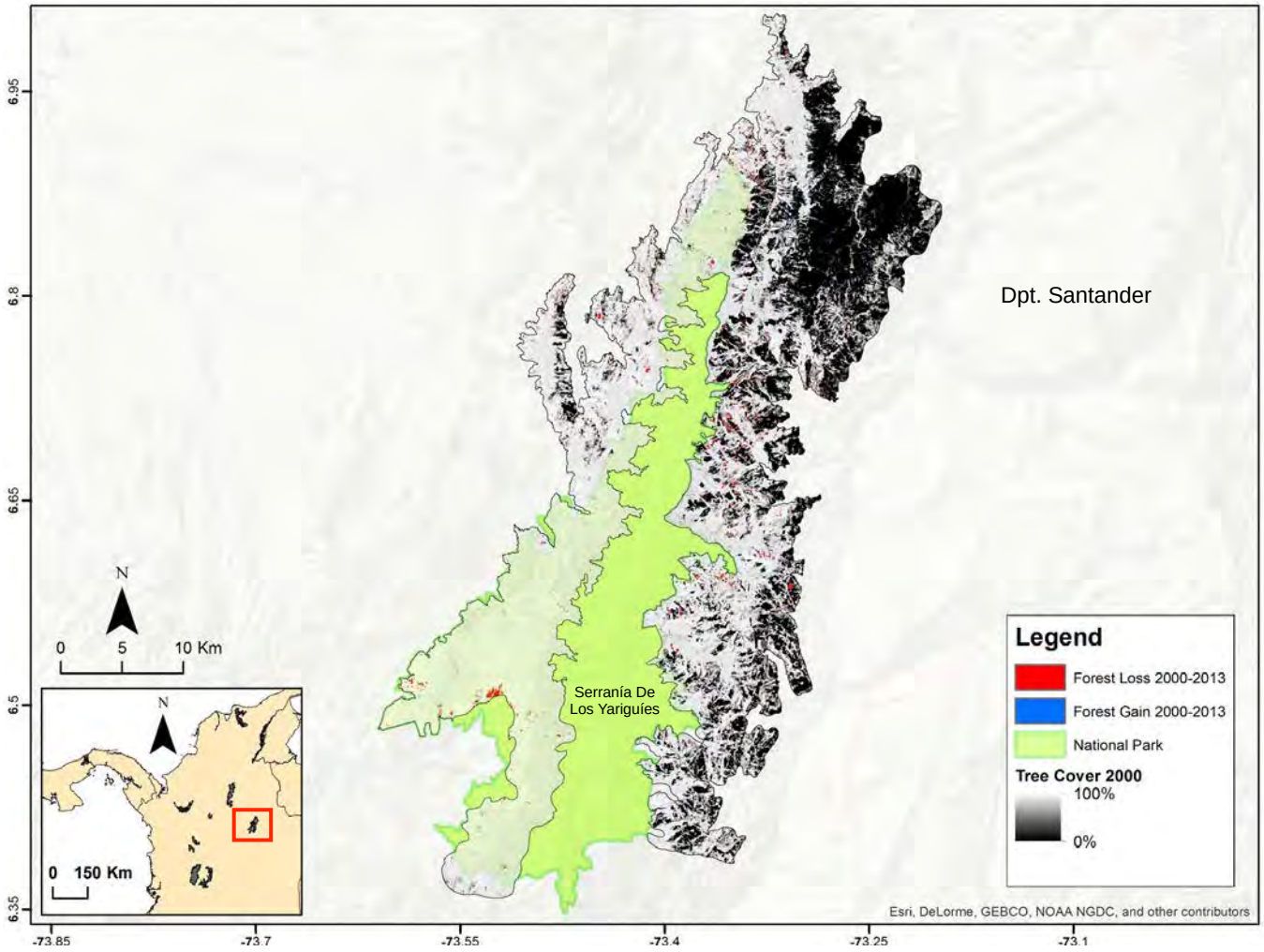

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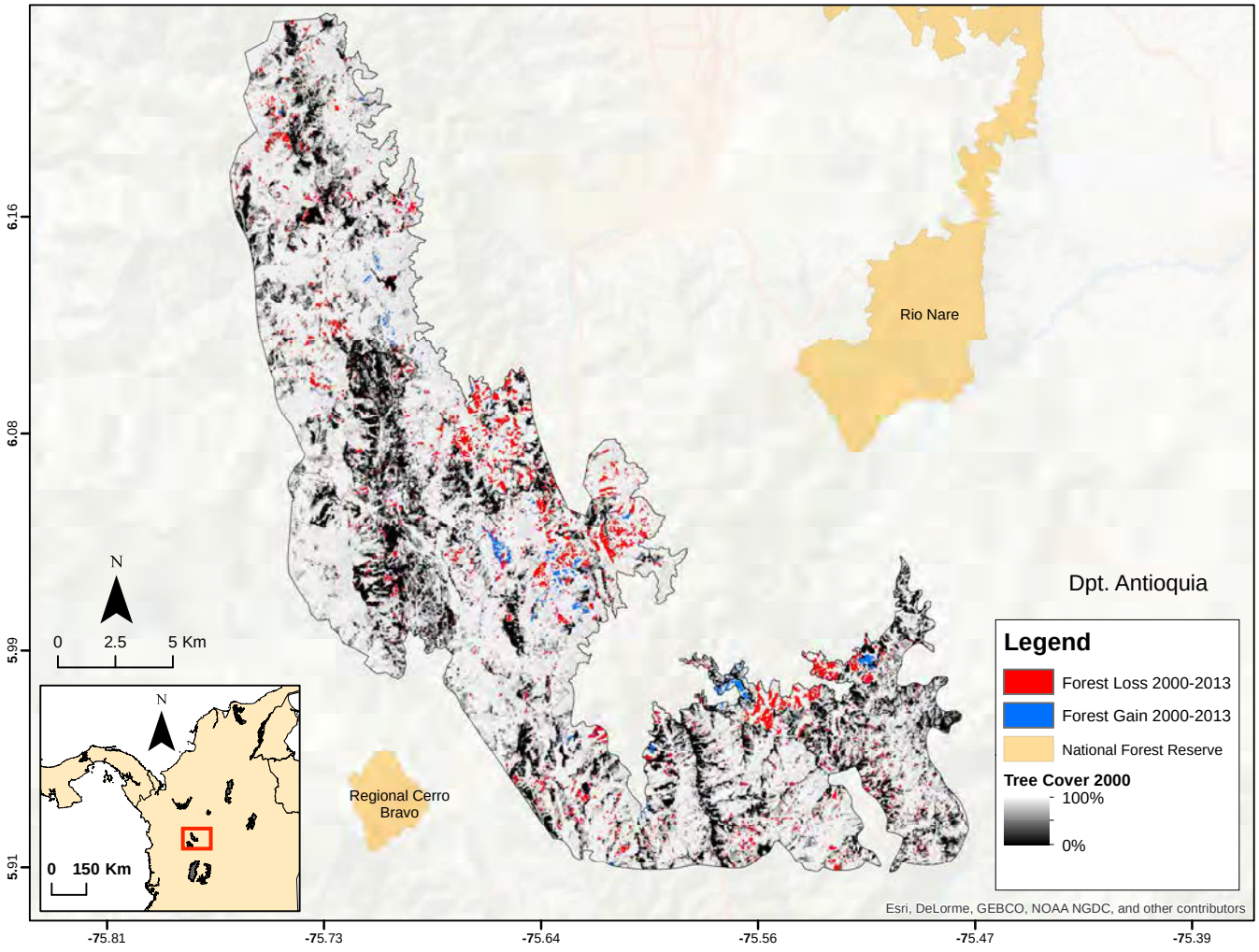

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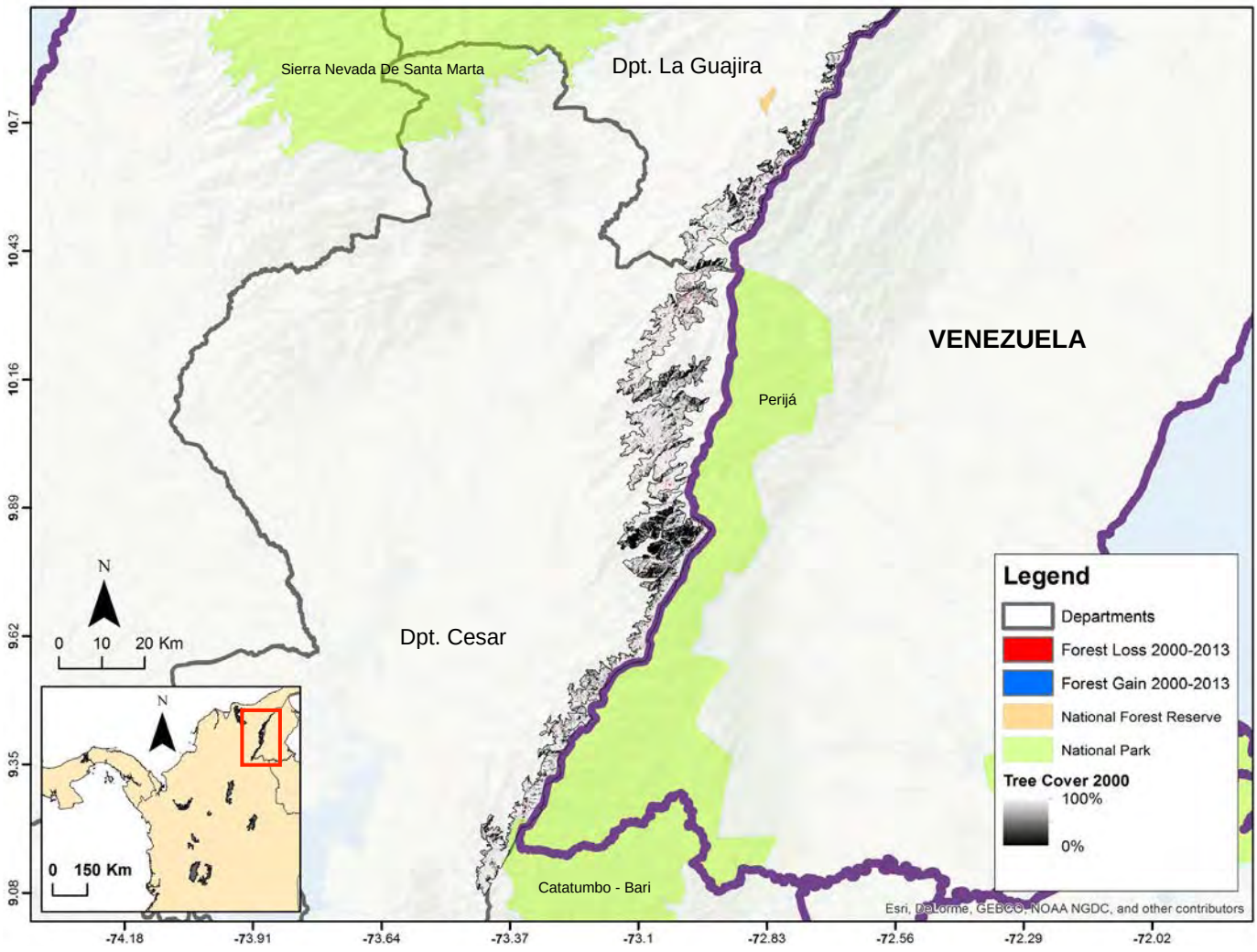

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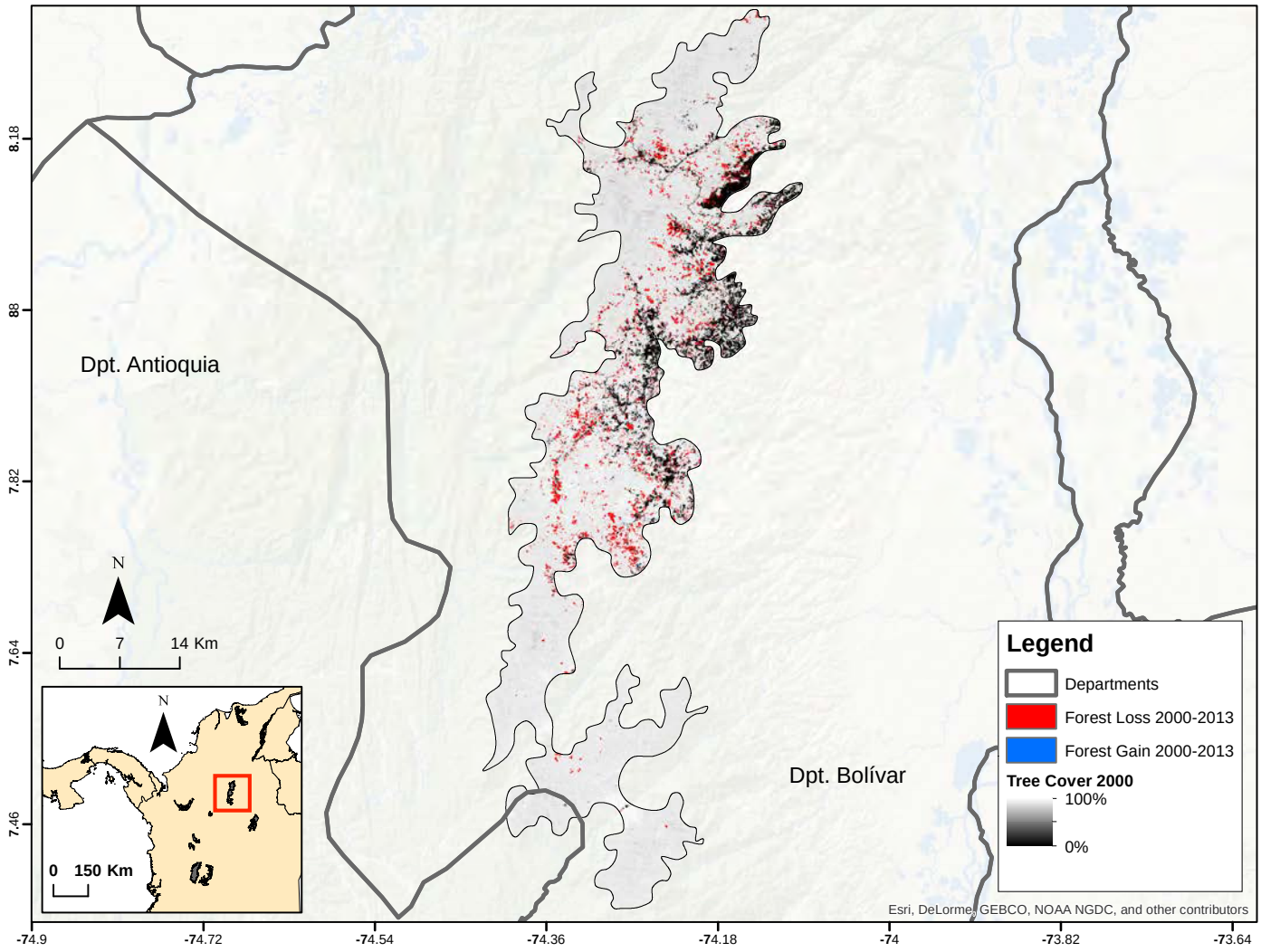

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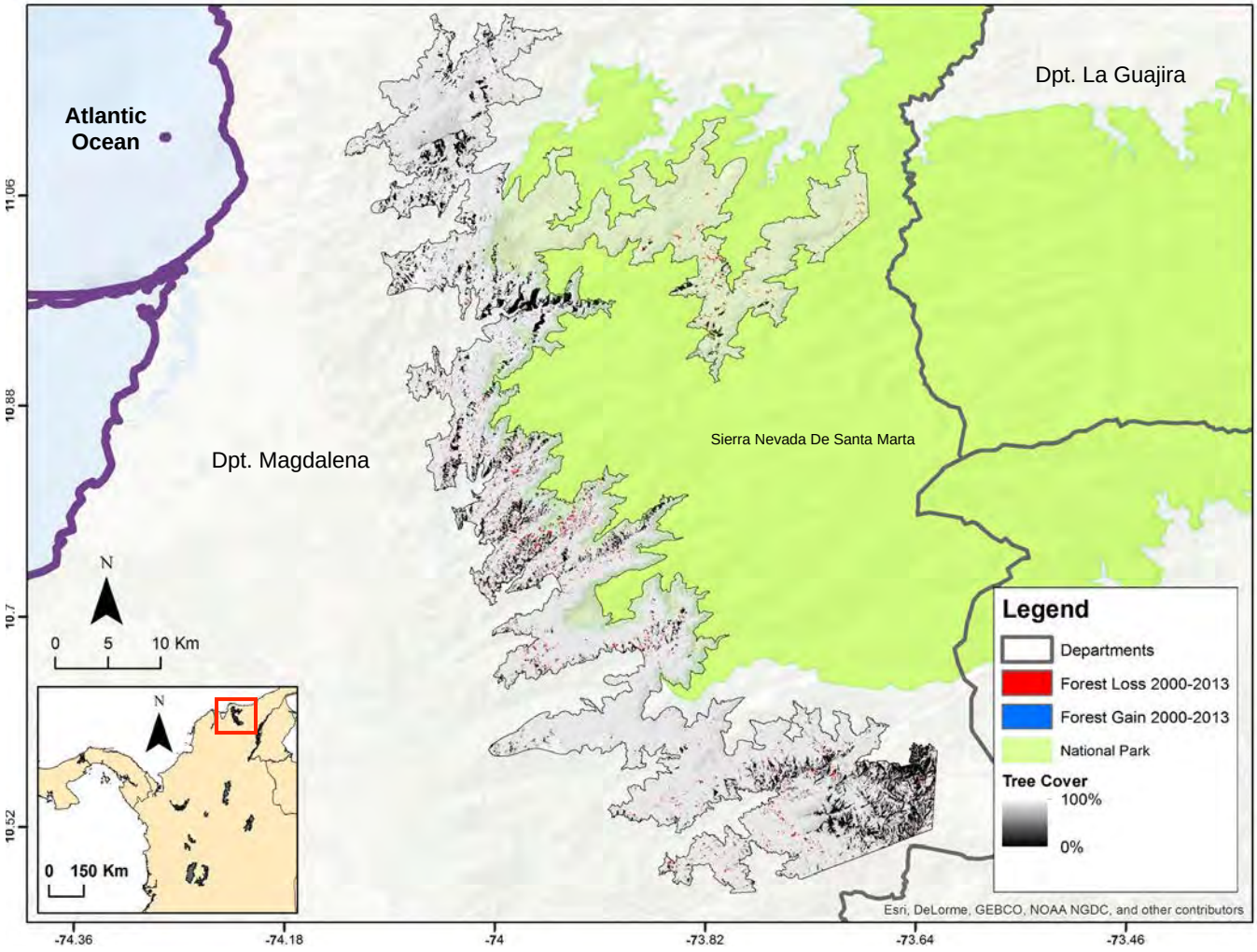

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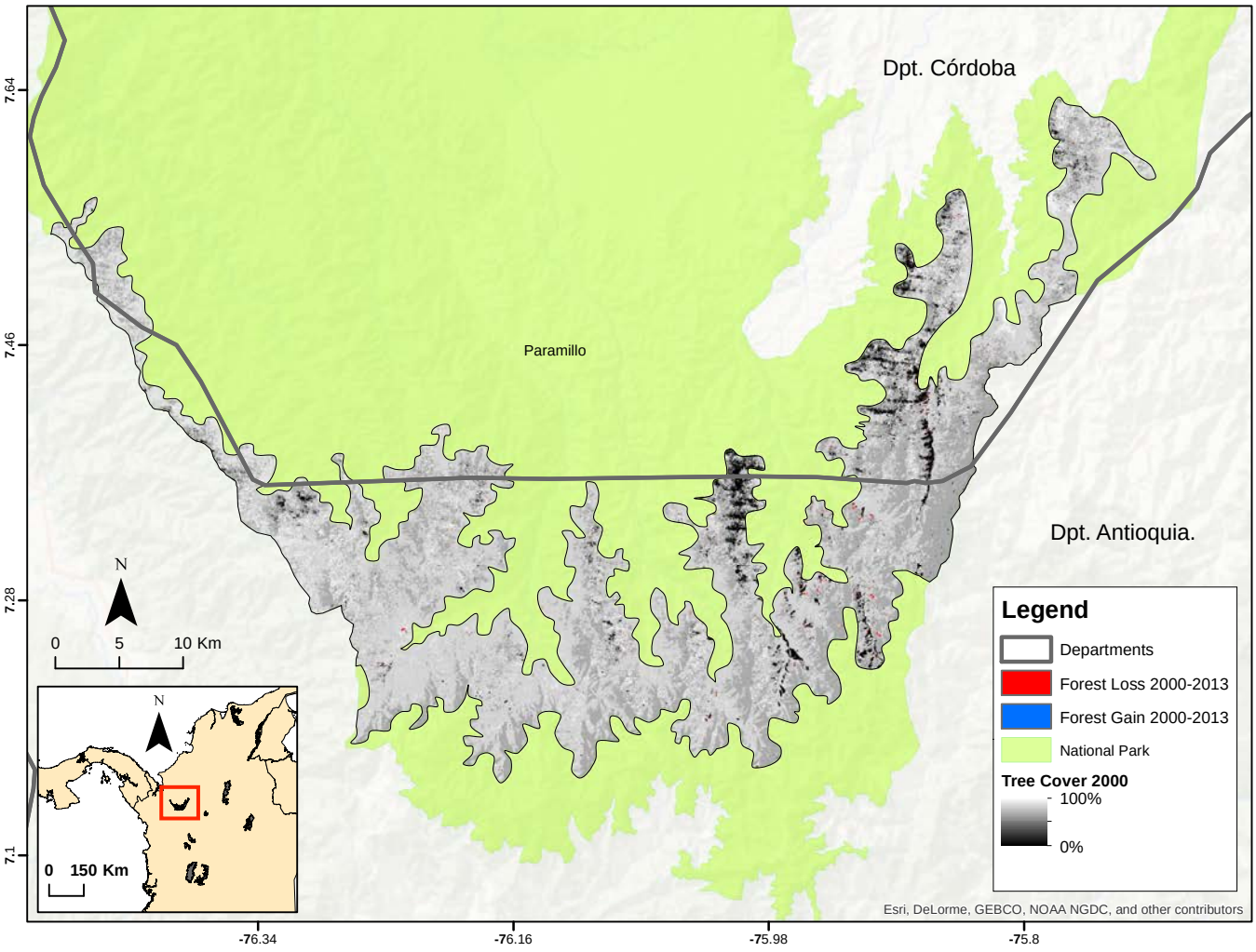

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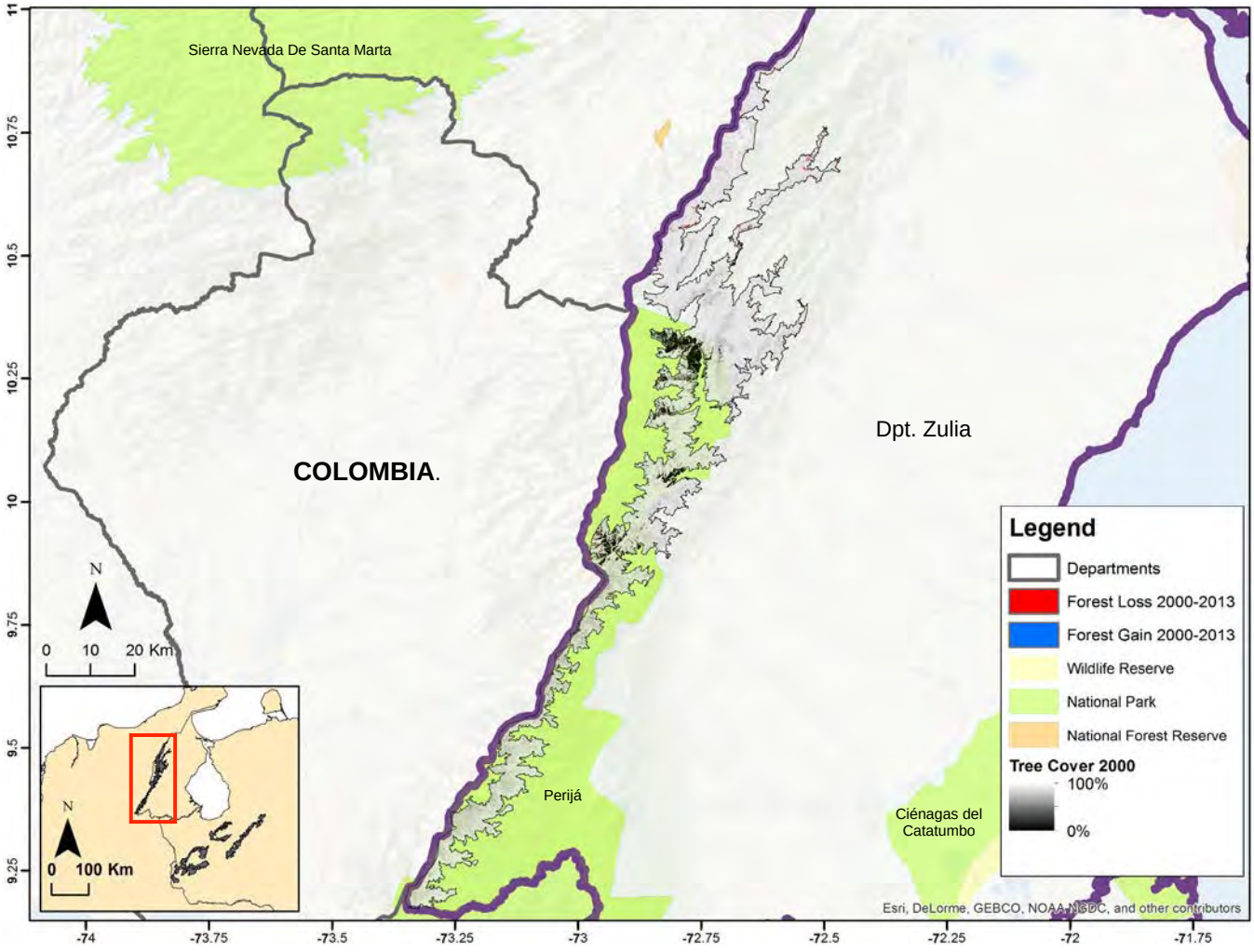

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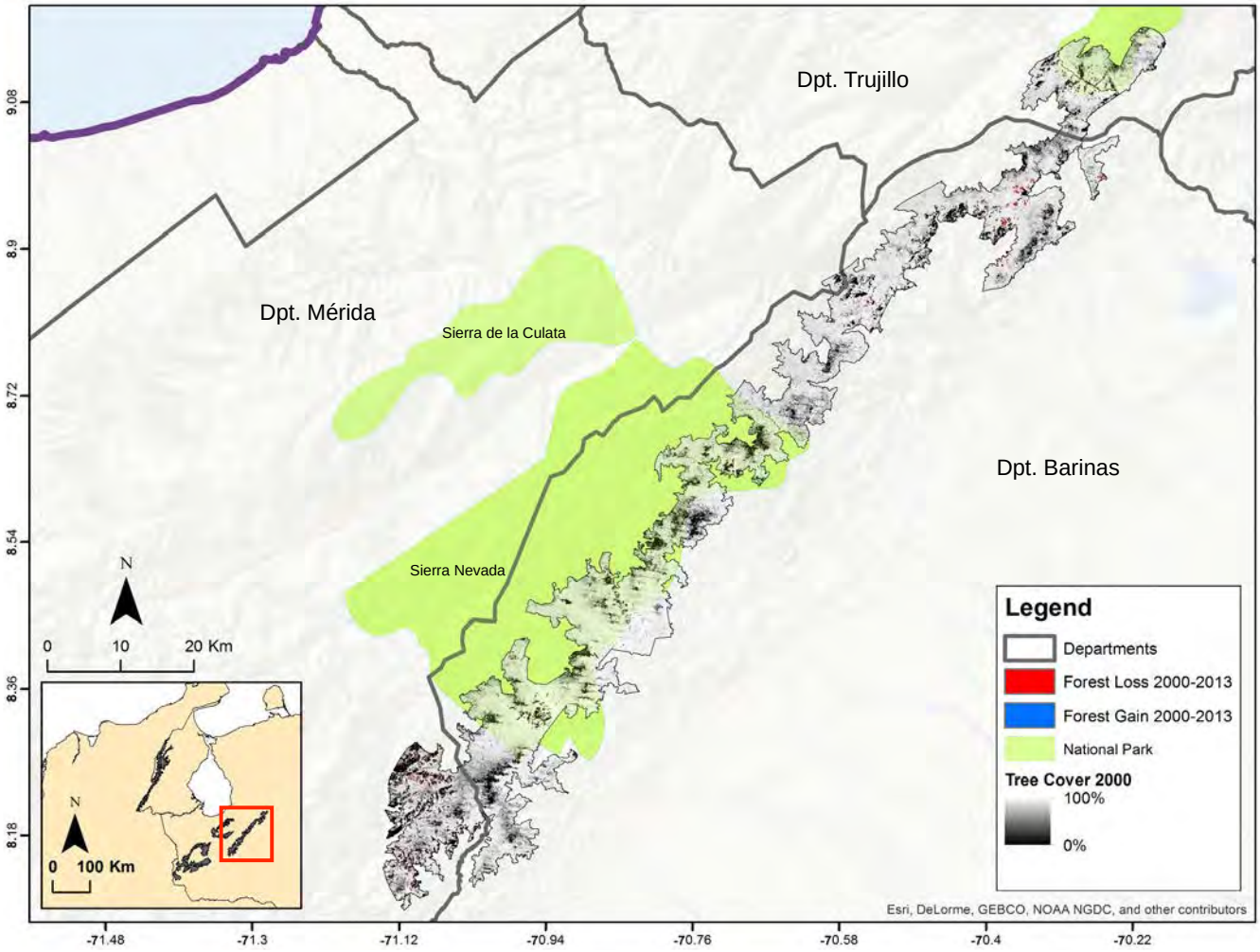

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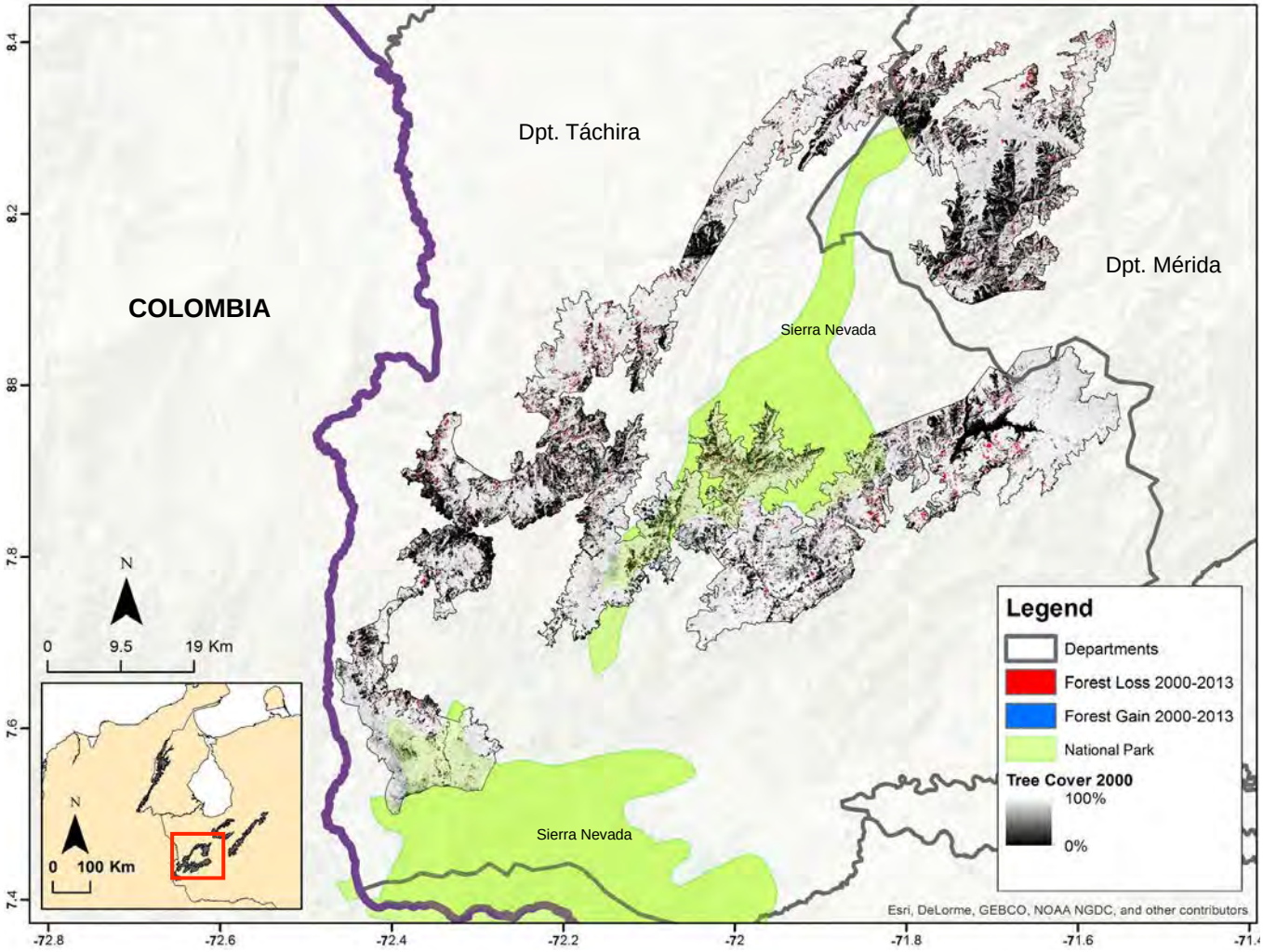

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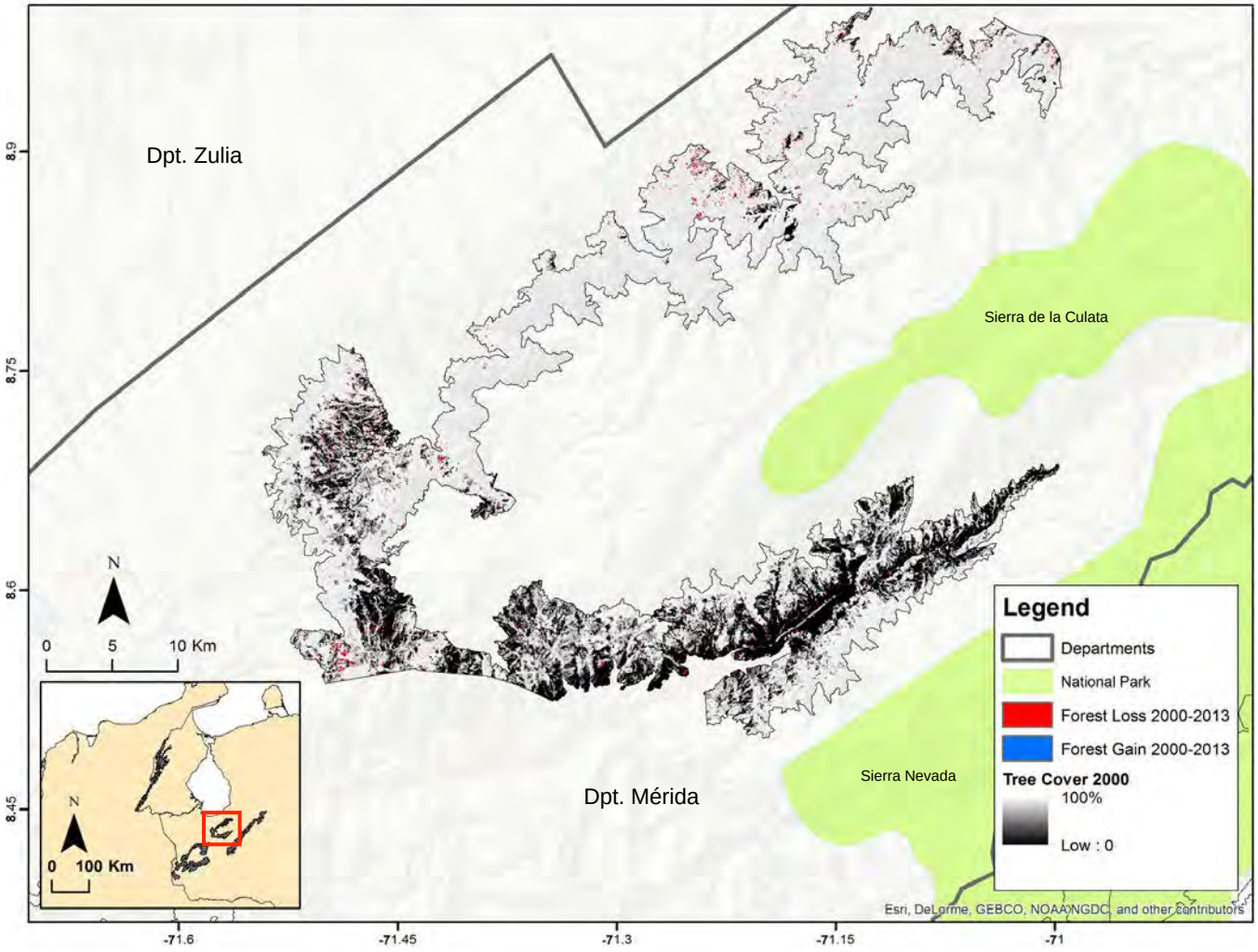

BIBLIOGRAPHY

American Bird Conservancy. 2013. Recommendations for the Golden-winged Warbler (Vermivora chrysoptera) focal areas in Honduras, Nicaragua, and Costa Rica: Results from 2013 Rapid Assessment. Internal Report.

American Bird Conservancy. 2014. Análisis regiónal de amenazas de la reinita alidora (Vermivora chyrsoptera). Internal Report.

Barker Swarthout, S., K. V. Rosenberg, T. C. Will, and M. I. Moreno. 2008. A collaborative web-based recording program for housing records of migratory birds during non-breeding periods in Central and South America. Ornitología Neotropical 19:531–539.

Bennett, R.E. 2012. Habitat associations of the Golden-winged Warbler in Honduras. Thesis, Michigan Technological University.

Boy, E, N. Bruce, K. R. Smith, R. Hernandez. 2000. Fuel efficiency of an improved wood-burning stove in rural Guatemala: implications for health, environment and development. Energy for Sustainable Development 4(2): 23-31.

Buehler, D. A., A. M. Roth, R. Vallender, T. C. Will, J. L. Confer, R. A. Canterbury, S. B. Swarthout, K. V. Rosenberg, and L. P. Bulluck. 2007. Status and conservation priorities of GWWA (Vermivora chrysoptera) in North America. The Auk 124: 1439-1445.

Catry, Paulo, Ana Campos, Vítor Almada, and Will Cresswell. 2004. Winter segregation of migrant European robins Erithacus rubecula in relation to sex, age and size. Journal of Avian Biology 35(3): 204-209.

Chander, R, S. Tolfree, J. Gerwin, C. Smalling, L Chavarria-Duriaux, G. Duriaux, and D. I. King. In Press. Conservation implication of Golden-winged Warbler Social and Foraging Behaviros During the Nonbreed Season, in Golden-winged Warbler Ecology, Conservation, and Management (Streby, H. M. D. E. Anderson, and D. A. Buehler Eds.). Studies in Avian Biology.

Chandler, R. 2013. Analysis of Golden-winged Warbler Winter Survey Data. Report for Cornell Lab of Ornithology.

Chandler, R. B. and D. I. King. 2011. Habitat quality and habitat selection of GWWAs in Costa Rica: an application of hierarchical models for open populations. Journal of Applied Ecology 48: 1038-1047.

Chandler, R. G. 2011. Avian Ecology and Conservation in Tropical Agricultural Landscapes with Emphasis on Vermivora chrysoptera. Open Access Dissertations. Paper 333.

Channan, S., K. Collins, and W. R. Emanuel. 2014. Global mosaics of the standard MODIS land cover type data. University of Maryland and the Pacific Northwest National Laboratory, College Park, Maryland, USA.

Confer, J. L., J. L. Larkin, and P. E. Allen. 2003. Effects of vegetation, interspecific competition, and brood parasitism on GWWA (Vermivora chrysoptera) netting success. Auk 120:138-144.

Dunn, J. L. and K. L. Garrett. 1997. A Field Guide to the Warblers of North America. Houghton Mifflin Harcourt, New York.

eBird. 2015. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. (Accessed: July 2015).

Eisermann, K. 2014. Golden-winged Warbler (Vermivora chrysoptera) in Guatemala: distribution and identification of focal areas for conservation action. Report prepared for the American Bird Conservancy.

ESMAP 2003. Household fuel use and fuel switching in Guatemala. Joint UNDP/World Bank Energy Sector Management Assistance Program. Online https://www.esmap.org/sites/esmap.org/files/03603.%20Household%20Fuel%20Use%20and%20Fuel%20Switching%20in%20Guatemala%20June%202003.pdf

Friedl, M.A., D. Sulla-Menashe, B. Tan, A. Schneider, N. Ramankutty, A. Sibley and X. Huang. 2010. MODIS Collection 5 global land cover: Algorithm refinements and characterization of new datasets, 2001-2012, Collection 5.1 IGBP Land Cover, Boston University, Boston, MA, USA.

Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." Science 342: 850–53.

Hilty, S. L. and Brown, W. L. 1986. A guide to the birds of Colombia. Princeton University Press, Princeton, NJ.

Hunter W. C., D. A. Buehler, R. A. Canterbury, J. L. Confer, and P. B. 2001. Wildlife Society Bulletin 29: 440-455.

Jones, H. L. 2003. Birds of Belize, University of Texas Press, Austin, TX.

Ketterson, Ellen D., and Val Nolan Jr. 1979. Seasonal, annual, and geographic variation in sex ratio of wintering populations of Dark-eyed Juncos (Junco hyemalis). The Auk 96(3): 532-536.

King, D, R. Chandler, C. Smalling, R. Trubey, R. Raudales, and T. Will. In Press. Non-Breeding Golden-Winged Warbler Habitat: Status, Conservation, and Needs. In Golden-winged Warbler Ecology, Conservation, and Management (Streby, H. M. D. E. Anderson, and D. A. Buehler Eds.). Studies in Avian Biology.

Komar, Oliver, B. J. O'Shea, A. Townsend Peterson, and Adolfo G. Navarro-Sigüenza. 2005. Evidence of latitudinal sexual segregation among migratory birds wintering in Mexico. The Auk 122 (3): 938-948.

Land, H. C. 1962. A collection of birds from the Sierra de las Minas, Guatemala. Wilson Bulletin 74:267-283.

Marra, P. P., K. A. Hobson, R. T. Holmes. 1998. Linking winter and summer events in a migratory bird by using stable-carbon isotopes. Science 282: 1884-1886.

Marra, Peter P., Thomas W. Sherry, and Richard T. Holmes. 1993. Territorial exclusion by a long-distance migrant warbler in Jamaica: a removal experiment with American Redstarts (Setophaga ruticilla). The Auk 110(3): 565-572.

Moreno M. I. and N. Bayly. 2014. Evalucación de las áreas focales no-reproductores de la reinita Alidorada (Vermivora chyrsoptera), la reinita cerúlea (Setophaga cerulea), y la reinita del canadá (Cardellina canadensis) en Colombia. Internal report from Selva Investigación para la Conservación en el Neotrópico-www.selva.org.co.

Morton, Eugene S. 1990. Habitat segregation by sex in the hooded warbler: experiments on proximate causation and discussion of its evolution. American Naturalist 135(3): 319-333.

Norris, D. R., P. P. Mara, T. K. Kyser, T. W. Sherry, and L. M. Ratcliffe. 2004. Tropical winter habitat limits reproductive success on the temperate breeding grounds in a migratory bird. Proceedings of the Royal Society Biology 271:59-64.

Ornat, Arturo Lopez, and Russell Greenberg. 1990. Sexual segregation by habitat in migratory warblers in Quintana Roo, Mexico. The Auk 107(3): 539-543.

Phillips, S.J., M. Dudik, and R. E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. Ecological Modeling 109: 231-259.

Rappole, J. H. and M. V. McDonald. 1994. Cause and effect in population declines of migratory birds. The Auk 111(3): 652-660.

Rappole, J. H., D. I. King, and J. Diez. 2003. Winter vs. breeding habitat limitation for an endangered avian migrant. Ecological Applications 13: 735-742.

Ridgely, R. S. and J. A. Gwynne. Jr. 1989. A Guide to the Birds of Panama. Second Edition. Princeton University Press. Princeton, NJ. 534 p.

Rosenberg K. V., T. Will, D. A. Buehler, S. Barker Swarthout, W. E. Thogmartin, R. Chandler, and R. E. Bennett. In press. Historical and current distribution and population status of Golden-winged Warbler. In. Golden-winged Warbler Ecology, Conservation, and Management (Streby, H. M. D. E. Anderson, and D. A. Buehler Eds.). Studies in Avian Biology.

Rosenberg, K. V. 1997. Ecology of dead-leaf foraging specialists and their contribution to Amazonian bird diversity. Ornithological Monographs, 673-700.

Ruckstuhl, K. E. 2007. Sexual segregation in vertebrates: proximate and ultimate causes. Integrative and Comparative Biology 47(2): 245-257.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011. USGS Patuxent Wildlife Research Center, Laurel, MD. [Online]. Available at: http://www.mbr-pwrc.usgs.gov/

Sexton, J. O., Song, X.-P., Feng, M., Noojipady, P., Anand, A., Huang, C., Kim, D.-H., Collins, K.M., Channan, S., DiMiceli, C., Townshend, J.R.G. 2013. Global, 30-m resolution continuous fields of tree cover: Landsat-based rescaling of MODIS Vegetation Continuous Fields with lidar-based estimates of error. International Journal of Digital Earth, 130321031236007. doi:10.1080/17538947.2013.786146.

Sherry T. W., M. D. Johnson, and A. M. Strong. 2005. Does winter food limit populations of migratory birds? In R. Greenberg and P. P. Marra, eds. Birds of Two Worlds: The Ecology and Evolution of Migration. John Hopkins University Press, Baltimore.

Slud, P. 1964. The birds of Costa Rica: Distribution and Ecology. Bulletin of The American Museum of Natural History 128: 5-430.

Stiles, F. G. and A. F. Skutch. 1989. A Guide to the Birds of Costa Rica. Cornell University Press, Ithaca, NY.

Streby, H. M., J. P. Loegering, D. E. Andersen. 2012. Spot-mapping underestimates song-territory size and use of mature forest by breeding golden-winged warblers in Minnesota, USA. Wildlife Society Bulletin, 36(1), 40-46.

Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282-2292.

Thurber, W. A., J. F. Serrano, A. Sermeño, & M. Benítez. 1987. Status of uncommon and previously unreported birds of El Salvador. Proc. West. Found. Vert. Zool. 3: 109–293.

Vertnet. 2015. [Web application] Available: http://www.vertnet.org/. (accessed July 2015)

Wetmore, A., R. F. Pasquier, and S. L. Olson. 1984. The birds of the republic of Panama. Part 4. Passeriformes: *Hirundinidae* (swallows) to *Fringillidae* (finches). Smithsonian Institution, Washington D.C.

Will, T. C., M. Escaño, and K. Rosenberg. 2010. International collaboration to model and survey Vermivora chrysoptera during the non-breeding season. Poster presentation at 25th International Ornithological Congress, Compos do Jordão, Brazil.

Will, T. et al., unpublished data. Chapter 1 (In Preparation) In A. M. Roth, R. W. Rohrbaugh, T. Will, and D. A. Buehler, eds. GWWA Status Review and Conservation Plan. [Online]. Available at www.gwwa.org.

Winker, Kevin.1998. Suggestions for measuring external characters of birds. Ornitología Neotropical 9: 23-30.

Wunderle Jr, Joseph M. 1995. Population characteristics of Black-throated Blue Warblers wintering in three sites on Puerto Rico. The Auk 112(4): 931-946.

Yojanan Lobo-y-Henriques J. C. 2013. Plan de conservación preliminary para la Reinita Alidorada (Vermivora chyrosptera) durante su temporada no reproductive, con énfasis en Colombia. Conservación Colombiana 18.

Yojanan Lobo-y-Henriques J. C. and M. M. Artega. 2013. Distribución especial de la Reinita Alidorada (Vermivora chrysoptera) en la region Neotroipcal: avances en el conocimiento de su distribución actua y posibles efectos del cambio climátcio global. Conservación Colombiana 18.

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