State of the Protected Areas Report 2024

An assessment of Bladen Nature Reserve, Golden Stream Corridor Preserve, Maya Mountain North Forest Reserve and the Boden Creek Ecological Preserve

December 2025

YA'AXCHÉ CONSERVATION TRUST

Harmony between nature and human development for the benefit of both

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Cover photo. View of the foothills at the boundary of the Bladen Nature Reserve, Ya'axché Conservation Trust

Citation: Ya'axché Conservation Trust, 2025. State of the Protected Areas 2024, Ya'axché Conservation Trust, Punta Gorda, Toledo District, Belize.

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Acronyms

ASPT-CR	Average Score Per Taxon- Costa Rica
BCEP	Boden Creek Ecological Preserve
BNR	Bladen Nature Reserve
BRIM	Biodiversity, Research, Inventory and Monitoring
BSR	Biodiversity Synthesis Report
CCAD	Central American Commission for Environment and Development
CRFR	Columbia River Forest Reserve
DBH	Diameter at Breast Height
EC	Electrical Conductivity
FD	Forest Department
F&F	Fauna & Flora
GSCP	Golden Stream Corridor Preserve
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
MGL	Maya Golden Landscape
MMM	Maya Mountain Massif
MMNFR	Maya Mountain North Forest Reserve
NA	Not Applicable
NPAS	National Protected Areas System
NTFP(s)	Non-timber Forest Products(s)
NTU	Nephelometric Turbidity Unit
PAM	Protected Areas Management
PA(s)	Protected Area(s)
PAP	Protected Areas Program
PAST	Paleontological Statistics
PPA	Private Protected Area
PTA(s)	Priority Target Areas
SPAR	State of the Protected Area Report
SVAP	Stream Visual Assessment Protocol
TFCG	Trio Farmers Cacao Growers Limited
Ya'axché	Ya'axché Conservation Trust

Preamble

Ya'axché's programs have undergone rapid growth over the last 10 years with extensive development in capacity and strategic direction. Its current program structure is now far from its humble beginnings but always staying true to its roots and its vision for conservation and livelihoods in the Toledo District, and more specifically, the Maya Golden Landscape (MGL). Within the last 10 years, Ya'axché has been able to add two protected areas to its Protected Areas Program, a major achievement in its relentless effort to accomplish its vision of '*Harmony between nature and human development for the benefit of both*'.

As part of its drive for evidence-based decision making and adaptive management approach, Ya'axché first introduced biodiversity research and monitoring in 2009 with its first assessment of biodiversity across the MGL published in 2010 as the first Biodiversity Synthesis Report. This report provided Ya'axché and the public with a snapshot of the status of biodiversity across the landscape, which included a mosaic of community farmlands and Ya'axché's Protected Areas (PAs) as study sites. Results of data analysis were used to target priority areas for conservation action and education and awareness campaigns. This report had a 9-year run with its last issue published in 2019.

During the same time period, a number of changes took place within the Protected Areas Program (PAP), including the addition of more study sites and additional alignment with national priorities in research and monitoring. The research and monitoring program transitioned into a standalone Science Program no longer nested within the wider PAP, having its own structure and program targets and budget. Human resources gaps were filled across both programs, and the efficiency and effectiveness of management activities increased significantly. However, the only measure of management effectiveness for the PAs remained in the Biodiversity Synthesis Report (BSR) with no available information on other aspects of Protected Areas Management (PAM), such as enforcement and compliance activities. This gap is now addressed through the State of the Protected Areas Report (SPAR), now in its 4th iteration having transitioned from an annual report into a 2-year report starting with the period beginning January 2023 and ending December 2024 which this report encompasses.

Ya'axché took the decision to incorporate a SPAR into its reporting framework and integrate the analysis of Biodiversity Research, Inventory and Monitoring (BRIM) as a tool to assess the status of PAs and their biodiversity. Notwithstanding the integration of the BSR into this report, research and monitoring activities outside the PAs will continue to be assessed and presented as the Farmscape Biodiversity Report for 2022-2023 (available) and 2024-2025 (pending). Note that information presented in this report in some cases may cover multiple years serving as a reference point for subsequent reports.

Executive Summary

Ya'axché privately manages the Golden Stream Corridor Preserve (GSCP) and the Boden Creek Ecological Preserve (BCEP) and co-manages the Bladen Nature Reserve (BNR) and the Maya Mountain North Forest Reserve (MMNFR) along with the Government of Belize. For the last 27 years, Ya'axché has been actively involved in Protected Areas Management (PAM) and has grown to become one of the leading organizations in Belize promoting sustainable livelihoods, as well as conservation of natural resources. With the growth of the organization came the need for adequate assessments of management effectiveness, particularly within the Protected Areas Program (PAP). This report is the first of its kind at the organization and is intended to provide a summary of the status of multiple target areas relevant to the management, monitoring and conservation of resources within the Protected Areas (PAs).

Seven (7) Priority Target Areas (PTAs) have been selected for this report. These target areas are not absolute and may include other targets of interest in future iterations of this report. For this report we include: (i) Habitat Indicators, (ii) Rare, Threatened, Socio-Economic, and Culturally Important Species, (iii) Broad Ecosystems and Land Use Change, (iv) Ecosystem Services, (v) Sustainable Natural Resource Use, (vi) Enforcement and Compliance, and (vii) Biodiversity Knowledge for Adequate Management. All seven PTAs were chosen based on their ability to indicate changes in conditions over time and whether there was data available and/or baselines in the process of being established. A combination of data analysis and expert opinion guided the assessment of conditions thereafter.

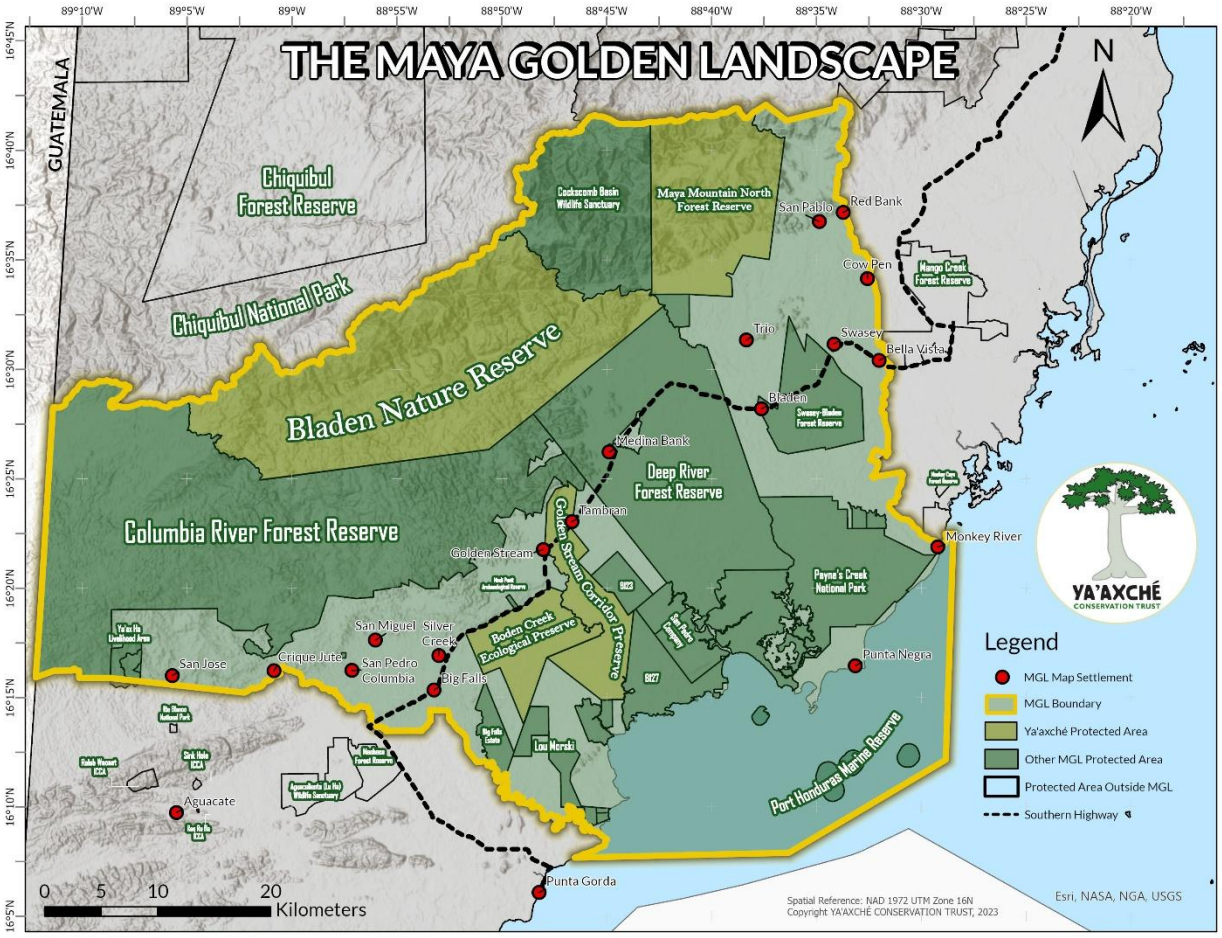
Based on the 2024 assessments, Habitat Indicator Species are in *good and stable condition* across all four PAs. This is a change in status from last reporting period, in which there was a *stable and deteriorating condition*. Available data on Rare, Threatened, Socio-Economic, and Culturally Important Species suggests that these species remain in *good condition* at BNR, MMNFR and BCEP but in 2024 *warrant moderate concern* at GSCP. Broad Ecosystems and Land Use Change show *negligible changes* for GSCP, BNR and BCEP with *moderate concern in a deteriorating trend* for the MMNFR. Sustainable Natural Resource Use warrants *moderate concern* for the GSCP although stable and deteriorating condition for both MMNFR and BCEP. Enforcement and Compliance is *stable and in good condition* for GSCP and BNR but warrant *moderate concern with a deteriorating trend* for the MMNFR and BCEP. Biodiversity Knowledge for Adequate Management has been improving within the protected areas with data providing sound evidence of good governance and

conservation efforts for flora and fauna. The addition of camera surveys in the BNR and BCEP has significantly improved the monitoring of important indicator species. For this reason and for the purposes of this report we consider the status in *good condition with an improving trend*.

The overall assessment of the PAs can be summed as follows: The Bladen Nature Reserve remains the most stable protected area with the vast majority of its forest cover intact and its biodiversity in *good condition*. The Golden Stream Corridor Preserve also remains *stable with some concern* over activities related to unauthorized extraction of NTFPs. Most of its land area is currently forested, and its biodiversity is in *good condition*. The Maya Mountain North Forest Reserve is *unstable* particularly due to management discrepancies. However, most infractions and activities affecting its condition are concentrated in a small portion of the reserve which warrants *moderate concern* due to the deteriorating conditions observed. It still retains most of its land area under forest cover despite the concerns. The Boden Creek Ecological Preserve is *unstable* and *warrants moderate concern* for deteriorating conditions in a small area of the reserve associated with land clearings and unregulated resource extraction. Monitoring of resources is in its infant stage in this protected area and will improve over time.

Introduction

Ya'axché's Protected Areas Management (PAM) and Science (biodiversity monitoring and research) efforts are focused in the conceptual area of scope referred to as the Maya Golden Landscape (MGL) in the Toledo District, Belize. The MGL is a mosaic landscape comprised of protected areas, private lands, indigenous communal lands and agriculture lands. Ya'axché currently manages and co-manages four (4) Protected Areas (PAs) with three (3) distinct protected area designations under Belize's National Protected Areas System (NPAS). These four (4) protected areas include the Golden Stream Corridor Preserve (GSCP), Bladen Nature Reserve (BNR) and the Maya Mountain North Forest Reserve (MMNFR) and the Boden Creek Ecological Preserve (Map 1).



Map 1. Ya'axché managed & co-managed Protected Areas within the Maya Golden Landscape in the Toledo District.

The Golden Stream Corridor Preserve is a Privately Protected Area (PPA) in the Toledo District established in 1998 through the efforts of Ya'axché which at the time was comprised of a consortium of local community members and conservation experts, both national and international. The PA encompasses 15,000 acres of lowland broadleaf forests that connect the foothills of the Maya Mountains to the coastal lowlands of Toledo. Ya'axché is fully responsible for all management activities within this PA.

The Bladen Nature Reserve is Belize's largest nature reserve with this designation providing the highest level of protection for any PA under the NPAS Act. The PA spans approximately 100,000 acres in the core zone of the Maya Mountain Massif (MMM). The remoteness of the PA provides an excellent shield from most anthropogenic impacts that other protected areas are affected by. Ya'axché holds co-management of this reserve along with the Government of Belize having major responsibility for the daily operational activities.

The Maya Mountain North Forest Reserve is an extractive reserve in the Toledo District with a long history of management absence up until 2015 when Ya'axché took on co-management of the reserve. Until 2022, it had maintained no major extractive activities other than an agroforestry concession regulated by the Belize Forest Department (FD) and managed by Ya'axché on behalf of a community group from the Trio Village. The PA encompasses 36,000 acres, most of which is rugged terrain that remains forested landscape on the eastern flank of the MMM. The forest reserve is also categorized as a Key Biodiversity Area (KBA) in the National Protected Areas System (NPAS).

The Boden Creek Ecological Preserve is a Privately Protected Area in the Toledo District established in 1998 through private ecotourism ventures. Acquired from predominantly agriculture uses, the area was set aside for conservation and ecotourism and managed privately until 2021 when the protected area was secured by Fauna and Flora (F&F)

International in Partnership with Ya'axché. The protected area was incorporated officially into Ya'axché's Protected Areas Program in 2024. The PA encompasses approximately 12,800 acres of lowland broadleaf forests that are adjacent to the Golden Stream River and directly connects to the Golden Stream Corridor Preserve.

Table 1. Acreage of Ya'axché-managed Protected Areas under sustainable conservation practices in the MGL.

Protected Area	Acres	Hectares
Privately Owned by Ya'axché		
Golden Stream Corridor Preserve (GSCP)	15,000	6,070.3
Boden Creek Ecological Preserve (BCEP)	12,800	5,180
Co-Managed with Government of Belize		
Bladen Nature Reserve (BNR)	100,000	40,468.6
Maya Mountain North Forest Reserve (MMNFR)	36,000	14,568.7
Total	**163,800**	**66,287.6**

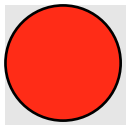
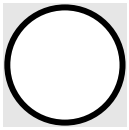
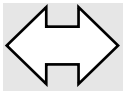
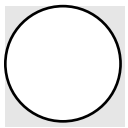
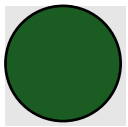
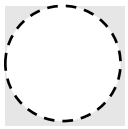
The purpose of this report is to assess the overall condition of all four (4) PAs under Ya'axché's management and to communicate protected area conditions to management partners, donors, stakeholders and the public. The report also highlights priority areas under Ya'axché's Biodiversity, Research, Inventory and Monitoring (BRIM) strategy as well as the individual protected area management plans. It also provides recommendations for future work particularly in the areas of concern as assessed through the process of developing the state of the protected areas reports, periodically.

This report takes the previous three reports of 2020, 2021 and 2022 as reference points to assess the status of the Protected Areas for the period beginning January 2023 to December 2024. Similarly, for data related to land use change and enforcement and compliance, the assessment of status was based on data collected for the periods 2023 - 2024. In synthesis, information briefs within the report will at times contain multi-year analysis of data with the assessment year for comparison.

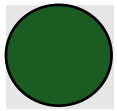
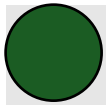
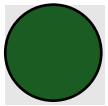
The SPAR is summarized in table format for seven target areas based on a synthesis of research and monitoring activities, management activities and effectiveness evaluations, and internal expertise. An Information Brief providing details of specific target areas with relevance to one or more of the four (4) PAs under Ya'axché's management mandate can be found at the end of each assessment section when data is available for publication.

Summary of State of the Protected Areas

To standardize the evaluation of condition and trends across target areas, we use the following evaluation key in the table below. The colours represent the condition status of the target area whether that be significant concern, moderate concern or good condition. Arrows represent the trend in conditions such as improving, stable or deteriorating. The confidence of the assessment is represented by bold solid circle for high confidence, solid line if medium confidence or dotted circle if low confidence in the assessment. If the organization is still gathering baseline data on a particular target or if data is in the form of a one-time inventory, the trend arrows are omitted. If a target area is not yet measured or is not applicable to the protected area, the condition is assessed as "Unknown" and "NA", respectively.

Resource Condition		Trend in Condition		Confidence in Assessment	
	Warrants Significant Concern		Condition is Improving		High
	Warrants Moderate Concern		Condition is Stable		Medium
	Resource in Good Condition		Condition is Deteriorating		Low

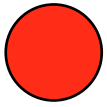
Summary of Condition and Trends of Priority Targets

Priority Targets	Condition Status/Trend				Rationale
	GSCP	BNR	MMNFR	BCEP	
I. Habitat Indicator Species					Ya'axché monitors indicator species on 12 transects distributed across a disturbance gradient within the MGL. On the 1-km long transects, point counts for 30 indicator birds and signs of 19 indicator mammals are recorded. The select birds and mammals belong to indicator groups that serve to reflect changes in habitat or underlying ecological conditions. Synthesis Reports with analyses for individual monitoring years from 2010-2018 can be found on Ya'axché's website. Transect data from GSCP and BNR since 2010 and from MMNFR since 2016 were analyzed for this report. Multiple indicator groups make up this target, and each is scored separately. Trends in the index of abundance for most habitat indicators in each PA allude to "good" environmental conditions over time. Migratory birds as a group declined across all PAs through 2022; however, they experienced an increase in abundances in 2023-2024, triggering a change in average PA condition from deteriorating to stable or increasing in this report. Meanwhile, game species, particularly game birds, continue to decline everywhere due to hunting pressures in the landscape and should not be overlooked. BCEP is relatively new to the protected areas program and is yet to be fully integrated into the monitoring activities under the science program. As such, it is data deficient, but the large expanse of forest (~10k acres) gives us confidence in reporting that habitat indicator species are in good condition.
II. Rare, Threatened, Socio-Economic, and Culturally Important Species					The terrestrial ecosystems across GSCP, BNR, and MMNFR support at least 24 threatened birds and mammals, including Geoffroy's spider monkeys (*Ateles geoffroyi vellerosus*), white-lipped peccaries (*Tayassu pecari*) and keel-billed motmots (*Electron carinatum*). Eight (8) mammals

Priority Targets	Condition Status/Trend				Rationale
	GSCP	BNR	MMNFR	BCEP	
					and eight (8) bird species of conservation concern are monitored on biodiversity transects. Threatened birds are consistently low across all three reserves, with significant declines in the yellow-headed parrot (*Amazona oratrix*) in BNR since 2012. Threatened game birds are especially in poor condition, with several significant, negative trends becoming clear in 2022 and creating a status of critical concern for GSCP and moderate concern for BNR and MMNFR. The only species with a significant increase in abundance is the mealy parrot in MMNFR. Trends vary for individual threatened mammal species in each reserve with the majority having low but stable indices of abundance over time. The abundance of pumas on GSCP and BNR transects has significantly increased since 2010, as has the abundance of Baird's tapir in BNR. Meanwhile, jaguar detection on GSCP transects has significantly declined during the same timeframe. Across the three reserves, 23 rare, threatened, and/or culturally important plants have been subject to studies to improve knowledge of their distribution, population size, age structure, and phenology to inform better management practices at the local and national level. Beginning in 2021, a total of 24 native tree species have been propagated at Ya'axché's Golden Stream nursery for out-planting into the MMNFR. As of December 2022, 910 seedlings from eight of those species were out planted to boost local populations and restore degraded areas in the PA. The mature forest of BNR supports at least 53 species of bats, while 34 species have been documented in the secondary forest of GSCP. Baseline information on native bee species exists for GSCP, BNR, and MMNFR only.
III.					Ecosystems within the PAs are considered intact for all protected areas. In the case of GSCP, ecosystems remain stable, and many areas are still

Priority Targets	Condition Status/Trend				Rationale
	GSCP	BNR	MMNFR	BCEP	
Broad Ecosystems and Land Use Change					recovering from historical heavy land use types such as cattle farming and from damages sustained from Hurricane Iris in 2001. The BNR is the most stable of all with all ecosystems intact. The remoteness of this protected area contributes significantly to its preservation. In MMNFR, the lowland broad-leaved wet forest ecosystem continues under pressure from agriculture activities. However, the area under pressure is small relative to the size of the PA. All other ecosystems within the MMNFR are shielded by rugged terrain and difficulty accessing these. BCEP has some areas under unauthorized cultivation, but the impacts are localized and near the community of Indian Creek. *Note:* All four PAs retain a large portion of their land mass under forest cover.
					The GSCP. Enforcement & compliance patrols continue to deter any major clearings within the PA boundaries. There are small areas that are being monitored where the protected area boundaries lines are shared with farmlands. 2024 saw one of the most severe dry seasons in recent times which led to significant localized damage from escaped agriculture fires. Despite this impact the conditions are very good and much of the damaged area is in recovery.
					The BNR has most of its natural vegetation intact. Some areas deep into the reserve appear to have expanded tiger ferns at the top of ridges, which is a natural occurrence. These areas a very small in relation to BNR's total acreage and don't appear to suffer from fire impacts as in other areas with tiger ferns outside of the PA system.
					In MMNFR, just north of the agroforestry concession is an area under illegal cultivation which has degraded the forest conditions resulting in unsustainable use of an estimated 300 acres of land within the reserve. This area continues to be active and attracts more incursions and clearings contributing to the deteriorating trend in forest cover in the area.

Priority Targets	Condition Status/Trend				Rationale
	GSCP	BNR	MMNFR	BCEP	
					In BCEP, the area immediately southeast of the village of Indian Creek has an area of disturbances and clearings for agriculture estimated around 200 acres within the boundaries of the reserve. Not all 200 areas are actively used throughout the year as it appears to be used for seasonal farming. The threat of expansion of this activity remains and should be addressed through key management strategies to prevent further negative impacts.
IV. Ecosystem Services					In 2016-2017, a freshwater bio-assessment was conducted within four watersheds in the MGL (Bol, 2018). The study was done to develop baseline data and potential station sites for continuous monitoring in order to assess long-term trends of the stream condition. All sites ranked either as "good" or "excellent" based on integrated scores for stream physical, biological, and chemical parameters (using SVAP and ASPT-CR scoring criteria). Monitoring efforts restarted in 2023 to gather long-term data on water quality. Currently, freshwater monitoring is conducted each season at the same sites established in 2016. With the introduction of new physiochemical parameters and flow monitoring, a broader perspective on watershed health is expected to be achieved.
V. Sustainable Natural Resource Use		NA			Sustainable extraction zones established for NTFPs in GSCP continue to be monitored. Extraction of cohune leaves within two extractions zones is seasonal and monitored by the ranger team. Requests by community leaders remain very low. The BNR, by virtue of its designation, cannot allow the use of resources within the reserve. As such, sustainable natural resource use is not applicable to this PA. The MMNFR is by designation an extractive reserve. Since 2015, Ya'axché along with the Trio Farmers Cacao Growers Ltd. (TFCG) have

Priority Targets	Condition Status/Trend				Rationale
	GSCP	BNR	MMNFR	BCEP	
					been developing an agroforestry concession to produce shade-grown cacao. This development has seen the conversion of 936 acres of forested land into productive shade-grown cacao. Illegal logging was still prevalent in 2023 with 6 reported cases. In 2024, only 1 report was documented. The decline in records is predominantly due to Ya'axché pulling out its enforcement & compliance teams out of the reserve in 2024 due to inconsistencies with the management & governance of the reserve. The logging concessionaire is responsible for monitoring all timber extraction in the reserve, including documentation and reporting of such activities. It can be assumed that most of the timber coming out of MMNFR is legal under the existing license.
					There is no structured extraction of resources in BCEP at the moment of writing. The sustainability of resources extraction is poorly understood since data is deficient. Records indicate illegal logging as a main issue. NTFPs are also extracted without authorization in some areas of the reserve. These NTFPs are cohune leaves and polewood for building thatch roofs.
VI. Enforcement and Compliance					The GSCP continues to enjoy a relatively high level of compliance with rules and regulations. The Golden Stream Field Station serves as a key site for deployment of patrols. Easy access to trail systems allows for near real time monitoring of activities within the protected area.
					The BNR conditions are stable. Patrol effort continues with increased efforts in the more remote reaches of the reserve. Incursions are still evident along the boundary line of CRFR and BNR where logging activity has been reported since 2021. Increased presence in the area can reduce any escalation of illegal activities but the remoteness poses significant logistical challenges
					MMNFR patrols began to wind down in 2023 as the activity of the logging concession increased. 86 patrols in 2023 were a slight decrease

Priority Targets	Condition Status/Trend				Rationale
	GSCP	BNR	MMNFR	BCEP	
					in effort from 2022 but in 2024 patrol effort was scaled down further to only 62 patrols. While illegal logging may still occur, it will likely go undocumented in areas where the logging concession is not active and without the added presence of Ya'axché rangers. Until an agreement for adequate management is secured, conditions may continue unmonitored and may deteriorate.
					BCEP was officially integrated into enforcement and compliance efforts in early 2024. As a conscious decision, the teams were only conducting periodic patrols in the protected area. These were only done when concerning reports were brought to the program's attention. Starting 2025, and coinciding with community relationship building, patrol efforts will be increased gradually. At this time there is significant concern over compliance with rules applicable to this private protected area.
VII. Biodiversity Knowledge for Adequate Management					The Science Program has steadily increased its monitoring efforts across all protected areas with streamlined activities and seasonal monitoring in place implemented by a dedicated ranger team supported by three technical staff including the Science Director, Science Manager and Research Officer. Data collected includes bird counts, vegetation surveys, freshwater monitoring, and mammal monitoring. This is being conducted via a combination of point counts, track censuses, physiochemical and biotic parameters, permanent sample plots, and camera trap surveys. The knowledge of biodiversity in the GSCP and BNR is well documented and continues to grow. For MMNFR and BCEP, there is room for improvement. These two protected areas have semi-permanent monitoring frameworks that are subject to change based on management challenges and limitations. Both have ongoing monitoring primarily via camera trap surveys which provide valuable data on the status of biodiversity within their boundaries.

I. Habitat Indicator Species

	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown
			⇔	⇑	⇔	

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Migratory Birds	Index of Abundance	⇑	⇑	⇑	Unknown	Eight (8) bird species monitored on the biodiversity transects are generalist migrant species without specific habitat requirements in Belize. Declines in the abundance of these birds could indicate deteriorating conditions of their migration routes among other stressors. Significant declines in migratory birds were observed in GSCP, the nearby Columbia River Forest Reserve, BNR, and Indian Creek Village from the period 2010-2022 (*see the information brief following this section*). Because this trend was seen across many sites in the MGL, including the intact forest habitat of the Bladen Nature Reserve, it was thought to be driven by external pressures. However, in 2023-2024, migrant indicators began to rebound, breaking the patterns of decline in GSCP, BNR, CRFR, and Indian Creek.
						GSCP. Migratory birds experienced a clear, significant decline in GSCP between 2010 and 2021. However, the migrant index of abundance on GSCP transects in 2022 was unusually high, breaking the trend from prior years. In 2023 and 2024, we continued to observe high numbers of migrant indicators, primarily **American redstarts**, **hooded warblers**, **magnolia warblers**, **wood thrushes**, and **black and white warblers**.
						BNR. There was a significant decline in migration route health indicators in BNR from 2010-2022. Distinct habitats in BNR reflect different numbers of migratory birds. The decline of migrants is documented at the transect located in broadleaf

	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						forest; this trend is not observed in the savanna transect, which has experienced a lower but more stable abundance of migrants over the monitoring years. In 2023-2024, we documented higher abundance of migratory birds at the forested transect, breaking the downward trend for BNR. This is primarily from increased numbers of American redstarts, hooded warblers, magnolia warblers, and wood thrushes in that PA.
						MMNFR. Monitoring in MMNFR was established more recently than in the other PAs. Migratory bird indicator abundances were variable between 2016 and 2021. In 2022, abundances were slightly higher than the average from the prior years of monitoring, and in 2023-2024, they increased enough to be detected as a slight statistically positive trend. Hooded warblers, magnolia warblers, and wood thrushes are common.
						BCEP. No regular bird monitoring occurred in BCEP during the reporting period. Plans are in place to integrate monitoring in the near future.
Forest Birds and Mammals	Index of Abundance				Unknown	Eleven (11) bird species and seven (7) mammal species are monitored as forest health indicators, as they are only found in primary forests or undisturbed secondary forests.
						GSCP. Forest birds and mammals have remained stable in GSCP since 2010. The index of abundance for each group in 2023-2024 is comparable to the average index of abundance since monitoring began.

	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						BNR. Forest birds and mammals have been stable in BNR broadleaf habitat since 2010.
						MMNFR. No linear trends have existed for forest mammals since 2016, indicating stability in the MMNFR forest. There is a noticeable decline in forest mammal index of abundance between 2016 and 2017, but it appears to stabilize between 2018-2022 though it remains low. This pattern might be caused by increasing human activity during the establishment of the cacao concession where the transects are located. Both the cacao and forested transects in MMNFR shared this pattern in the forest mammal index of abundance. Forest birds have increased at the MMNFR transects since 2016; this is weakly significant at the forest transect.
						BCEP. No regular bird monitoring occurred in BCEP during the reporting period.
Pine Savanna Birds	Index of Abundance	NA		NA	NA	Three (3) of the monitored bird species are linked to pine savanna ecosystems and are considered indicators of the health of that habitat. Pine savannas in the MGL are threatened by increasingly frequent wildfires, which could decrease pine regeneration and pine nesting sites for birds.
						GSCP. Not assessed. There is no savanna habitat within this protected area.
						BNR. The BNR savanna habitat experienced a significant decline in savanna birds from 2012-2021. Though as a group, savanna

	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						birds increased in 2022-2023, breaking the trend; this is mainly a result of increased detection of blue-gray gnatcatchers at the transect. The yellow-headed parrot experienced a steep decline at the BNR savanna transect from 2012-2021 and remained low in 2023-2024, giving reason for concern.
						MMNFR. Not assessed. There is no savanna habitat within this protected area.
						BCEP. Not assessed. There is no savanna habitat within this protected area.
Wetland Birds and Mammals	Index of Abundance				Unknown	Three (3) bird species are monitored as wetland indicators because of their link to healthy riparian or littoral habitat. Two (2) mammal species are monitored as indicators of riparian forest health. Between the two, the neotropical river otter is rarely recorded on the transects while the Baird's tapir is consistently recorded.
						GSCP. No trends are evident for wetland birds in GSCP, which appear stable across the protected area over time. A slight decrease in abundance of wetland mammals has been detected as of 2024; this is a result of decreased tapir detections at the transects over time.
						BNR. There is a significant positive trend in wetland mammal indicators. This is being driven by an increase in tapir detections in the Bladen savanna transect over time. The BNR transect

	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						locations historically recorded fewer wetland bird species than the transects in the other protected areas, but these birds have been observed less often at both the forest and savanna transects of BNR in the last few years. No significant trends are evident yet for wetland birds, but this indicator group will be monitored in future years to see if the absence continues.
						MMNFR. Wetland mammals appear stable in this KBA, with no significant changes in abundance since 2016. As in BNR, wetland birds are not especially abundant on the MMNFR transects but have been absent in several of the most recent years. Continued monitoring will determine if this is an area of concern.
						BCEP. No regular bird monitoring occurred in BCEP during the reporting period.
Disturbed Forest Birds and Mammals	Index of Abundance				Unknown	Three (3) bird species and one (1) mammal species are monitored as disturbance indicators. These species are known to tolerate and even thrive in fallow lands, forest gaps, and human impacted landscapes. Of the three (3), the bronzed cowbird and dickcissel have never been recorded on any transect since 2010, though citizen science records (available at eBird.org) show both species have been recorded at nearby locations. The results shared are for the plain chachalaca and jaguarundi.
						GSCP. GSCP and the neighboring CRFR have seen a significant decline in plain chachalaca since 2010. This indicates improved forest conditions over time. Jaguarundis are rarely recorded at the GSCP transects, and none were detected there in 2023-2024.

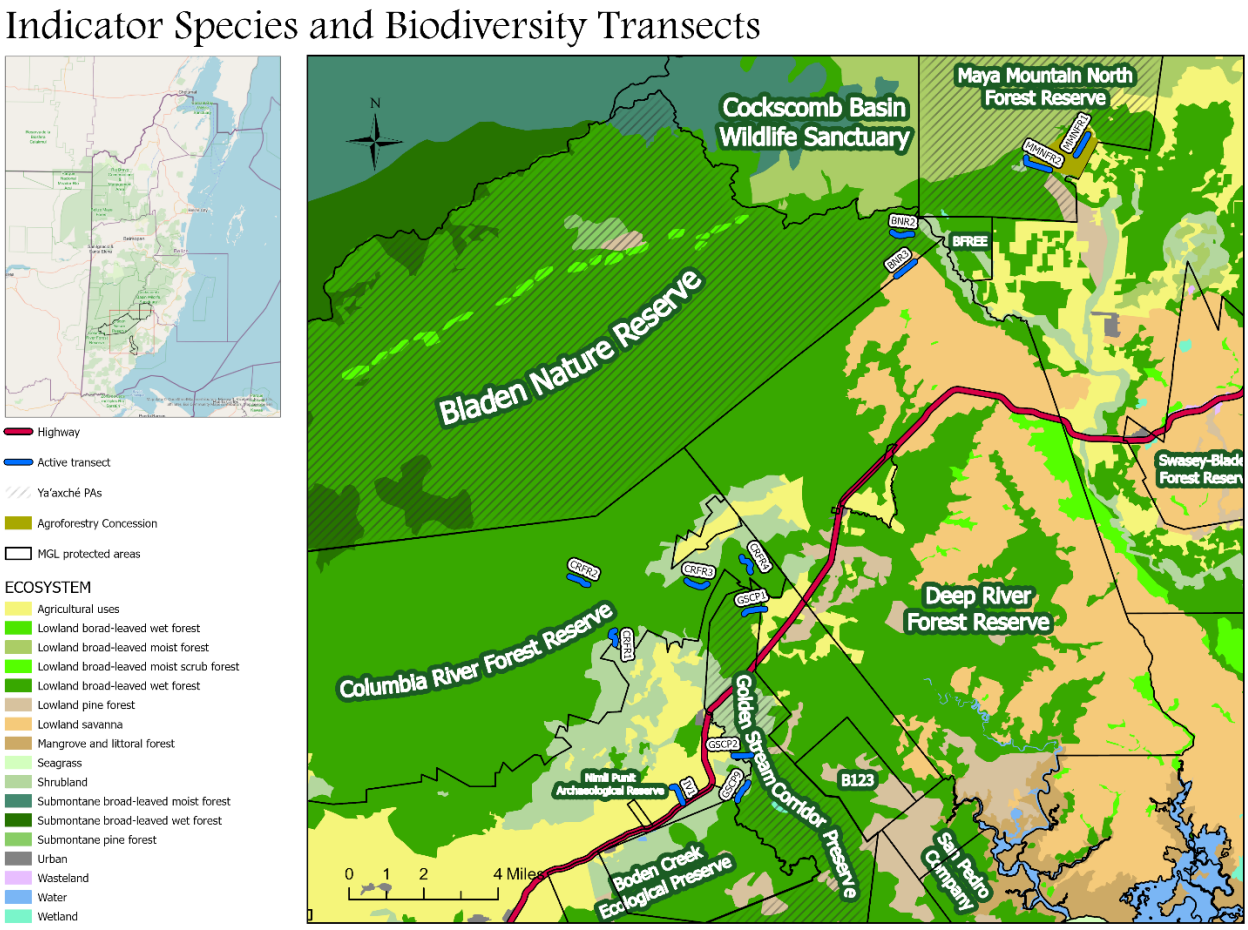
	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown
			⇔	⇑	⇔	

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						BNR. No trends have been detected within the broadleaf forest habitat, where plain chachalacas are not common and in many years, none are observed. In comparison, the savanna habitat has seen a significant decline in plain chachalacas over time. Detection of jaguarundis at the BNR transects has been rare since monitoring began, and 2023-2024 are no different.
						MMNFR. Plain chachalacas and jaguarundis are rarely detected on the MMNFR transects. A weakly significant decline in plain chachalacas from the MMNFR forested transect is emerging as of 2023.
						BCEP. No regular bird monitoring occurred in BCEP during the reporting period. Mammals are not yet monitored for the reporting period.
Game Birds and Mammals	Index of Abundance	⇓	⇓	⇓	Unknown	Three (3) commonly hunted game bird species are monitored as indicators of hunting presence and sustainable use. Six (6) game mammals, including white-lipped and collared peccaries, pacas, and agoutis are also monitored.
						GSCP. As a group, there are no linear trends for game bird index of abundance, mostly because abundances have been very low since monitoring began in 2010. However, some individual game bird species are facing serious declines (see more details under the next resource category, *II. Rare, Threatened, Socio-Economic, & Culturally Important Species*). Game mammals are more commonly recorded in GSCP, but no trends have been seen for this group since 2010. In comparison, the nearby CRFR transects have seen

	Habitat Indicator Species	Overall Condition	GSCP	BNR	MMNFR	BCEP Unknown
			⇔	⇑	⇔	

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						a significant decline in game mammals over 14 years, which was broken for the first time in 2024 when a large herd of white-lipped peccaries were recorded. Zero game birds have been recorded in the nearby Indian Creek Village transect since 2012. The lack of game birds on the GSCP, CRFR, and Village transects is expectedly due to hunting pressures from the nearby communities.
						BNR. Game birds have significantly declined in the savanna since 2012, while no clear trends have been confirmed in the broadleaf forest. Game mammals do not show any linear trends over 12 years; however, game mammal index of abundance in the last three years has increased above the average since monitoring began.
						MMNFR. Game birds significantly declined at the broadleaf forest transect from 2016-2022. In 2023, numbers improved slightly, breaking the trend. Within the cacao agroforestry habitat, game birds are rarely detected. Game mammal trends are still variable by year, and no clear significant relationships have been documented. There was a noticeable decline in game mammal abundance between 2016 and 2017, and abundances since then have remained low.
						BCEP. No regular bird monitoring occurred in BCEP during the reporting period. Mammals are not yet monitored for the reporting period.

Information Brief: Indicator Species and Biodiversity Transects



Map 2. Transect locations and ecotypes.

Ya'axché began monitoring biodiversity in 2006 using bird and mammal transects. Over the years, the monitoring program has grown to encompass new target taxa and methodology but transects have remained relevant for identifying long-term trends. As of 2024, eleven (11) transects exist across the MGL. These are point-count and sign transect, all 1km in length, with stopping points every 200m to observe and listen. Birds are detected using sight and sound cues, while mammals are detected using direct sightings, tracks, and an array of different signs such as scat, smell, sounds, and scratch marks.

Transect locations

Diverse habitats and a range of disturbance levels were chosen for transect locations to ensure that our monitoring program is representative of the land cover found across the landscape. Two (2) transects are located in BNR, four (4) in CRFR, three (3) in GSCP, and two (2) in MMNFR. One (1) transect from Indian Creek village was discontinued in 2023. The location and ecotype of the transects is depicted in Map 2. Details of each of the transects can be found in Table 2.

Indicator species

Table 2. Description of transect disturbance levels and the year that consistent monitoring was established. Any data recorded on the transects prior to the year listed below were not included in this report.

Transect	Year Est.	Disturbance
BNR2	2010	Minimal
BNR3	2012	Minimal
CRFR1	2010	Minimal; 0-20% hurricane damage (2001); proximity of agriculture
CRFR2	2010	Minimal; 0-20% hurricane damage (2001)
CRFR3	2010	Minimal; 0-20% hurricane damage (2001)
CRFR4	2010	Minimal; 0-20% hurricane damage (2001)
GSCP1	2010	60-75% hurricane damage (2001); proximity of village and agriculture
GSCP2	2010	60-75% hurricane damage (2001); proximity of agriculture
GSCP9	2012	60-75% hurricane damage (2001); proximity of agriculture
IV1	2012	60-75% hurricane damage (2001); proximity of highway and agricultural clearings
MMNFR 1	2016	Up to 40% thinning of overstory with cacao crop planted underneath
MMNFR 2	2016	Minimal

Target species include thirty-one (31) birds and nineteen (19) mammals, which are classified into six (6) indicator groups based on habitat preferences and ecology (Tables 3 & 4).

Species lists and indicator group assignment were first based national and IUCN Red List conservation priorities, expert knowledge, ecological preferences as given in "Field Guide to the Mammals of Central America and Southern Mexico" (Reid, 2009) and "Birds of Belize" (Jones & Gardner, 2003). The species were then validated by the local knowledge of Ya'axché's field ranger team.

Indicator groups are considered when analyzing bird and mammal data and are used to draw conclusions from the monitoring results. For example, an increase of "Disturbed Forest" indicators could indicate habitat degradation, whereas decreased "Game Species" richness could indicate a high level of hunting pressure and/or habitat degradation.

Table 3. Target mammal indicator species (n=19).

Common Name	Class	IUCN Status
Agouti	G	LC
Baird's Tapir*	W	EN
Collared Peccary	G	LC
Jaguar*	F	NT ▼
Jaguarundi	D	LC ▼
Margay*	F	NT
Northern Naked-tailed Armadillo	NA	DD
Neotropical River Otter*	W	NT ▼
Nine-banded Armadillo	G	LC
Ocelot	F	LC
Paca	G	LC
Puma*	F	LC ▼
Red Brocket Deer	F	DD
White-lipped Peccary*	G	VU
White-nosed Coati	NA	LC
White-tailed Deer	G	LC
Yucatan Black Howler Monkey*	F	EN
Yucatan Brown Brocket Deer	NA	VU
Geoffroy's Spider Monkey*	F	EN

Table 4. Target bird indicator species (n=31).

Common Name	Migra -tory	Class	IUCN Status
American Redstart	Y	M	LC ↓
Black and White Warbler	Y	M	LC ↓
Blue-gray Gnatcatcher	Y	P	LC
Bronzed Cowbird	N	D	LC
Brown-hooded Parrot	N	F	LC
Cerulean Warbler	Y	F	NT ↓
Chestnut-sided Warbler	Y	M	LC ↓
Common Yellowthroat	Y	M	LC
Crested Guan*	N	G	LC ↓
Dickcissel	Y	D	LC ↓
Golden-winged Warbler*	Y	F	NT ↓
Grace's Warbler	N	P	LC ↓
Great Curassow*	N	G	VU
Great Tinamou*	N	G	NT ↓
Hooded warbler	Y	M	LC
Keel-billed Motmot*	N	F	VU ↓
Keel-billed Toucan	N	F	LC ↓
Kentucky Warbler	Y	F	LC ↓
Little Tinamou	N	F	LC ↓
Louisiana Waterthrush	Y	W	LC
Magnolia Warbler	Y	M	LC
Mealy Parrot*	N	F	NT ↓
Northern Waterthrush	Y	W	LC
Painted Bunting	Y	M	LC
Plain Chachalaca	N	D	LC
Prothonotary Warbler	Y	W	LC ↓
Slaty-breasted Tinamou	N	F	LC ↓
Swainson's Warbler	Y	F	LC
Wood Thrush	Y	M	LC ↓
Worm-eating Warbler	Y	F	LC
Yellow-headed Parrot*	N	P	EN ↓

*Assessed as part of the threatened bird or mammal indicator for the target "Rare, Threatened, Socio-Economic, & Culturally Important Species."

KEY: M = migration route health, P = pine savannah health, D = disturbed forest, F = forest health, G = game (hunting pressure), W = wetland health, NA = not assigned. LC = least concern, NT = near threatened, VU = vulnerable, EN = endangered, DD = data deficient.

Arrow indicates a trend in global populations.

Methods

The core data collected in transects since 2010 are the number of species observed, and the number of individuals observed per species. The monitoring team aims to visit each transect once per month. To complete one visit, birds are monitored twice on the same day: early morning and late afternoon. Large mammal monitoring is done simultaneously with bird monitoring, but signs and sightings are only recorded once during the day to avoid double counting. A more detailed description of the methodology used on the transects can be found in Ya'axché's BRIM strategy document (Wicks, 2009).

Analysis

The number of indicator species recorded on the transects was standardized across years and reserves by using an index of abundance for each indicator group and for each species of conservation concern.

The index of abundance gives an indication of the status of an animal population, based on the numbers of animals seen per unit of time or distance, in a particular area over several years. In this case, the indices were calculated as the number of individuals observed per 1000m.

Indices of abundance over time were plotted and analyzed for trends and significance using ordinary least squares regression techniques using PAST software (Hammer et al. 2001).

Data from all GSCP transects are reported together for a comprehensive score for that reserve. For BNR and MMNFR, data from each transect are presented separately because the transects in those reserves have habitat and/or land use types that are distinct from each other. The CRFR and village transects are reported for comparison against the PAs managed by Ya'axché.

Indicator group trends

The index of abundance for each indicator group and PA can be found in **Figure 1**. Regression equations and p-values are reported below only for those groups with statistically significant trends.

Indicator groups that have statistically significant declines:

Migration Route Health Birds

- Declined in GSCP from 2010-2021 ($y = -0.2507x + 6.2234$; $R^2 = 0.3816$; $p<0.05$). This trend was broken 2022-2024.
- Declined in BNR from 2010-2022 ($y = -0.36117x + 6.2589$; $R^2 = 0.37542$; $p<0.05$). This trend was broken in 2023-2024.
- Declined in CRFR from 2010-2022 ($y = -0.2390x + 4.4117$; $R^2 = 0.6655$; $p<0.001$). This trend was broken in 2023-2024.
- Declined in Indian Creek village from 2012-2021 ($y = -0.4273x + 6.5092$; $R^2 = 0.49196$; $p<0.05$). This trend was broken in 2022-2023.

Pine Savanna Birds

- Declined in BNR savanna from 2010-2021 ($y = -0.30858x + 4.6585$; $R^2 = 0.5044$; $p<0.05$). This trend was broken in 2022-2023.

Disturbed Forest Birds

- Declined in BNR savanna from 2010-2023 ($y = -0.1843x + 1.9654$; $R^2 = 0.5794$; $p<0.005$).
- Declined in Indian Creek village from 2012-2023 ($y = -0.58493x + 6.387$; $R^2 = 0.3824$ $p<0.001$).
- Declined in GSCP from 2010-2024 ($y = -0.2214x + 2.9839$; $R^2 = 0.6917$; $p < 0.001$).
- Declined in CRFR from 2010-2024 ($y = -0.1429x + 2.0021$; $R^2 = 0.5058$; $p < 0.005$).

Game Birds

- Declined in BNR savanna from 2012-2023 ($y = -0.0953x + 0.9709$; $R^2 = 0.5821$; $p < 0.005$).

Game Mammals

- Declined in CRFR from 2010-2023 ($y = -0.6692x + 10.485$; $R^2 = 0.7110$; $p < 0.001$). This trend was broken in 2024.

Wetland Mammals

- Declined in GSCP from 2010-2024 ($y = -0.0294x + 1.2753$; $R^2 = 0.2603$; $p = 0.05$).

Indicator groups that have statistically significant increases:

Migration Route Health Birds

- Increased in MMNFR from 2016-2024 ($y = 0.7912x + 1.4961$; $R^2 = 0.6982$; $p = 0.005$)
- Increased in MMNFR broadleaf from 2016-2023 ($y = 0.9991x + 0.1435$; $R^2 = 0.6231$; $p < 0.05$).

Forest Health Birds

- Increased in MMNFR broadleaf from 2016-2023 ($y = 0.9555x + 0.4601$; $R^2 = 0.4879$; $p = 0.05$).

Game Birds

- Increased in CRFR from 2016-2024 ($y = 0.0150 + 0.0158$; $R^2 = 0.2603$; $p = 0.05$).

Game Mammals

- Increased in Indian Creek village from 2012-2022 ($y = 0.4262 + 3.1912$; $R^2 = 0.3923$; $p < 0.05$). This trend was broken in 2023.

Wetland Mammals

- Increased in BNR from 2010-2024 ($y = 0.0424x + 0.0473$; $R^2 = 0.6790$; $p < 0.001$).

No other statistically significant trends exist.

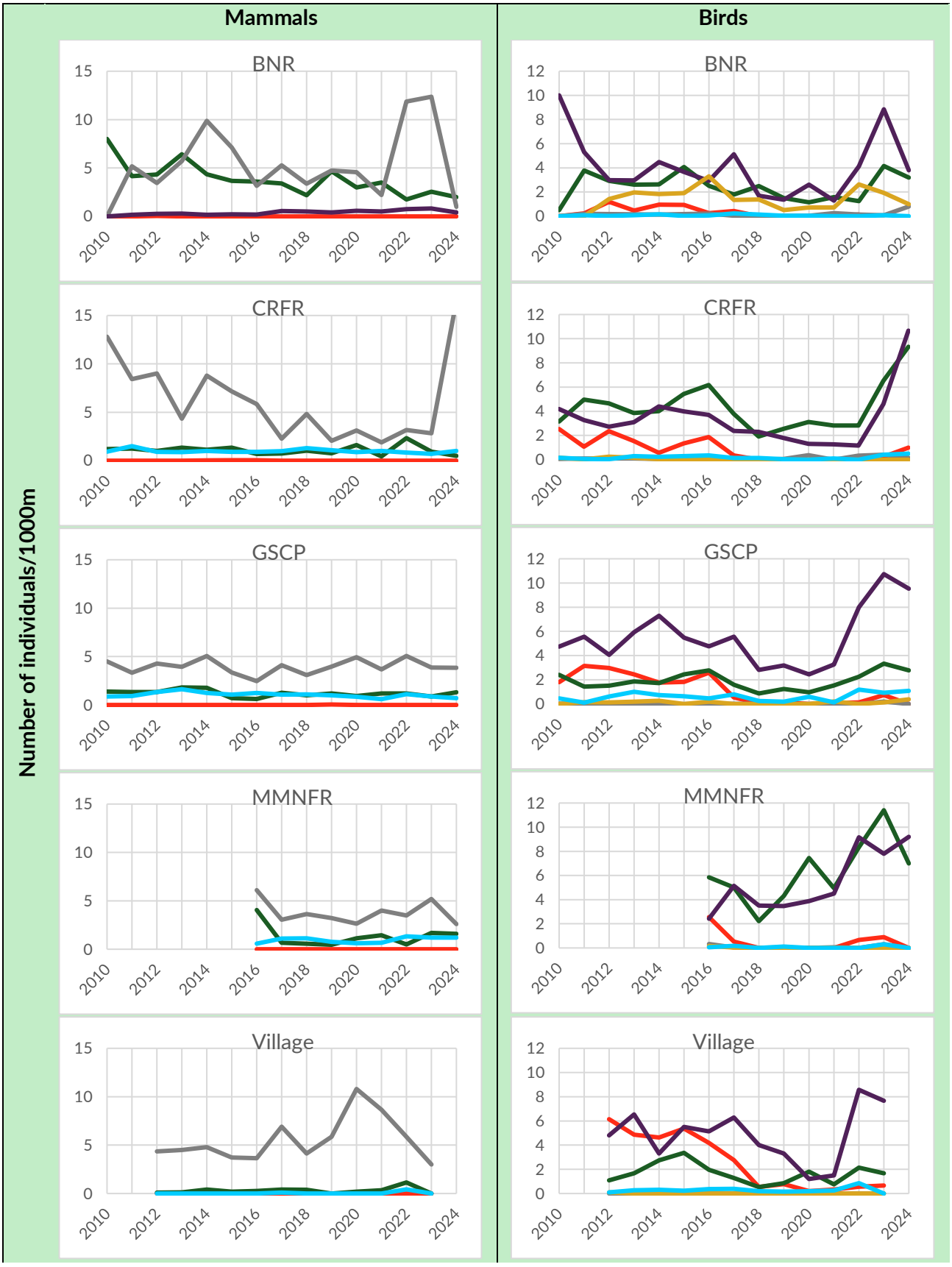
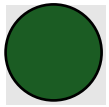
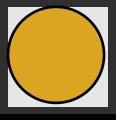
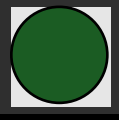
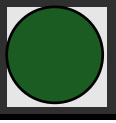


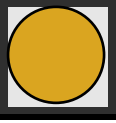
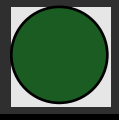
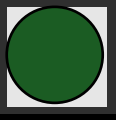
Figure 1. The index of abundance for each indicator group and PA for the years monitored.

II. Rare, Threatened, Socio-Economic, & Culturally Important Species

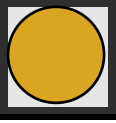
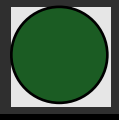
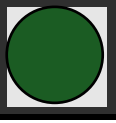
	Rare, Threatened, Socio-Economic, and Culturally Important Species					Overall Condition	GSCP	BNR	MMNFR	BCEP
Indicators of Condition	**Specific Measures**	**Condition Status/ Trend**				**Rationale**				
		GSCP	**BNR**	**MMNFR**	**BCEP**					
Jaguars	Number of Individuals	Unknown				Jaguars are apex predators in jungles of the neotropics. A stable jaguar population over time indicates trophic integrity in the landscape. Camera trap surveys in BNR and MMNFR have allowed Ya'axché to capture, identify, and track the movement of individual jaguars in BNR since 2021 and in MMNFR since 2019. The ecological monitoring across PAs was later expanded to include the BCEP in 2024. More years of data are needed to assess trends. Time stamps of the photos, camera station locations, and jaguar rosettes were utilized to ensure certainty of individuals. In some cases, photos were too blurry or the animal was not fully within the image frame, making it impossible to fully identify the individual. BNR. During the 2023 dry season, camera traps detected jaguars across five stations. From these images, two individual males were identified. One of these male jaguars was first detected in BNR during the 2021 dry season; this individual stayed in BNR throughout the entire 2023 year and was recaptured in the 2023 wet season. The second male jaguar identified in 2023 had also been previously captured in BNR in 2021. Cameras were not deployed in 2024. The presence of the same two male jaguars in BNR from 2021-2023 indicates stability of resources. More jaguars are likely to be present in the area, but additional high-quality photos are needed to identify them with certainty.				

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

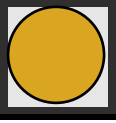
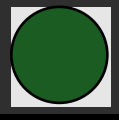
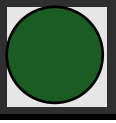
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						MMNFR. At least three unique jaguars have been recorded in the MMNFR concession since monitoring began. During the 2023 dry and wet seasons, camera traps at the agroforestry concession detected two individual male jaguars. One of these jaguars was first detected in MMNFR in 2021. In the 2024 dry season, a female jaguar was detected across two stations; this individual had last been recorded during the 2022 wet season.
						BCEP. Camera trap biodiversity monitoring in this PPA started in 2024. During the 2024 wet season, camera trapping detected jaguars at three different stations. From the images, three unique individuals are suspected. One jaguar is clearly a male, and the other two were captured together in the same photo; these two are suspected to be a female and her offspring. Additional years of monitoring are needed to determine if these individuals continue to stay in BCEP and to clarify their identities.
Threatened Birds	Index of Abundance				Unknown	Eight (8) bird species monitored along the biodiversity transects are of *conservation concern* because they have either a threatened IUCN Red List status or a near-threatened status with decreasing global populations. These species include the **cerulean warbler, golden-winged warbler, keel-billed motmot, great curassow, great tinamou, mealy parrot,** and **yellow-headed parrot**. In 2022, the crested guan joined this list with an updated '*Near Threatened*' status.

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

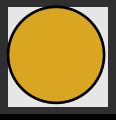
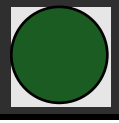
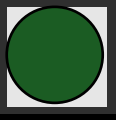
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						The cerulean warbler has never been recorded at any transect location in the MGL since monitoring began.
						GSCP. The keel-billed motmot has never been recorded on the GSCP transects since monitoring began in 2010. This species, along with the yellow-headed parrot are not expected at GSCP due to their range limitations and habitat preferences. Mealy parrots and golden-winged warblers are rarely recorded, and no clear significant relationships have been documented. The condition of threatened game birds in GSCP warrants significant concern. The crested guan has experienced a significant decline since 2010 and has not been recorded there in the last six years. The great curassow was recorded in 2023 for the first time in 11 years. Great tinamous are declining in all other monitored PAs (BNR, MMNFR, and CRFR). This species has always been recorded in low numbers at the GSCP transects since 2010, so while the negative trend is also present here, it is not felt so strongly as in the other PAs.
						BNR. The golden-winged warbler was recorded on the BNR transects for the first time in 2022. Keel-billed motmots and mealy parrots are not very common and do not show clear or significant trends. Yellow-headed parrot numbers have experienced a critical decline giving reason for *moderate concern*. The yellow-headed parrot is facing threats of illegal poaching for the pet trade and habitat degradation from frequent fire.

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

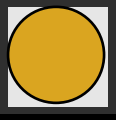
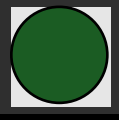
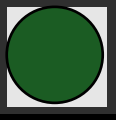
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						As with GSCP, threatened game birds warrant concern in BNR. Great curassow numbers are decreasing. Continued monitoring will determine if this becomes a significant trend. Crested guans have experienced a significant decline from the BNR savanna since 2012. This decline is also observed to a lesser extent in the broadleaf forest, though the trend is not yet significant. Finally, great tinamous have significantly declined from both the BNR savanna and broadleaf forest transects.
						MMNFR. Yellow-headed parrots are rare but not expected at the MMNFR transects because these transects are not located near the parrots' preferred pine savanna habitat. Golden-winged warblers and keel-billed motmots are rarely recorded. After seven years of monitoring, trends have emerged for threatened game birds in MMNFR. Great curassow abundance has significantly decreased at the broadleaf forest transect. The species has never been recorded along cacao transect. Great tinamous are also facing significant declines from the broadleaf forest transect. Declines are also observed along the cacao transect where it is more rarely recorded, but these are not yet significant. Crested guans are rare at the MMNFR transects, and no trends have emerged yet, but zero birds have been recorded in the last six years. In contrast, mealy parrots have seen a significant increase in index of abundance since 2016.
						BCEP. No regular bird monitoring occurred in BCEP during the reporting period.

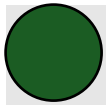
	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

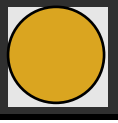
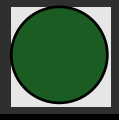
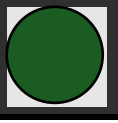
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Threatened Mammals	Index of Abundance				Unknown	Of the mammals monitored along the biodiversity transects, eight (8) species are of conservation concern: Yucatan black howler monkeys, jaguars, pumas, margays, Baird's tapirs, white-lipped peccaries, neotropical river otters, and Geoffroy's spider monkeys. The Yucatan brown brocket deer has never been recorded on a transect and was not assessed. The range for the species covers northern Belize and is not expected to extend into the Toledo District. GSCP. Neotropical river otters have never been recorded on the GSCP transects and are rarely detected at transects in other PAs; this is expectedly due to the distance of transects from large water sources. Geoffroy's spider monkeys, margays, and white-lipped peccaries have rarely been recorded since 2010, but all have stable indices of abundance since monitoring began (no trends). Since 2010, the number of Yucatan black howler monkeys detected on the GSCP transects has decreased, though not significantly. While this mammal has historically been recorded in GSCP, none were recorded between 2018-2023. In comparison, the nearby CRFR has recorded howler monkeys in only one year since 2010. Jaguars have declined along GSCP transects between 2010 and 2024 ($y = -0.0218 + 0.5362$; $R^2 = 0.3477$; $p < 0.05$). The Baird's tapir is common in GSCP, though lower numbers in the last two years have started to produce a weak downward trend since monitoring began.

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

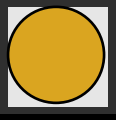
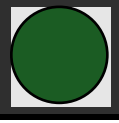
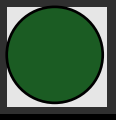
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						On the other hand, Pumas have seen a significant increase in abundance during that same time.
						BNR. Neotropical river otters are rarely recorded at the transects due to the transect locations, and no trends are yet clear. Jaguars, margays, Geoffroy's spider monkeys, and white-lipped peccaries are regularly recorded in BNR, and all species have stable indices of abundance since monitoring began (no trends). The Baird's tapir is increasing at BNR due to an increase of the species at the savanna transect. Pumas have also seen a significant increase in abundance since 2010. For the first time, Yucatan black howler monkeys are showing a significant decline even in the forested transect ($y = -0.0691 + 1.2190$; $R^2 = 0.4188$; $p < 0.05$).
						MMNFR. The neotropical river otter has never been recorded on a MMNFR transect. Margays, white-lipped peccaries and Geoffroy's spider monkeys are rarely recorded on the transects, and trends cannot yet be identified. Yucatan black howler monkeys, pumas, and Baird's tapirs are regularly recorded with stable indices of abundance. Jaguars have seen a slight increase in index of abundance since 2016, but this trend is not significant.
						BCEP. Mammals are not yet monitored for the reporting period.

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

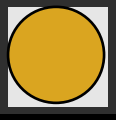
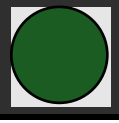
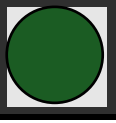
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Bats	Number of Species, Relative Abundance			Unknown	Unknown	The most recent PA bat survey took place in 2016. At that time, 53 species were recorded through mist and harp netting and acoustic monitoring in BNR (Foxley & Gartzia, 2014). Thirty-four (34) species were recorded in GSCP. Both are likely underestimates of true species richness. Trapping results show a difference between bat assemblages in the mature forest of BNR and that of GSCP and between BNR and the agroforests and orange orchards outside of the reserves. BNR has the highest species diversity, including a high number of rare species. It is dominated by *Artibeus jamaicensis*, which has been linked to continuous mature forest habitat. GSCP has the lowest overall species richness in the study, which may be due to the structure of the secondary forest which is recovering from Hurricane Iris damage in 2001. The species assemblage in GSCP is composed of bats more common in disturbed and open areas.
Rare and Endangered Trees	Abundance & Age Structure					GSCP. The broken ridge ecosystem type found in GSCP forms the ideal conditions for the growth of the critically endangered Honduran rosewood (*Dalbergia stevensonii*). The reserve is considered one of the last remaining strongholds for the species due to deforestation elsewhere within its range. Populations have been monitored consistently since 2013 to track growth rates and phenology, which are critical for the creation of biologically relevant timber management plans at the national level. Fires in the 2024 dry season burned some areas of rosewood habitat in GSCP and damaged some of the tagged

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						trees, which may affect flowering and fruiting in subsequent years.
						BNR. A total of 227 tree species from 65 plant families have been recorded from roughly 5,000 trees within 4 permanent sample plots in the BNR (Brewer, 2014). Out of these, 72 species (32%) have distributions restricted to northern Mesoamerica. The BNR landscape, composed of limestone ridges, creates niche conditions that promote the evolution of species specialized to unusually high drainage, pH, and calcium levels compared to what is found in soils from more common substrata across the Neotropics. The rough terrain of the BNR landscape also contributes to the protection of trees from illegal extraction. Notable rare, restricted, and/or ecologically important species include ***Bartholomaea sessiliflora***, ***Beilschmiedia hondurensis***, ***Chiangiodendron mexicanum***, and ***Guettarda davidseorum***.
						MMNFR. Surveys for threatened timber species in 2020-21 revealed previously unknown populations of prickly yellow (*Zanthoxylum*) species (Dorgay, 2021b). Due to a history of legal and illegal logging in the reserve, the age structure for several of the populations is skewed toward younger trees. These populations were targeted with improved signage in the reserve, increased patrols, and out-planting and monitoring of saplings from 2022-2024. Between November 2021 - December 2022, 910 native saplings were planted to restore more than 6 acres of agricultural clearings in MMNFR and boost local populations. 251 big-leaf mahogany (*Swietenia*

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

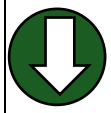
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						macrophylla, IUCN-Vulnerable) were planted, along with other species of socio-economic or wildlife value. Another 755 native trees were planted by farmers into farmlands at the border of the protected area; these plantings included an additional 115 *Swietenia macrophylla* and 185 Honduran rosewood (*Dalberia stevensonii*, IUCN-Critically Endangered). As of 2024, approximately 70% of the big-leaf mahogany monitored within the reserve had survived.
						BCEP. Though Ya'axché has not yet conducted plant surveys in BCEP, the area is recognized as key habitat for Honduran rosewood (*Dalbergia stevensonii*). Ranger patrols have deterred the extraction of this timber species since Ya'axché began managing the reserve. The status and trend for the species should be assessed through subsequent surveys.
Native Bees	Number of Species				Unknown	Since June 2019, Ya'axché has actively captured and documented native bee species across the MGL protected areas and farms (reported in Dorgay, 2021a). To date, 52 bee species have been recorded. This is roughly 1/3 of the 148 known species documented for the country of Belize. Across all areas sampled, the majority of individuals captured come from the stingless bee tribe Meliponini. In total, 15 meliponine species are known across the MGL. Ten (10) of those have socio-economic value as honey producers. Numbers of species are reported here; subsequent years of native bee monitoring

	Rare, Threatened, Socio-Economic, and Culturally Important Species	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						will establish trends. A native bee ID guide has been developed and made publicly available on Ya'axché's website.
						GSCP. 13 native bee species from three (3) tribes have been identified. Eleven (11) species belong to the tribe Meliponini; one (1) of these is an endemic species (*Tetragona mayarum*) found in Mayan forests. Another bee, *Scaptotrigona pectoralis*, is especially susceptible to pesticides and can be considered an indicator of chemicals in its environment (de Souza Rosa et al., 2015).
						BNR. 34 species of native bees belonging to 11 tribes have been identified. Two (2) species are endemic to the region: *Tetragona mayarum* and *Paratetrapedia albilabris*. Two (2) species, *Melipona beechei* and *Scaptotrigona pectoralis*, are especially susceptible to pesticides and can be considered indicators of chemicals in their environment (Valdovinos-Nuñez et al., 2003). Two (2) bees, *Ancyloscelis apiformis* and *Epicharis lunulata*, are considered rare or uncommon (Michener, 1994).
						MMNFR. 11 species of native bees from three (3) tribes have been identified. One (1) species, *Nannotrigona perilampoides*, is especially susceptible to pesticides and can be considered an indicator of chemicals in its environment.
						BCEP. No bee surveys took place in BCEP during the reporting period.

III. Broad Ecosystems and Land Use Change

	Broad Ecosystems & Land Use Change	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Extent of Broadleaf Forest	Percent cover					The GSCP has retained its forest cover in 2023 with the estimate of 99% and declined to 97.88% forest cover in 2024. In 2024 fires affected the northern parcel of the reserve, impacting approximately 826 acres or approximately 5.5% of the total area of the reserve. Much of this acreage is recovering and not readily noticeable from remote sensing analysis.
						The BNR enjoys widespread protection via its location at the center of the Maya Mountains block of PAs. Restricted and patrolled access to the reserve ensures little opportunity for any forest areas to be cleared. For the period 2023-2024 BNR retained 99% of its forest cover within an estimated 100,000 acres of reserve.
						The MMNFR retains most of its forest cover. The larger area of the reserve is still well intact due to remoteness and rugged terrain making access for clearings nearly impossible. The MMNFR, excluding the concession area maintains, 99% forest cover within an estimated 36,000 acres.
						BCEP is data deficient. In 2023, it was estimated that forest cover in the protected area was approximately 92%. The remaining percentage is associated with regenerating areas, agriculture areas or areas that have remained as grasslands

	Broad Ecosystems & Land Use Change	Overall Condition	GSCP	BNR	MMNFR	BCEP

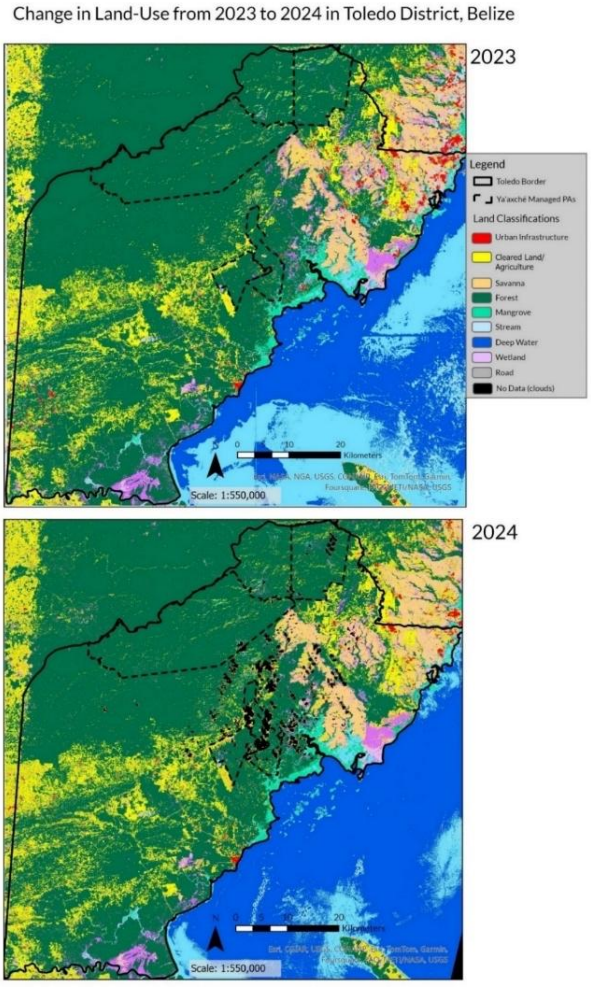
Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						following conversion to agriculture back in the 90's and earlier. 2024 data is not available. Agriculture incursions pose the biggest concern for any declines in forest cover.
Extent of Deforestation	Percent cover					GSCP. No significant deforestation was detected in 2023. Conditions are good with a slight deterioration due to fire impacts of 2024. Those fires resulted in long-term fire scars that are detected through remote sensing and tallying up to 55.6 acres. These scars are the result of fire related forest loss at the foothills on the northern boundary line of the GSCP.
						BNR. No deforestation was detected in BNR for both 2023 and 2024.
						MMNFR. 2023 saw continued clearings, particularly illegal unregulated agriculture. Up to an estimated 115.7acres of forest were cleared for agriculture accounting for an estimated 0.79% of the land cover of the PA. A total of 1667 acres or 4.7% is under some form of unauthorized illegal agriculture activity. In 2024, a reassessment of the disturbed areas including active farms accounted for 104 acres or 0.29% of land cover of the PA, suggesting that some areas have either been abandoned or left in fallow.
						BCEP. Between 2023-2024, there was approximately 200 acres under some form of clearings within the boundaries of the protected area. Of this area, approximately 100 acres were cleared in 2023. These 200 acres represent 1.6% of the

	Broad Ecosystems & Land Use Change					Overall Condition	GSCP	BNR	MMNFR	BCEP
Indicators of Condition	**Specific Measures**	**Condition Status/ Trend**				**Rationale**				
		GSCP	BNR	MMNFR	BCEP					
						total area of the reserve. This figure is a crude assessment of clearings in the reserve using satellite imagery. In 2024, a reassessment of disturbed areas including the 2023 identified areas account for approximately 711 acres or 5.3% of the land cover of the PA. It is worth noting that there was no indication of expansion of new clearings. It appears that clearings are occurring within this existing patch of disturbed land.				
Extent, Increase, and Impact of Agricultural Lands	Area of land cleared or under unsustainable development	NA	NA			No agriculture lands are found within the GSCP and the BNR, as such, this indicator does not apply to these two protected areas. In MMNFR, the area of illegal land clearings within the vicinity of Governor Creek were still present in 2023 but appear to decrease in 2024. The areas that appear to be under pressure from agriculture clearances are north and south of agroforestry concession. These areas account for 104 acres of clearings and only a 0.09% increase from 2023 levels. The extent and impact are very minimal. BCEP. Approximately 100 acres were cleared in 2023 for agriculture. These acreages occur in an area of disturbed land that in 2024 measured approximately 711 acres. It appears that there was no net loss in forest cover in 2024 based on the remote sensing analysis. This is the desired state while management planning processes are ongoing and community relationships built.				

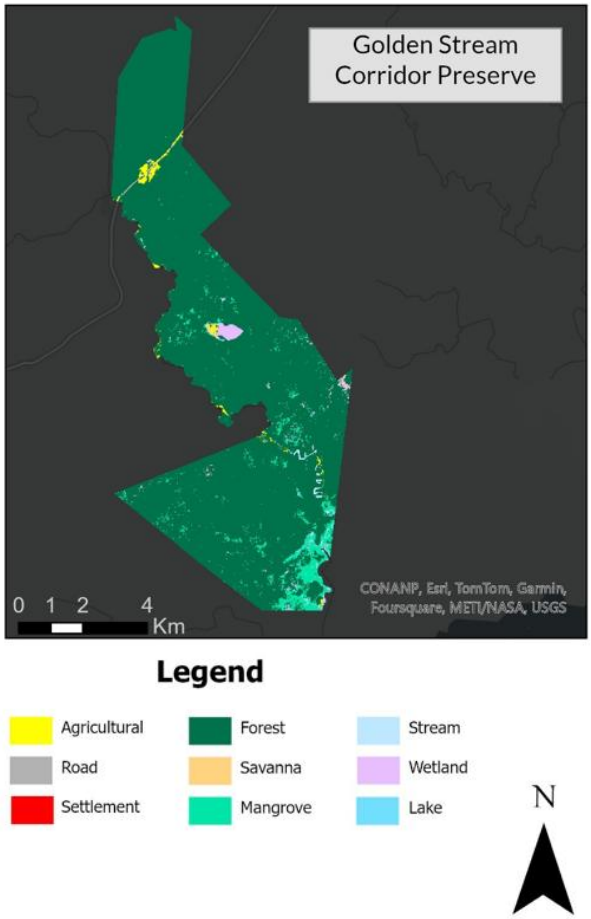
Information Brief: Forest Cover within Ya'axché's Protected Areas

The total area of the MGL under terrestrial ecosystems measures approximately 275,416 hectares or approximately 680,568 acres. From this total terrestrial area, Ya'axché manages 66,288 hectares as protected areas under three different designations. Ya'axché-managed areas make up approximately 24% of the total area of the MGL encompassing the areas in the Golden Stream Corridor Preserve, Bladen Nature Reserve and the Maya Mountain North Forest Reserve and the Boden Creek Ecological Preserve. The GSCP is a PPA as is the BCEP, the BNR is a strict nature reserve, and the MMNFR is a forest reserve with the lowest level of protection.

The GSCP functions as a structural corridor providing forest connectivity between the PAs in the Maya Mountains and the PAs in the lowland forest of the Toledo District. The PA lies in the middle of traditional agricultural landscape where the land-uses have changed the landscape from a once forested area to an increasingly fragmented mosaic of traditional farmlands, monocrop agriculture and forest patches. As the farmlands continue to expand and develop, the accessible areas bordering the PA have been converted to some form of agriculture and are actively being used. The rate of conversion from forest to agricultural land in the buffer areas appears to be low and currently not cause for concern. Enforcement and compliance patrols and community engagement have kept this PA relatively intact.

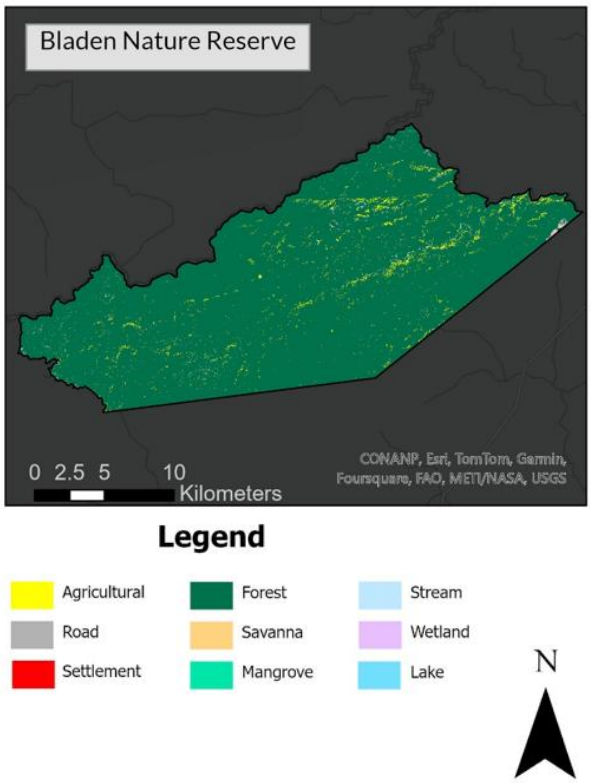


Map 3. Land cover classification in the MGL.



Map 4. Land cover classification in the Golden Stream Corridor Preserve for the period 2023-2024.

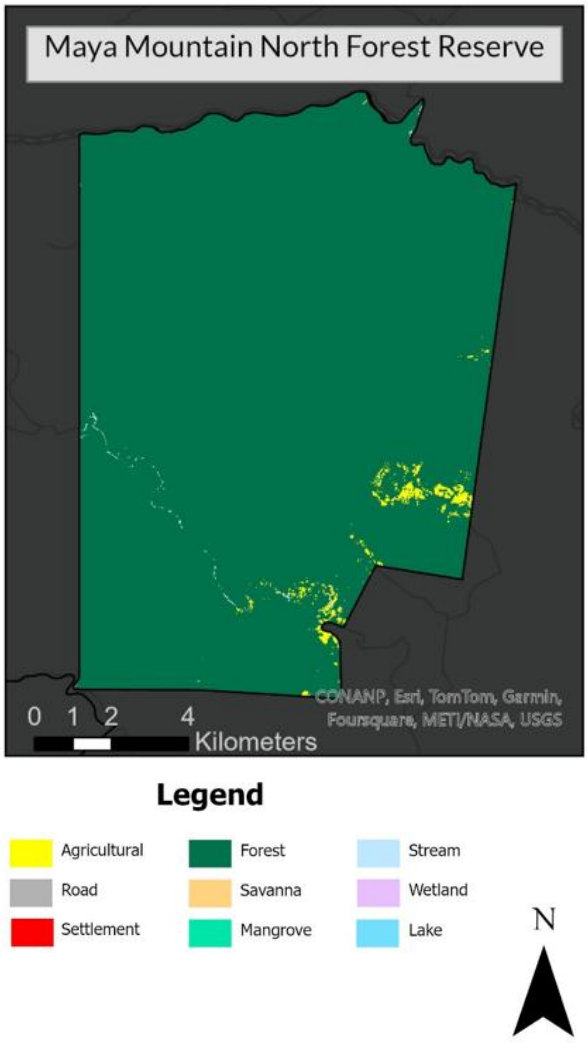
The BNR as a strict nature reserve only allows education and research activities within its boundaries. Its remoteness serves as a primary layer of protection. Enforcement and Compliance patrols serve as this protected area's secondary layer of protection. For the period 2023-2024 there were no changes in the landscape. For the most part, the BNR maintains its forest nearly intact. Minor infractions reported between 2023-2024 in the western boundaries of the reserve have not had a significant effect on the forest cover, but it is contributing to the degradation of resources in the localized boundary area. Logging was the main infraction detected in the western boundary with secondary evidence of hunting.



Map 5. Land cover classification in the Bladen Nature Reserve for the period 2023-2024.

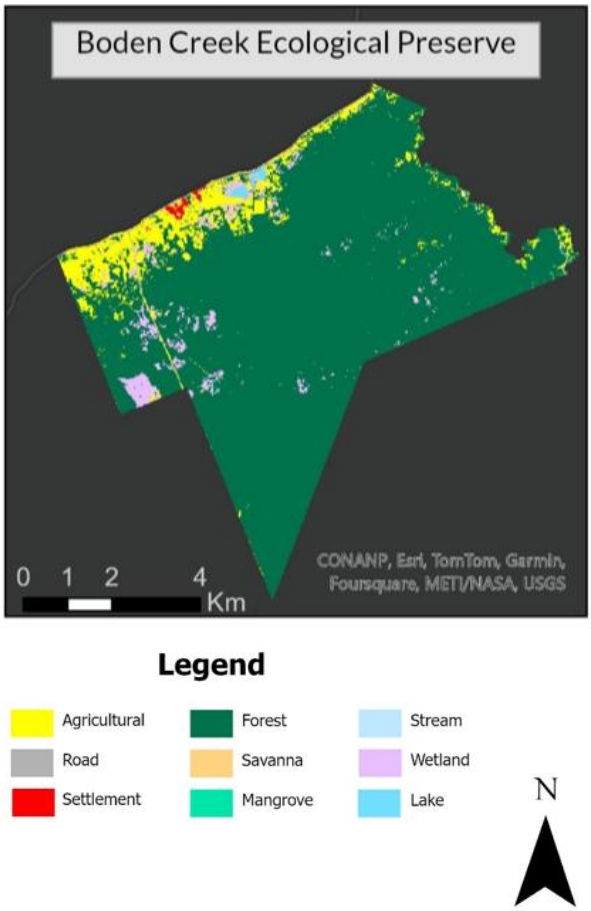
The MMNFR is by definition an extractive reserve. Since 2015, the development of a cacao agroforestry concession has seen the conversion of semi degraded areas inside the reserve into productive cacao plantations. The core, northern and western sections of the reserve are relatively intact owing to its rugged terrain that starts at the foothills and gradually rises to the upper elevations of the Maya Mountains. Both large scale industrial and traditional agriculture flank, the reserve to the east and the south where degradation and conversion have been persistent during the 2023-2024 period. Forest loss within this reserve was related to illegal and in some cases legal agriculture. Clearings in the vicinity of the Trio Branch River are associated with the established cacao agroforestry concession which allows annual crops to be grown for a limited time. The clearings on the southeast

corner of the reserve are illegal clearings mostly for annual crops.



Map 6. Land Cover Classification in the Maya Mountain North Forest Reserve 2023-2024.

BCEP, being the most recent addition to the protected areas program, is still data deficient but for the period 2023-2024 there is now a baseline measure of the status of its forests. For this period there was a marked contrast to the other protected areas. For starters, there is an area in close proximity to the Southern Highway that has been under natural regeneration for the last two and a half decades following intensive agriculture and logging operations. In the late 90's invasive activities were halted, and the property was set aside for conservation. The area under natural regeneration is now a mosaic of scrubland, grasslands and secondary growth with and increase in unauthorized clearings typically for small-scale agriculture. Overall, the degradation is limited to the areas under regeneration and not within the more mature forest stands. If further degradation is to be halted, enforcement and compliance patrols will be required at a more frequent and consistent basis.



Map 7. Land Cover Classification in the Boden Creek Ecological Preserve.

Forest cover changes continue to be relegated to the buffer areas of the reserves for the most part. Of the four protected areas, the BNR is the most intact with little to no changes in forest cover. The GSCP ranks second considering most of its forest cover is still under regeneration

from past conversion. The trend of forest loss and habitat degradation is expected to continue as the landscape outside the reserves continues to develop into productive landscapes. This trend will require additional support from the farming community to promote sustainable practices that will minimize the detrimental effects of high rates of forest loss in the surrounding areas of the PAs of the MGL.

IV. Ecosystem Services

Ecosystem Services		Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Freshwater Quality	Macro-invertebrate assemblages					Ya'axché began freshwater monitoring in 2008, and data were collected periodically in the subsequent years. Regular, repeated assessments have been conducted twice a year since the wet season of 2023 to increase confidence in the condition and confirm trends. 12 sites are assessed across four (4) watersheds in Toledo. BCEP and GSCP share the same sites along the Golden Stream River. Macroinvertebrates were collected from diverse riparian habitats and identified to family level. Macroinvertebrate assemblages were scored by assigning a sensitivity value from 1-10 to each family collected at the streams. The very pollutant tolerant families are assigned a value of 1, while the very sensitive (pollutant intolerant) families are assigned a value of 10. The sum of these is divided by the number of scoring taxa collected from each sample to obtain the Average Score Per Taxon- Costa Rica (ASPT-CR) index value. Higher ASPT scores indicate the stream to be of higher ecological status, while lower scores indicate a stream of degraded ecological status. GSCP and BCEP. ASPT scores from the monitoring sites within the Golden Stream watershed ranged from 4.81 - 5.79. BNR and MMNFR. Within the Monkey River watershed, monitoring sites in the protected areas ranged from 5.15 – 5.88.

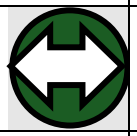
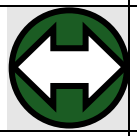
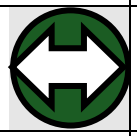
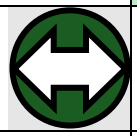
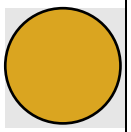
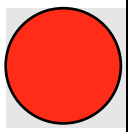
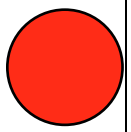
	Ecosystem Services	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						An ASPT value greater than six [> 6] indicates high ecological status of the stream. All sites scored between 4-6 indicating waters with regular quality and medium contamination, which is rated as "good" on the scale.
	Dissolved oxygen					GSCP, BCEP, BNR and MMNFR. Dissolved oxygen in waterways was within the ideal range, 6.61 – 8.16 mg/L, above Mexico's 5.00 mg/L minimum standard for aquatic life in warm surface waters. This is similar to the values identified in 2016.
	Turbidity					Turbidity for all sites in all four (4) reserves ranged from 0.27-3.4 NTU, which are within Mexico (<10NTU) and Costa Rica (<25NTU) standards for water quality. This is similar to the values identified in 2016.
	Electrical conductivity					Salinization of freshwater resources, both from natural and man-made sources, is a growing water quality challenge. Salinity can negatively impact sectoral water use, health, biodiversity, and ecosystem services. Electrical Conductivity (EC) is a commonly measured parameter to assess salinity. The EC values for each tributary vary based on the substrate material and season. Calcareous sites on GSCP and BNR have higher values, while siliceous sites in MMNFR are expectedly lower in comparison. Conductivity in rivers generally ranges from 50-1500 µS/cm with ideal values below 500 µS/cm (Conductivity, 2012).

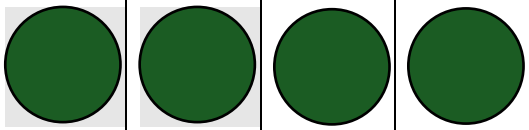
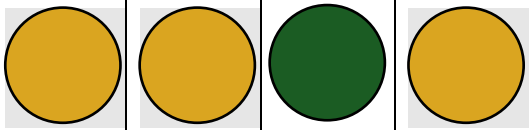
Ecosystem Services		Overall Condition	GSCP	BNR	MMNFR	BCEP

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						GSCP and BCEP. Electrical conductivity of the sites in the Golden Stream watershed ranges from 3.75-40.73 µS/cm in both seasons. This is a significant decrease from the previous 2016 assessment.
						BNR. Sites on the Bladen Branch of Monkey River range from 211.66-243.7 µS/cm in both seasons. This is significantly higher than the electrical conductivity at either of the sites in MMNFR that are part of the same watershed. This is similar to the values identified in 2016.
						MMNFR. Electrical conductivity is 80.6-97.43 µS/cm for the sites on the Trio River Branch of Monkey River during both seasons. Electrical conductivity is significantly lower for sites on the Governor's Creek Branch of Monkey River at 41.1-82.3 µS/cm during both seasons. This is similar to the values identified in 2016.
	Temperature					GSCP and BCEP. The water temperature for sampled sites in the Golden Stream watershed ranges from 24.6°C – 25.9°C in both wet and dry seasons. This is similar to the values identified in 2016.
						BNR and MMNFR. The water temperature of the sites remained at a consistent range on the Monkey River watershed for the wet season ranging from 26.3°C – 27.9°C and in the dry season

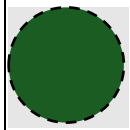
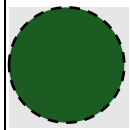
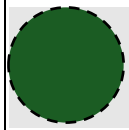
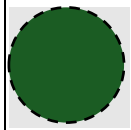
Ecosystem Services		Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						from 24.4°C – 27.6°C. This is similar to the values identified in 2016.
	pH					The pH for all sites sampled was near neutral within the range of 7.37-8.7. This has remained stable since 2016.
	Phosphate					Phosphate levels are elevated for all four PAs. Despite the absence of anthropogenic sources such as agriculture or settlements upstream, phosphate concentrations were consistently elevated across all monitoring sites. Given the protected status of the watersheds and their origin in the Maya Mountains, it is likely that the high phosphate levels are influenced by natural geological or soil characteristics, which may contribute phosphorus through baseflow and surface runoff, especially during periods of increased rainfall and weathering. Phosphate was not monitored before 2023. <0.03 mg/L is low; 0.03-0.1 mg/L borderline high; >0.1 High
						GSCP and BCEP. Phosphate levels from the Golden Stream watershed ranged from 0.28 mg/L – 0.7 mg/L for both wet season and dry season.
						MMNFR. Phosphate readings in monitoring sites within the MMNFR ranged from 0.44 mg/L – 1.43 mg/L for both wet and dry season.

	Ecosystem Services	Overall Condition	GSCP	BNR	MMNFR	BCEP

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						BNR. Phosphate levels in the Bladen branch for the Monkey River watershed ranged from 0.363 mg/L – 1.14 mg/L.
	Nitrite					Nitrite was not monitored before 2023. Nitrite levels for all sites ranged from 0.0006 mg/L – 0.05 mg/L for both wet season and dry season. Nitrite readings are within healthy ranges: unpolluted freshwater systems below 0.1 mg/L; maximum contaminant level of 1 mg/L for drinking water (U.S. Department of Health and Human Services, 2013).
	Nitrate					Nitrate was not monitored before 2023. Nitrates are commonly found in freshwater bodies (surface water and groundwater). They are naturally occurring compound formed from nitrogen and oxygen atoms. While nitrates occur naturally, higher concentrations are often linked to anthropogenic activities like agriculture and wastewater discharge. <0.3 mg/L low; <1.0 mg/L buffer zones; >1.0 mg/L elevated
						GSCP and BCEP. Nitrate levels were elevated in the Golden Stream watershed for both the wet season and the dry season. Readings ranged from 0.67 mg/L – 1.166 mg/L for both seasons.
						MMNFR. Nitrate levels were elevated in both the Trio Branch and Governor Creek of the Monkey River watershed. Readings ranged from 0-1.07 mg/L for both wet and dry season.

	Ecosystem Services	Overall Condition	GSCP	BNR	MMNFR	BCEP

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						BNR. Nitrate levels in the Bladen Branch were within acceptable ranges. Readings consisted of 0.1 mg/L – 0.6 mg/L for both wet and dry seasons.
	Stream physical condition					The Stream Visual Assessment Protocol (SVAP) is a qualitative scoring criterion of the different physical attributes of a stream, including channel condition, riparian zone, shade (canopy), bank stability, hydrologic alteration, pools, water appearance, nutrient enrichment, sedimentation, insect/invertebrate habitat, in-stream fish cover, barriers to fish movement, fishing pressure, presence of garbage and manure presence. The scores of each attribute are average to result in an overall site score.
						In 2016, all sites in all three reserves scored either in either the "good" or "excellent" range for stream physical condition. The SVAP method has not been repeated since that time, leading to low confidence in this condition.

V. Sustainable Natural Resource Use

	Sustainable Natural Resource Use	Overall Condition	GSCP 	BNR NA	MMNFR 	BCEP 

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Knowledge	Up-to-date documentation for resource use is available in communities eligible to harvest resources in the reserve		NA			GSCP. Current knowledge of NTFPs remains unchanged. Ya'axché's community liaison manager actively communicates with community leaders particularly during transition periods from outgoing leadership to incoming leadership. On average, requests for NTFPs stand at two requests per year. This section does not apply to BNR. MMNFR. The TFCG continues to develop the agroforestry concession with extraction mostly restricted to cacao harvests. A few instances the group successfully applied for a permit to harvest trees from within the concession that were needing to be removed to clear canopy to reduce shade cover over the cacao plots. These exceptions to extraction from the agroforestry concession are made by the Forest Department and in consultation with Ya'axché. BCEP. The intention is to establish an NTFP extraction zone following the GSCP model. Discussions with community leadership of Indian Creek Village are ongoing and the extraction zones will be designed taking into consideration feedback from the leadership and other community members. Currently, extraction is unregulated with instances of aggression toward patrol efforts in the PPA.

Sustainable Natural Resource Use		Overall Condition	GSCP	BNR	MMNFR	BCEP
				NA		

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Opportunity for Subsistence Activities	Subsistence users are engaged in subsistence management	NA	NA		NA	MMNFR continued to provide access to farmers for the small-scale subsistence production of annual crops within the agroforestry concession. A small number of farmers continued to cultivate up to 2 acres per farmer in the fertile flood banks of the Trio Branch River. Cultivation here is only possible outside of the rainy season when crops can be at risk of flash flooding.
	Proportion of permits that are approved for subsistence use		NA	NA		The GSCP extraction zones have benefited buffer communities who request extraction of construction material for traditional home building. All materials are NTFPs which were identified in consultation with the communities. Fewer than two permitted requests per year is common for this activity. In 2023, one permit was requested and approved for 700 leaves. In 2024, no requests were made. BCEP. There is potential to establish a model for regulated and approved subsistence activities in the protected area. For the period 2023-2024, there is ample evidence of subsistence farming by some members of Indian Creek Village. However, the PPA comes with rules governed by a trust deed that requires that activities within its boundaries do not go contrary to conservation principles. Discussions with the leadership of Indian Creek are ongoing and can result in a sustainable multiple use model that can be replicable elsewhere.

	Sustainable Natural Resource Use	Overall Condition	GSCP	BNR	MMNFR	BCEP
				NA		

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Extent of Legal vs. Illegal Natural Resource Use	Incidence					GSCP. There was only 1 request for cohune leaf extraction documented in 2023 and none in 2024. There was a total of 5 documented instances of NTFP extraction during the period 2023-2024. Of those, 3 were in 2023 and 2 were in 2024. A total of 3 instances of illegal logging were documented for the same period with 1 occurring in 2023 and 2 occurring in 2024. The extraction is monitored and although there is some illegal extraction the impact is minimal and very localized.
						The BNR remains stable. There is no legal extraction that is permitted in the reserve. Evidence of illegal logging was once again documented on 2 occasions, both occurring in 2023. All indications are that the illegal activities are of a transboundary nature and all timber products are transported across the Belize/Guatemala border via a network of horse trails. There is a persistent hotspot for illegal fishing with 4 instances recorded in 2023 but none in 2024. These occurrences are few and far between, with most cases, if any, occurring during the dry season.
						MMNFR saw continued illegal activity as documented the previous year. Illegal timber extraction and illegal fishing were the major concerns for the period 2023-2024. Ten (10) incidents of illegal logging were reported for that period, seven (7) of which occurred in 2023 and the other 3 in 2024. Three (3) instances of illegal fishing all in 2023 were documented.

	Sustainable Natural Resource Use	Overall Condition	GSCP 	BNR NA	MMNFR 	BCEP 

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						The cacao concession entered its 9th year of development and production. A total of 58,975 lbs. of wet cacao bean were harvested by the TFCG for the 2023 season. A total of 49,044 lbs of wet cacao bean were harvested in 2024. A long-term logging license was granted to Hummingbird Furnishings Ltd for the extraction of timber from the MMNFR excluding the agroforestry concession. Ya'axché does not have access to logging data and is not responsible for monitoring logging activity.
						BCEP. Currently resource extraction is not authorized for any resource in this protected area. For the period 2023-2024 there were some exceptions made when the leadership of the village or from members of the community contacted Ya'axché's ED with specific requests which were granted.

VI. Enforcement & Compliance

Enforcement & Compliance		Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
Effectiveness of Patrols	Number of patrols					Patrols within GSCP remained consistent during the period 2023-2024. The location of the field station and proximity to patrol routes allows for ease of access and wide coverage of the priority areas for patrols and deters illegal entry into the reserve. A total of 180 patrols were deployed in 2023 and a total of 159 patrols were deployed in 2024. These results are similar to 2022 which recorded 181 patrols. The reduced number of patrols in 2024 is due to ranger teams deployed to fight fires during the month of April through May significantly affecting patrol effort. Nonetheless the total number of patrols for 2024 is still an effective at curbing illegal activities in the protected area.
						The BNR generally enjoys the benefits of its remoteness. A total of 290 patrols in 2023 and 209 in 2024 are consistent with the previous reporting period which recorded 224 patrols. Fluctuations in patrol numbers for BNR are typically related to weather and remoteness of some routes. In 2024 a decrease in patrols from 2023 record was due to the team being called to other protected areas to fight fires.
						Patrol effort in MMNFR declined in 2023 and 2024. A total of 207 patrols were deployed in 2022. A total of 134 patrols were deployed in 2023. A total of 104 patrols were deployed in 2024 once again owing to the diverted effort due to wildland fires in other protected areas.

	Enforcement & Compliance	Overall Condition	GSCP	BNR	MMNFR	BCEP
						

Indicators of Condition	Specific Measures	Condition Status/ Trend				Rationale
		GSCP	BNR	MMNFR	BCEP	
						Patrol effort in BCEP was inconsistent over the last two years. Issues surrounding tenure claims and significant incursions in the PA had required the scaling back of patrols in some areas to avoid direct conflict with people. In 2023 a total of 127 patrols were conducted in this PA. In 2024 a total of 3 patrols were officially documented in the SMART system. This was mostly due to patrols being significantly curtailed and many patrols did not follow the normal procedures with most site visits by rangers being verification of activity.
Protected Area Rules and regulations infractions	Number of infractions					The GSCP documented one (1) infraction related to illegal extraction of NTFPs in 2022. Compared to the two years prior, 2022 was a very quiet year. The BNR documented nine (9) infractions in 2022 which was a significant decrease from 27 the year before. Six (6) infractions were hunting incidents, two (2) were illegal entries, and one (1) was logging. The logging infraction is still related to the transboundary incursions that are now established at the border with CRFR and BNR. The MMNFR recorded a total of 20 infractions. 14 of the recorded infractions were associated to illegal logging and timber extraction. 2 instances of hunting, 2 instances of illegal entry, 1 illegal entry and 1 possession of wildlife. In BCEP there were 63 infractions documented during this reporting period. Mostly evidence of illegal entry (37) but with significant infractions of illegal land clearing (11) and farming (9).

	Enforcement & Compliance					Overall Condition	GSCP 	BNR 	MMNFR 	BCEP 
Indicators of Condition	**Specific Measures**	**Condition Status/ Trend**				**Rationale**				
		GSCP	**BNR**	**MMNFR**	**BCEP**					
						Other infractions were hunting (4) and logging (2). Considering patrol effort was reduced in 2025 these infractions may be and under reporting of the extent of infractions in BCEP for the period 2023-2024.				

Information Brief: Enforcement and Compliance Patrols - Incidents

2023 was an active year for incursions into the protected areas. The Bladen Nature Reserve (BNR) in particular had some notable infractions that were documented at two known hot spots. In January of 2023 a patrol team set out on a stakeout operation during evening hours. The stakeout team monitored an area along the Bladen Branch River that is occasionally targeted for fishing. In the early hours of January 30, 2023, the team encountered a group of three men spear fishing in the river. The team was able to apprehend the men and confiscate their catch and gear and handed them to the forest department for prosecution. The case went to court where the magistrate based on the evidence and the fact that accused showed remorse and admitted fault were released with a warning and their admission entered into the record. As is common when arrests like these occur, word spread that the ranger teams had conducted an arrest and that it led to court action. Illegal incursions into this area of the BNR declined significantly in the months following the arrest.

Photo 1. Gear and fish confiscated during stake out patrol January 30, 2023

Another hotspot that was monitored closely in 2023 was the boundary with the Columbia River Forest Reserve (CRFR). For a couple of years there has been an increase in transboundary incursions from Guatemala and into the CRFR which led to incursions into the BNR. To address the threat, Ya'axché partnered with the Belize Defence Force to conduct joint operations in the CRFR and the BNR to deter the activity. During a September joint operation, the Ya'axché team documented a wide network of logging trails with ample evidence of logging in the CRFR and some in the BNR. As is often the case, no one was found in the vicinity of the logging sites but there was evidence of recent activity based on recent camp sites and remnants of timber felling.

Photo 2. Logging activity documented in the western boundary area of the BNR September 2023

These joint operations are key in suppressing activity coming from the Guatemala border. Intelligence sharing with the BDF and mutual support over the last two years has improved documentation of hotspot areas and although operations have yet to yield an arrest, it has proven to at least reduce the activity during the

peak seasons. Most logging activity occurs during the peak of the dry season in April with another peak around the months of August and September. Most joint operations take place during these times to maximize the chances of apprehending someone at the sites.

Photo 3. Part of an active illegal logging camp in the BNR September 2023.

In 2024 illegal activities were less prominent compared to 2023. There was a reduction in the documented incursions in the CRFR and BNR boundary areas. The arrest that occurred in 2023 after the fishing incident had also reduced incursions into the easter boundary of the BNR. This pattern, however, did not translate to other protected areas where there was a slight increase in logging activity. An enforcement patrol was investigating an area east of the Golden Stream field station in the Golden Stream Corridor Preserve after receiving intelligence that some logging activity was occurring at night. The patrol encountered a group of people some 500 meters from the Southern Highway and 40 meters into the reserve. The group scattered leaving behind all gear and timber already cut into boards of varying dimensions. The team proceeded to document the scene and confiscated the equipment and handed it over to the forest department.

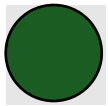
Photo 4. Illegal logging in the GSCP February 28, 2024.

The forest department confiscated the boards that had been cut and transported it to the GSCP field station. The planks were eventually retained by Ya'axché and used for repairs to ranger facilities.

VII. Knowledge of Biodiversity for Adequate Management

	Knowledge of Biodiversity for Adequate Management					Overall Condition	GSCP 	BNR 	MMNFR 	BCEP 
Indicators of Condition	**Specific Measures**	**Condition Status/ Trend**				**Rationale**				
		GSCP	**BNR**	**MMNFR**	**BCEP**					
Baseline Data	Comprehensive species lists of key taxa					Since 2009, plants and bats have been surveyed thoroughly in GSCP and BNR and species lists are in use in the management of those reserves. The list of known mammal species for BNR prior to 2021 was compiled from the reports of multiple, external research projects, the data from which was not held by Ya'axché. In 2021, Ya'axché established a camera grid in eastern BNR to create its own baseline data on species presence and abundance. Through this effort, one (1) previously unrecorded species, the Northern naked-tail armadillo (*Cabassous centralis)*, was confirmed for the PA. In MMNFR, which Ya'axché began managing more recently, bats have not yet been studied. In 2021, Ya'axché – along with research partners Round River Conservation Studies – conducted bird and tree surveys across the southern third of the PA in order to update the known species lists for those taxa. In addition, camera surveys have been running in the reserve since 2019 to document mammals and additional wildlife. BCEP. Little biodiversity information for BCEP exists, and the reports that are available are at least 10 years old. In 2024, Ya'axché has started to increase its understanding of mammal				

	Knowledge of Biodiversity for Adequate Management					Overall Condition	GSCP	BNR	MMNFR	BCEP
Indicators of Condition	**Specific Measures**	**Condition Status/ Trend**				**Rationale**				
		GSCP	**BNR**	**MMNFR**	**BCEP**					
						presence and abundance in the PA by establishing a wildlife camera grid. More years of wildlife monitoring and additional methods, including plant surveys, are needed.				
	Accurate ecosystem maps with descriptions					Ecosystem maps for all three reserves come from larger ecosystem maps for Belize that were produced as part of the Central American Ecosystems Map project (Worldbank/CCAD) in 2001 (Meerman and Sabido). The Belize maps were improved by Meerman using ground-truthed vegetation data in 2004 (Meerman, 2005). However, the resolution of the ecosystem maps could be improved for the MGL through the integration of on-the-ground survey data and drone classification of vegetation. Ya'axché is exploring the use of drones for ecotype mapping since 2021. An aquatic ecosystem map for Belize is available, though the national aquatic ecosystems concept is a work in progress and is pending validation with field data (Esselman et al. 2005).				
	Accurate lists of threatened, socio-economically important and invasive species					Species lists of threatened and socio-economically important bird, mammal, bee, and tree species are up to date for the GSCP, BNR, and MMNFR. More surveys are needed in BCEP. In all reserves, recent information on invasive species is lacking. *Gmelina arborea* and tilapia are two invasive taxa identified as potential threats in Belize, though a lower population and lower rates of urbanization and				

	Knowledge of Biodiversity for Adequate Management					Overall Condition	GSCP	BNR	MMNFR	BCEP
Indicators of Condition	**Specific Measures**	**Condition Status/ Trend**				**Rationale**				
		GSCP	**BNR**	**MMNFR**	**BCEP**					
						encroachment into forests of the MGL compared to other areas make invasive species less of a threat here. Surveys in 2009 did not identify *Gmelina* in BNR or GSCP, but follow-up surveys should be done to confirm that it has remained absent, and that other invasive species remain absent.				
	Accurate understanding of NTFP harvest limits		NA	NA	NA	Cohune palm leaves are one of the most used NTFPs by community members buffering the reserves. The leaves are harvested from the standing palm and used for thatch. GSCP has two (2) sustainable use zones where cohune leaves can be extracted by villagers after they make a request and obtain a permit from Ya'axché. In 2018, Ya'axché conducted a study on cohune leaf regeneration rates under different harvest intensities to identify the level of harvest (maximum number of leaves per tree) that is sustainable in GSCP, i.e., allows for continued reproduction and leaf regeneration of the species for long-term harvest. The resulting ideal harvest intensity was integrated into the management practice of the extraction zones.				
	Accurate understanding of priority species life cycles and population dynamics				NA	Priority species for life cycle and population dynamic studies in GSCP, BNR, and MMNFR are certain rare, threatened, data deficient, and/or timber trees that are lacking management plans at the national level. Since 2013, Ya'axché has gathered monthly phenology data on seven (7) tree species. Honduran rosewood (*Dalbergia stevensonii*) is also the subject of a stump regeneration study in MMNFR.				

Information Brief: Wildlife Camera Trapping in BCEP, BNR, and MMNFR

Camera traps have been widely utilized as an indispensable tool to monitor the diversity, distribution, and activity patterns of wildlife. Ya'axché began monitoring wildlife using the transect sampling method and subsequently evolved to using innovative tools such as camera traps in two (2) co-managed PAs, MMNFR and BNR and in one (1) owned and managed PA, BCEP. Wildlife monitoring allows us to understand the presence of species, particularly target species that have cultural, socio-economic, and ecological importance for Belize.

Bladen Nature Reserve

During the 2023 dry season, BNR recorded 38 species (20 mammals and 18 birds), including 17 indicator species (12 mammals and 5 birds) as listed in Ya'axche's BRIM Strategy. In the 2023 wet season, 39 species were recorded (20 mammals and 19 birds), with 21 indicator species (11 mammals and 10 birds).

Mammal species richness was comparable to the 2022 camera trap survey; however, there was a decline in bird diversity across both 2023 seasons. A key finding shows that majority of carnivorous species, game species and gamebirds overlapped in both seasons.

A consistent observation during ecological monitoring at BNR is the high detection rate of white-lipped peccaries. These forested-dependent species are sensitive to disturbance and BNR continues to provide a safe haven for these vulnerable species.

Photo 3. A Central American Red Brocket Deer with its fawn in BNR during the dry season.

Photo 4. White-lipped peccaries with its young in BNR during the dry season.

Maya Mountain North Forest Reserve Cacao Concession

During the 2023 dry season, MMNFR concession recorded 51 species (18 mammals, 31 birds and 2 reptiles), with 19 indicator species (10 mammals and 9 birds). In the 2023 wet season, 54 species were recorded (20 mammals and 32 birds and 2 reptiles), with 21 indicator species (11 mammals and 10 birds). For 2024 dry season, 51 species were recorded (19 mammals, 29 birds, 2 reptiles and 1 arachnid), with 19 indicator species (11 mammals and 8 birds).

In comparison to the 2019-2022 camera-trap surveys, wildlife activity patterns remain active across the cacao concession, as most predator and game species overlapped across both seasons. However, it is important to note that forest-dependent species such as the white-

lipped peccary, which was detected during the 2019 survey, has not been detected in subsequent years. Human activity within the concession may have caused the herd to avoid the area. However, the remaining forest reserve and the neighbouring Bladen Nature Reserve continue to serve as an important habitat.

Photo 5. Margay detected in one of the camera stations in MMNFR Concession.

Photo 6. Collared Peccary detected in one of the camera stations in MMNFR Cacao Concession.

Boden Creek Ecological Preserve

During the 2023 dry season, BCEP recorded 50 species (20 mammals and 30 birds), with 20 indicator species (12 mammals and 8 birds). Predators detected included jaguar, puma, ocelot, jaguarundi and margay, while games species included Central American Agouti, collared peccary, lowland paca, nine-banded armadillo, red brocket deer and white-lipped peccary. Gamebirds detected included the great curassow, great tinamou, little tinamou and plain chachalaca. Other avian species included raptors, doves and a variety of resident and migrant birds.

The detection of both predators and prey that serves as bioindicators across BCEP highlights its ecological significance as a corridor. While the baseline data collected limits the depth of the analysis, it still provides valuable insights into species richness and distribution in BCEP.

A notable finding from this survey was the detection of white-lipped peccaries. Ya'axché's previous camera trapping efforts in the Maya Mountains showed the highest detection rates of this species in BNR across both seasons, with occasional detections in the MMNFR concession. However, the species has never been detected in nine years of monitoring the lowland farming landscapes. BNR and MMNFR, by extension, the Maya Mountain Massif, remain critical strongholds for this species, which depends on large contiguous forest for survival.

Photo 7. White-lipped peccaries detected in one of the camera stations at BCEP

Photo 8. Puma detected in one of the camera stations at BCEP

Implication of Wildlife Camera Trapping

Wildlife camera trapping across three PAs for both seasons has increased our knowledge about species diversity and relative abundance. Wildlife detected by the cameras include five (5) wildcats, seven (7) games species, six (6) gamebirds, alongside opportunistic sightings of resident and migrant birds and reptiles. Most of the species detected are of conservation concern and serve as important environmental indicators of forest health, prey availability, disturbance and migration pattern. Notably, the activity pattern of predators and preys reflect conditions consistent with a healthy forest, characterized by minimal human disturbance and relatively intact trophic levels. Additionally, an important observation from the 2023-2024 camera-trap surveys is photographic evidence of multiple species reproducing, which is crucial for ensuring population growth.

For BNR, an additional species was detected that had not been documented during previous monitoring effort in this protected area, the greater grison. Although this species has been documented across agricultural landscapes. In MMNFR cacao concession, biodiversity remains high, demonstrating the value of the concession as a conserved landscape with sustainable agriculture activities. For BCEP, the detection of white-lipped peccaries highlights its role as a critical part of the Southern Biological Corridor, supporting species movement and ecological connectivity with adjacent protected areas in the Toledo coastal plains forests.

Continuous ecological monitoring in these PAs will allow us to better understand fluctuations in indicator species, track changes in community structure and detect shifts in ecosystem health overtime.

Conclusions

Conditions across the four protected areas range from fair to very good. Fluctuations in effort has impacted some data collection for both enforcement & compliance and research & monitoring work and is reflected in the status of each PA. It is not easy to make comparisons across the protected areas so the focus should rely on annual comparisons to make inferences on improvements or deteriorations in status.

Golden Stream Corridor Preserve

NTFP extraction continues to be the only issue of concern in GSCP. There are other infractions which are too infrequent to consider a significant concern. The sustainable extraction zone saw one request for extraction over the entire two-year period. Ther appears to be either unwillingness to apply for extraction permits through the right channel or lack of awareness of the extraction process.

Wildlife in the GSCP were recorded in low numbers consistent with other years of data collection. We suspect that hunting pressures outside the PA are in some way affecting populations in the general area. Patrol effort reduces the likelihood of hunting in the PA but cannot account for pressures outside the PA boundaries. The 2024 fire season introduced a significant level of disturbance to the norther section of the PA and may be contributing to persisting low numbers of both mammals and game birds recorded. The exception was migratory birds recorded in higher numbers than in previous years. Overall, the condition of the GSCP remains good and stable.

Bladen Nature Reserve

The BNR remained the most intact and undisturbed PA of all. The remoteness of this reserve provides a natural barrier to illegal activity. Illegal timber extraction was still a concern for the western sector of the BNR and will require additional interagency collaboration to stem the flow of illegal timber across our borders.

Camera trap data collection suggests that mammal populations are in comparable numbers with our previous reporting period. Migratory birds showed an increase in numbers in BNR as well breaking a downward trend in the last four years. The large expanse of remote wilderness remained unchanged during the reporting period with little disturbance. Ya'axché's enforcement and compliance efforts were increased during the reporting period and while some infractions were documented there is little concern about the status of the resources of the BNR. Over all the status of the BNR is very good and stable.

Maya Mountain North Forest Reserve

The MMNFR has always been a challenging PA to manage. There is management presence through the efforts of the existing logging concession, but issues have mounted with discrepancies in management roles. Illegal logging was the primary issue affecting this PA. As the logging concession established itself the enforcement and compliance patrol effort was scaled down

limiting the ability of the team to document illegal activities.

Most of the biodiversity monitoring in MMNFR is centered around the cacao agroforestry concession. Camera trap data from this reporting period indicate that important species continue to persist within the agroforestry area, however there are notable absences of some species recorded in the early years of development of the concession. Remote sensing analysis confirms a significant percentage of the PAs acreage is forested and in good condition. Overall, the status of the MMNFR is Fair with some moderate concern.

Boden Creek Ecological Preserve

The status of the Boden Creek Ecological Preserve below the ideal level of knowledge and management effectiveness. Since the acquisition of management responsibilities by Ya'axché there has been significant inputs into its management. Community relationship building was identified as a primary focus in the early years of management of this protected area. Ya'axché now has a baseline on the activities occurring in the protected area and who are the key stakeholders. For the reporting period enforcement and compliance patrols have been the most affected with declining patrols over time and an apparent increase in illegal activity. Nevertheless, the large area that the protected area covers is predominantly forested with minimal disturbances. Overall, the status of the resources of the protected area are in good stable condition but require improvements in management inputs if it is to show any increases in management effectiveness in the next reporting period.

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State of the Protected Areas Report 2024

An assessment of Bladen Nature Reserve, Golden Stream Corridor Preserve, Maya Mountain North Forest Reserve and the Boden Creek Ecological Preserve

December 2025

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