

From Wildfire to Looting

Safeguarding Maya Cave Heritage Amid Growing Pressures in Belize

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with Monkey Bay Wildlife Sanctuary & the Belize
Institute of Archaeology



First in a thousand years

A three-metre speleothem, carved and polished into an altar, its surface still caked in ceremonial charcoal — undisturbed since the ancient Maya period.

I was the first archaeologist to see it. Whether anyone else gets that chance depends on the implementation of protective measures over the vast karst system that characterizes the park.

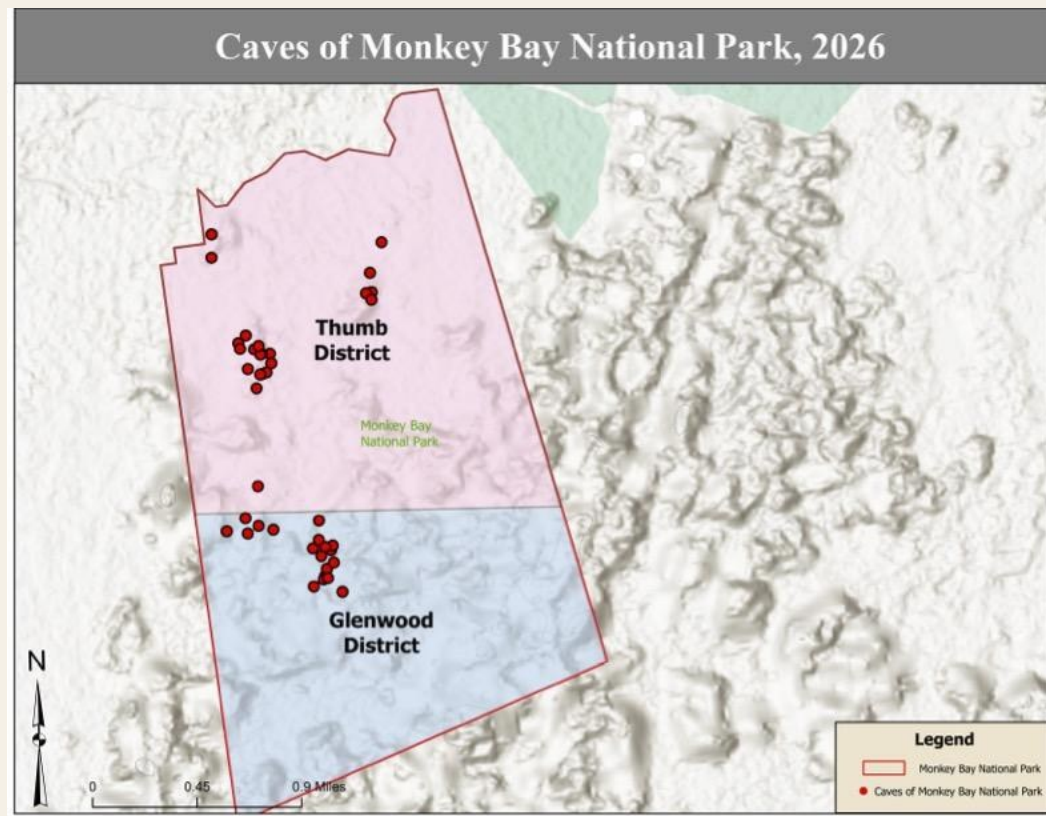


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Altar, Altar Chamber, Altar Cave



Intact olla (pot) encased in layer of calcite, Olla Chamber, Altar Cave.



MONKEY BAY NATIONAL PARK, BELIZE

Sibun River Valley karst

About 90 km from Che Chem Ha, one of the region's better-known ancient Maya ritual cave sites.

43

caves identified since 2023

7

fully mapped to date

FOUR FIELD SEASONS

Fieldwork Expeditions 2025-2026

February 2025

Altar Cave mapped

First full survey of Altar Cave — the altar chamber, ceremonial charcoal, and jute deposits that opened this project.



June 2025

Field survey

5 caves inventoried (Actun Ik, Altar, Conch, Four Pot, Single Pot); 4 newly mapped; charcoal sampled in all 5 for radiocarbon dating.



Jan–Feb 2026

Fieldwork training

BVAR-LSAKP training initiative: mapped Actun Nohoch Chii & Kitchen Cave. 10 participants trained in survey, SRT, and inventory.



June 2026

Sample collection

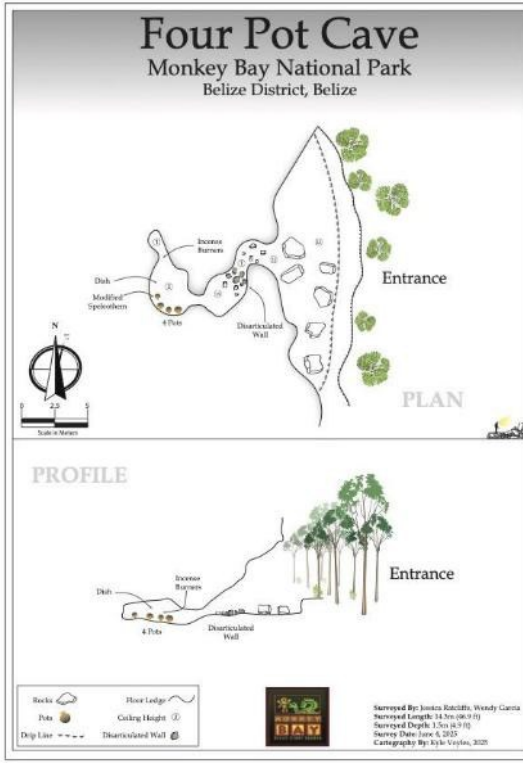
Charcoal from 4 caves, jute from 10; first SLAM LiDAR scan; 2 new caves found, bringing the inventory to 43.



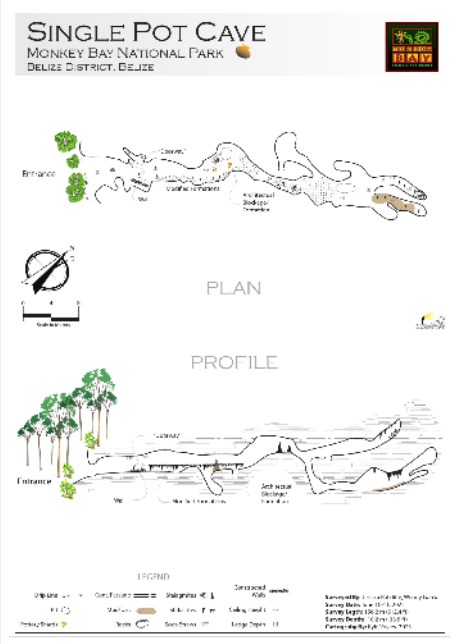
Every season builds on the last — the same caves get better documented, and the map of what's out there keeps growing.

JUNE 2025 FIELD SURVEY

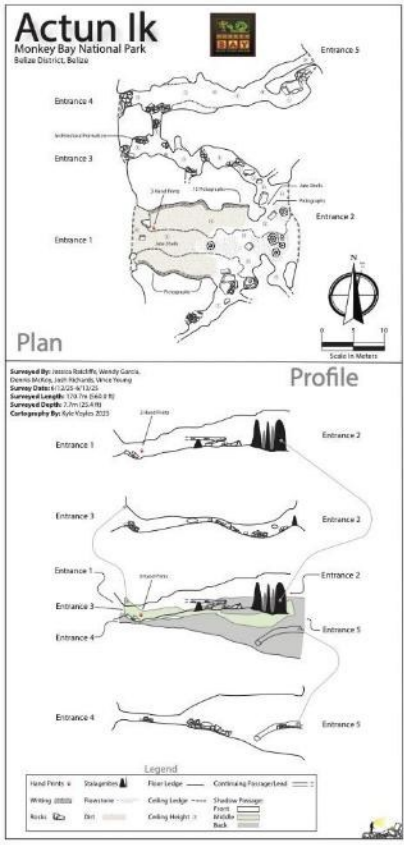
Five caves, five official maps



Four Pot Cave



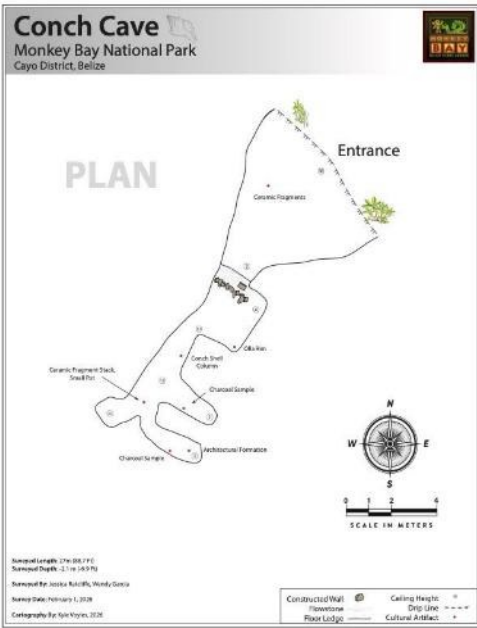
Single Pot Cave



Actun Ik



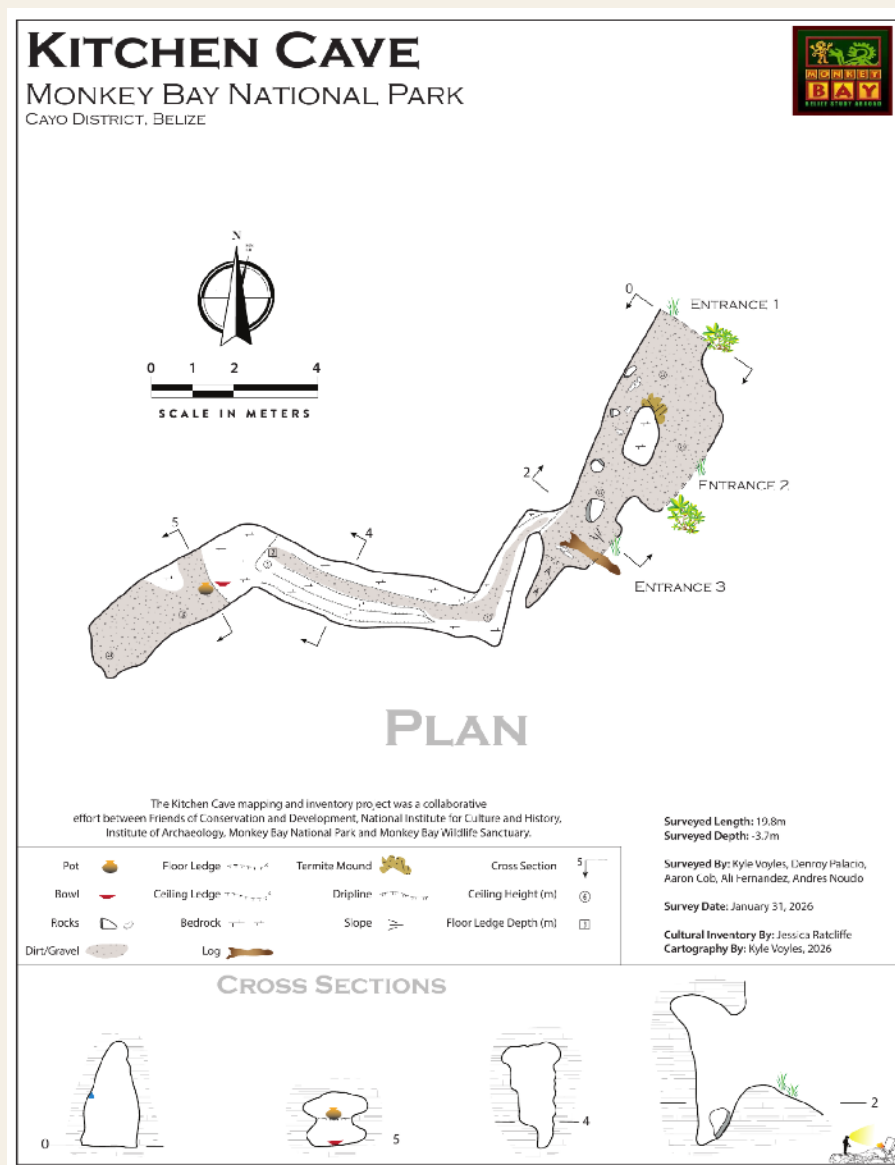
Altar Cave



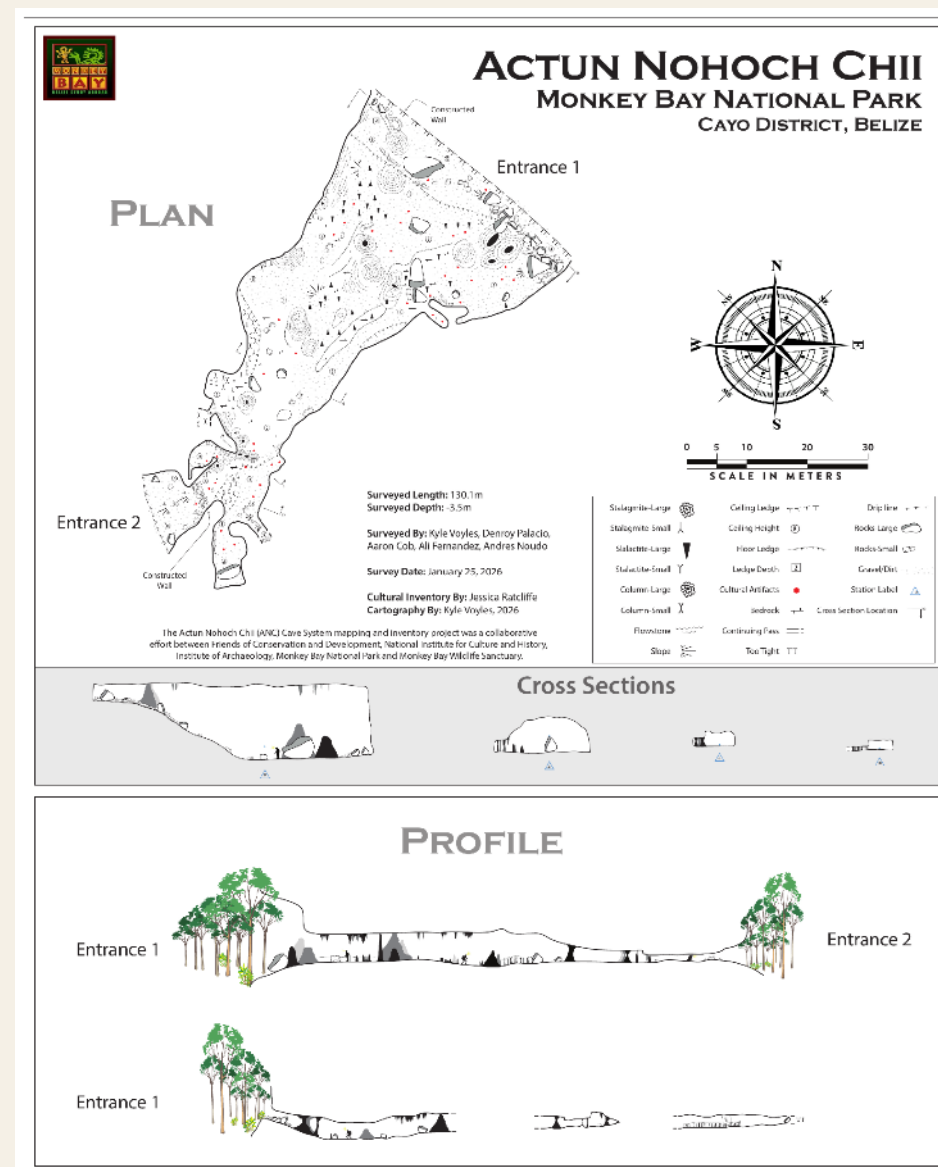
Conch Cave



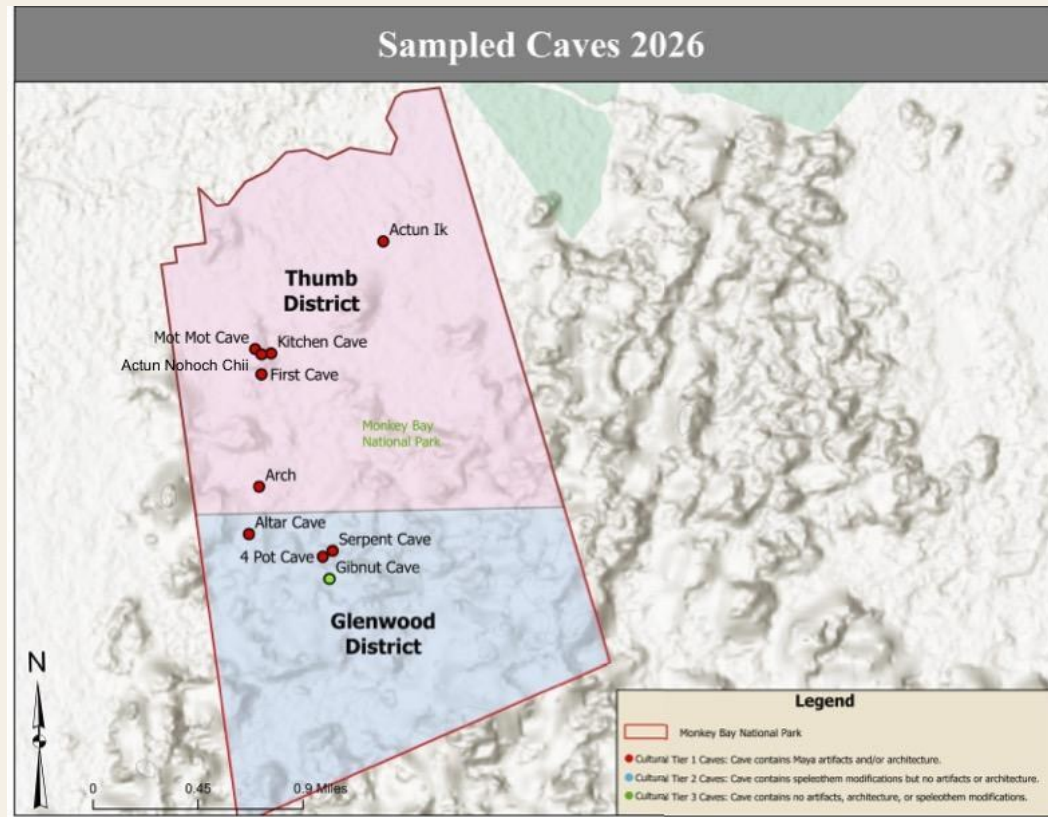
Two more caves mapped



Kitchen Cave — surveyed January 31, 2026



Actun Nohoch Chii — surveyed January 25, 2026



CLASSIFYING 43 CAVES

Three cultural tiers

- **Tier 1** — contains Maya artifacts and/or architecture (e.g. Altar Cave, Kitchen Cave, Conch Cave)
- **Tier 2** — speleothem modifications present, but no artifacts or architecture (e.g. Serpent Cave, Faces Cave)
- **Tier 3** — no artifacts, architecture, or speleothem modification observed (e.g. Gibnut Cave)

Most caves surveyed so far sit in Tier 1 — but tiering every one of the 43 is exactly the gap our mapping backlog needs to close.

THREAT ONE — FIRE & CLIMATE

819

hectares burned inside the park by Belize's largest wildfire on record, May 2024

100,170

gallons dropped by helicopter on Monkey Bay and nearby reserves that same month (IFRC/CDEMA)

3.75/4

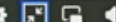
the Management Plan's highest-ranked climate threat to the cave system: rising temperature altering cave microclimates

Heat and fire don't stop at the tree line — they reach the speleothems, sediment, and charcoal we depend on to reconstruct the past.



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Exit fullscreen



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**MBNP Management Plan
Proposal 2026**

: Rating Criteria for Assessing
Climate Change Adaptation Threats
Per Target (TNC, 2007)

Ranking Criteria	Rating		Rating Definitions
Certainty: The certainty that the effect of Climate Change will occur, or the cause of the described impact will affect the target	Very High	4	Confirmed
	High	3	Considered very probable but not confirmed
	Medium	2	Considered probable
	Low	1	Considered a limited probability, much debate
Severity: Level or damage to this key element, which can destroy it in 50 years	Very High	4	Destroys the ecosystem or its production activities
	High	3	Seriously degrades the target
	Medium	2	Moderately degrades the target
	Low	1	Slightly impairs the target
Scope: Geographical coverage of the target that will be impacted in 50 years	Very High	4	75% - 100% of the geographic coverage
	High	3	50% - 75% of the geographic coverage
	Medium	2	25% - 50% of the geographic coverage
	Low	1	<25% of the geographic coverage
Irreversibility: The impact is permanent or cannot be reversed naturally or through human action	Very High	4	Not reversible, even with human intervention
	High	3	Reversible but at high cost or very long term (>100 years)
	Medium	2	Reversible with human intervention
	Low	1	Naturally reversible or with little human intervention and/or little cost

FROM THE MANAGEMENT PLAN

Almost none of this comes back

The Plan defines "Irreversibility" as impact that is permanent, or cannot be reversed naturally or through human action — scored 4 when "not reversible, even with human intervention."

Climate threat to the cave system	Certainty	Severity	Scope	Irreversibility	Average
Rising temperature — alteration of cave microclimate	4	3	4	4	3.75
Rising temperature — disruption of fragile subterranean ecosystems	2	3	4	4	3.25
Rainfall change — interrupts stalagmites, stalactites & formations	2	3	3	4	3.0
Hurricanes & storms — physical damage to delicate formations	2	3	3	4	3.0
Inland flooding — submerges chambers, dissolves formations	3	2	2	4	2.75

Every single climate threat assessed for the cave system scores the maximum 4/4 on irreversibility — the Plan's own data, not ours.

The second front is human

Yellow Jaw cave had already been stripped to a single pot rim by the time we reached it.

A fresh bullet casing appeared at a cave entrance between two site visits, eight months apart.

Single Pot Sibun Red Neck olla destroyed.

Undocumented caves are undefended caves.



Top: Single Pot Vandalism. Bottom: Bullet shell casing located outside Conch Cave.

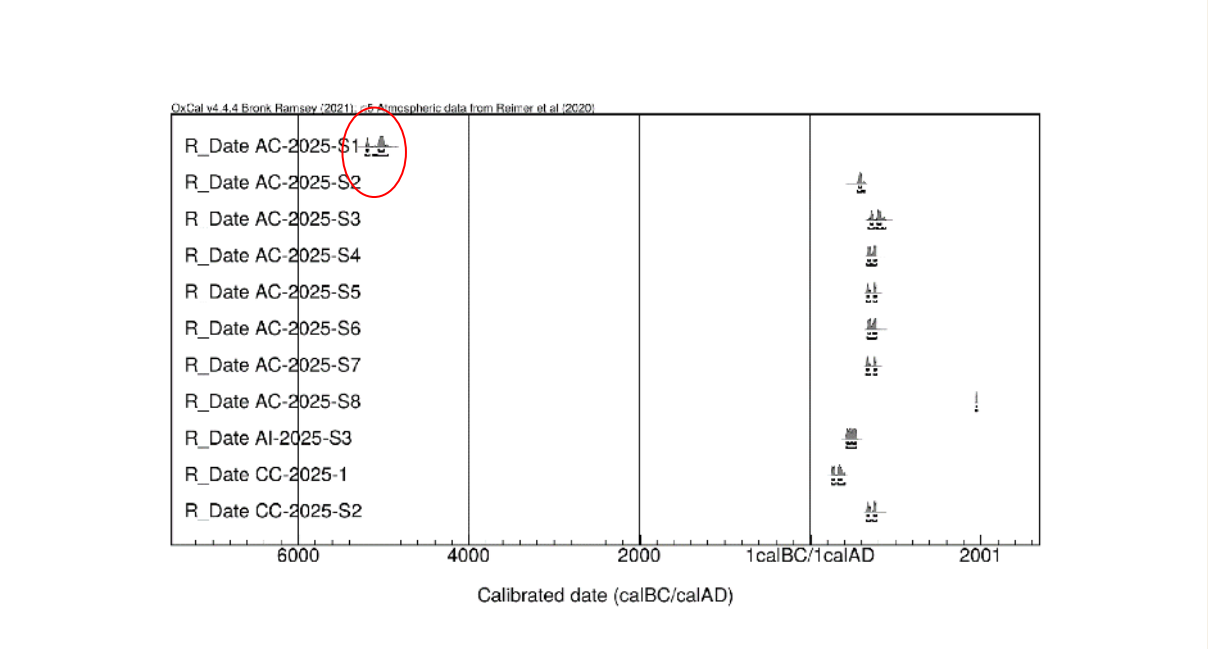
Two millennia of ritual use

WHAT'S AT STAKE

- Ceramic evidence: Middle Preclassic to Postclassic
- Radiocarbon evidence: Archaic to Postclassic (Peterson 2006).
- Preservation of ceramics is excellent

Period	Approximate chronology (BCE/CE)
Archaic	(10,000BCE - 2000 BCE)
Early Pre-Classic	2000-1000 BCE
Middle Pre-Classic	1000-400 BCE
Late Pre-Classic	400 BCE – 250 CE
Early Classic	250 – 550 CE
Late Classic	600 – 900 CE
Terminal Classic	800 – 1000 CE
Post-Classic	950 – 1524 CE
Spanish Colonial	Post 1524

Maya Chronological Periods



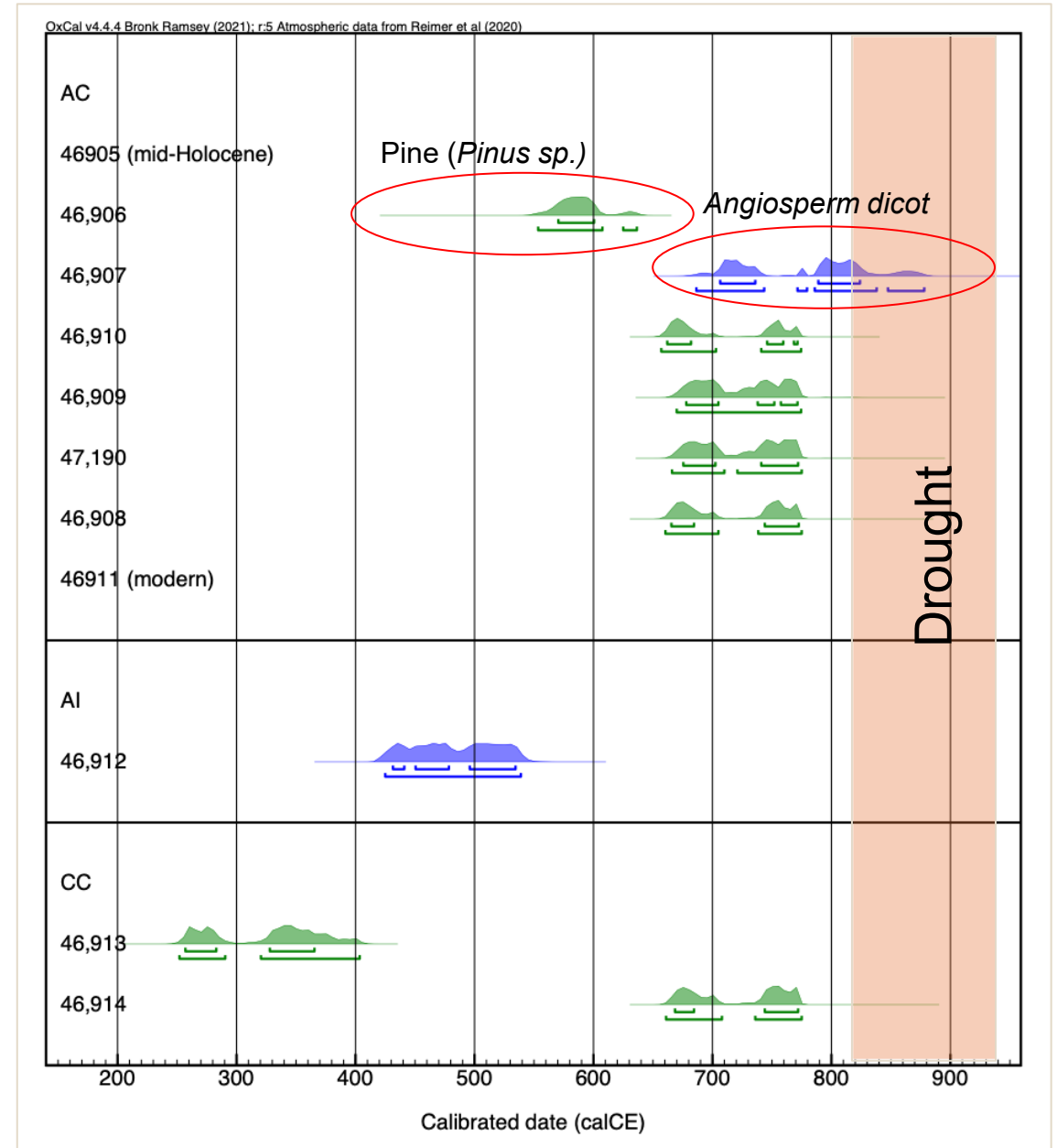
Pilot Study Radiocarbon dates from Altar Cave, Conch Cave, and Actun Ik.



Charcoal *in-situ*; Altar Cave



Pilot Study calibrated radiocarbon dates and archaeobotanical data



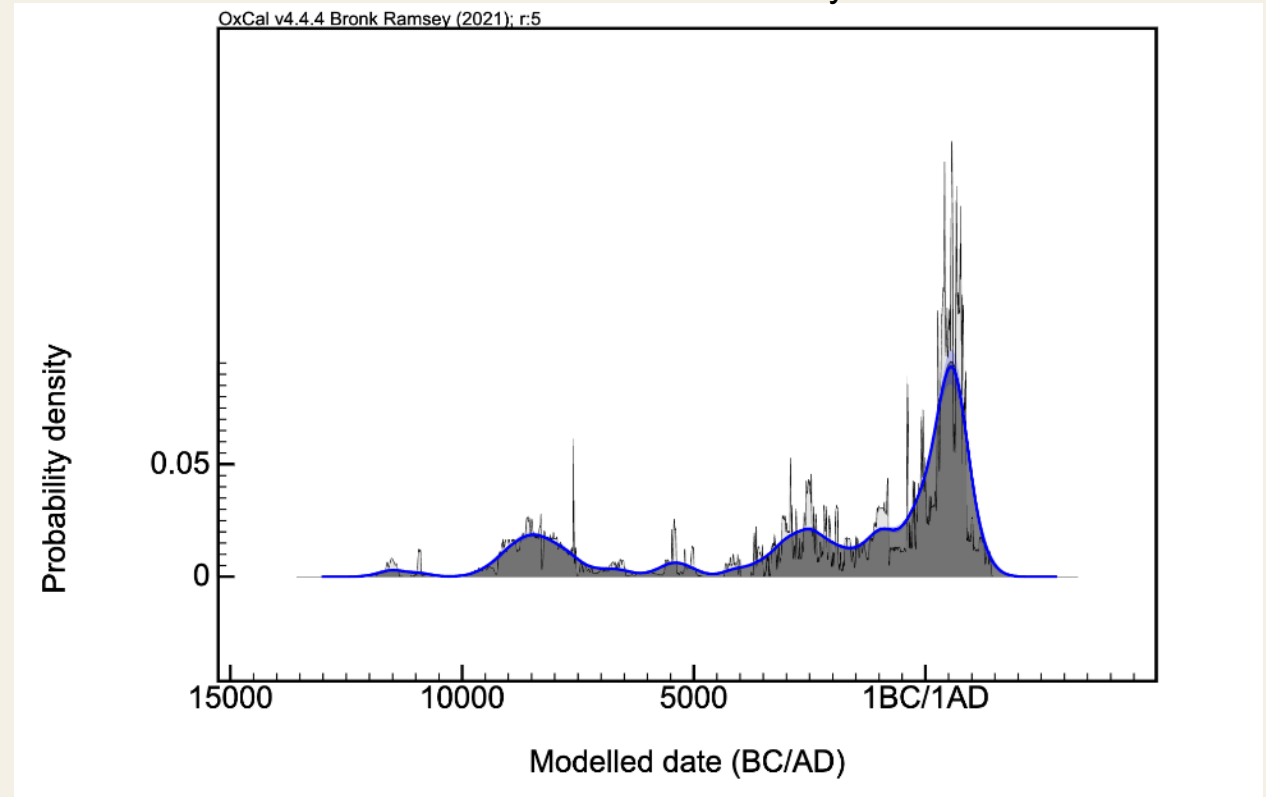
A REGION-WIDE PATTERN

Ritual activity tracks the drought

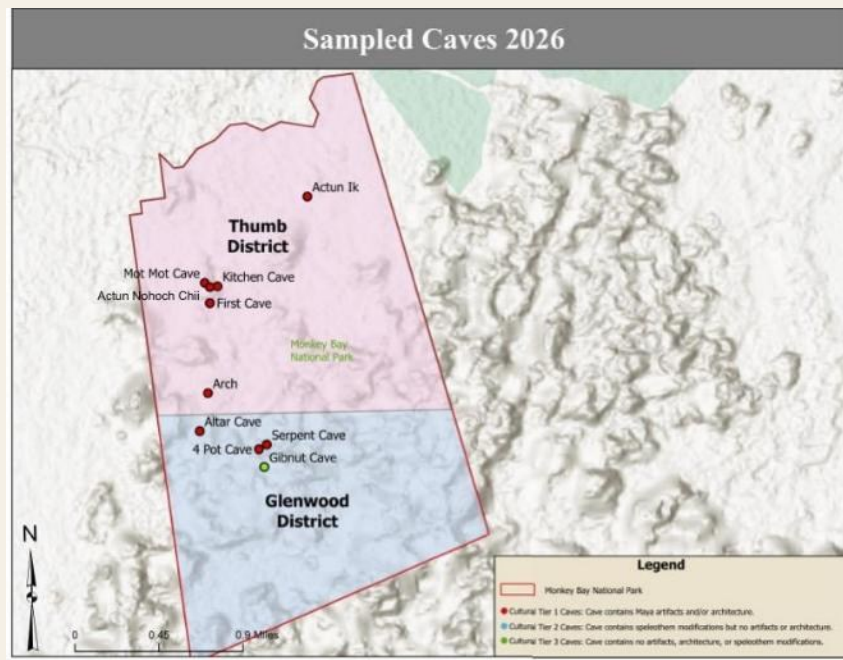
This kernel density model aggregates radiocarbon dates from every dated cave across Mesoamerica, with dates mostly stemming from projects in Belize. The sharpest peak in the entire record sits right at the Terminal Classic — precisely when the well-documented regional drought was at its worst.

All dates from the Pilot Study predate the drought, revealing a unique pattern of cave use.

MesoRAD data (Price, M. et al 2021).
+ MBNP Pilot Study



KDE model of all dated caves, including MBNP — probability density of ritual activity over time



A SHARED RITUAL LANDSCAPE

Jute (*Pacychilus* sp.)

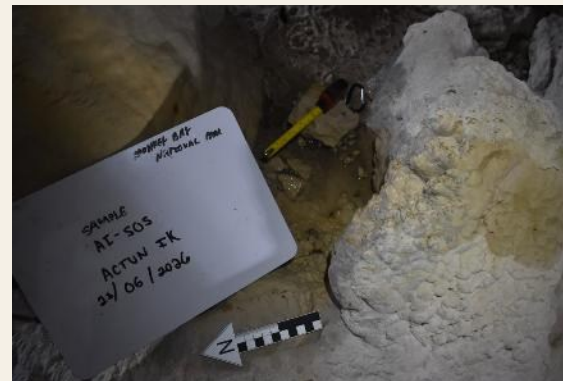
Jute shell offerings recur at cave entrances across the park. Dating them provides a proxy dating method and may provide another method of radiocarbon dating in Belize archaeology.



Jute- Altar Cave entrance



Jute- Serpent Cave entrance



Jute- Actun Ik interior of stalagmite



Modern *jute* reference samples, Sibun River

Current Study (2026)

- Charcoal sample
- Jute sample



Proof of Study (2025)

- AC-2025-S1: Archaic
Charcoal (*sp. cf. Fabaceae*);
BCE 5208-4297
- AC-2025-S2: Classic
Charcoal (*Pinus. sp.*);
AD 553-636
- AC-2025-S3: Late Classic
Charcoal (*sp. Angiosperm dicot*);
AD 686 to 878
- AC-2025-S4: Late Classic
Charcoal (*Pinus sp.*);
AD 702-775
- AC-2025-S5: Late Classic
Charcoal (*Pinus sp.*);
AD 660-775
- AC-2025-S6: Late Classic
Charcoal (*Pinus sp.*);
AD 670-774
- AC-2025-S7: Late Classic
Charcoal (*Pinus sp.*)
AD 657-774

HOW WE WORK

Four methods, one non-invasive standard

Sample Analysis

Charcoal AMS-dated at the Oxford Radiocarbon Accelerator Unit; jute shell use-wear analysis, AMS dates cross-checked with Amino Acid Racemization to control for the freshwater reservoir effect.



SLAM LiDAR

A Raven SLAM 3D scanner captured a full point cloud of Actun Nohoch Chii in under 40 minutes — now being processed at Northern Arizona University.



Digital Cave Mapping

Distox2 laser stations paired with real-time sketching — the same method now taught to rangers, not just used by the research team.



Inventory Process

Artifacts labeled by proximity to survey stations, photographed in dark-zone conditions, measured, and described — distinguishing built features from natural breakdown.

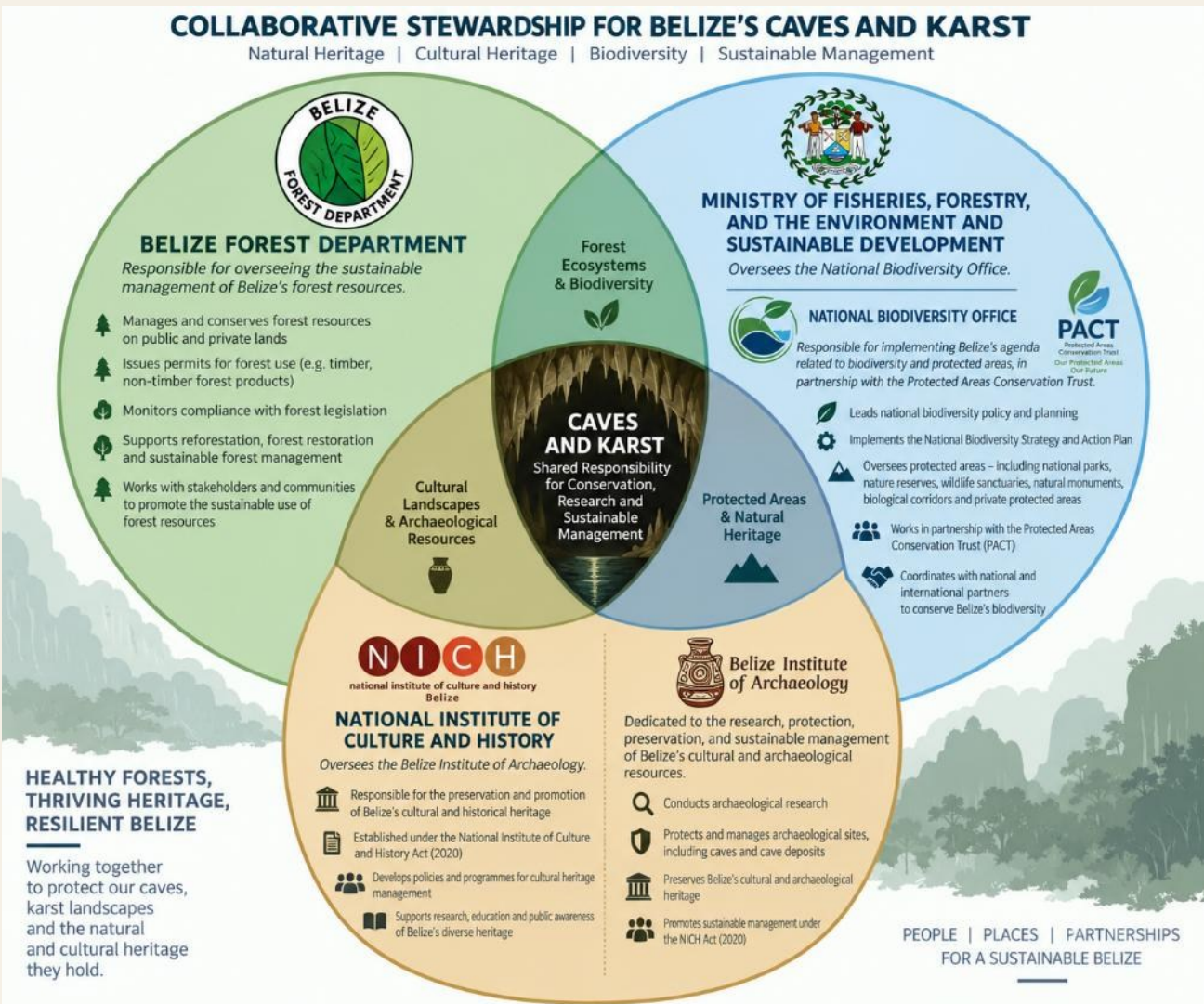
Cave Name	Elevation (m)
Status (LVL 1-6)	Entrance Access
Number/ Map	Geological Description (Dry or wet?)
Date Discovered	Wildlife observed
Date Revisited	Archaeological Content
Recorded By (most recent)	Associated Features and Artifacts
Zone	Condition of artifacts
Easting	Notes
Northing	Tier 1, 2, or 3?

Across all four: surface-collection only. No excavation, and nothing unique to a cave — ceramics, modified speleothems — ever leaves it.

A co-management model

Not indefinite research — a partnership that turns fieldwork directly into protection capacity, built jointly with Monkey Bay Wildlife Sanctuary and the Belize Institute of Archaeology.

Every map, inventory, and trained ranger becomes a tool the park keeps using after the field season ends — directly implementing actions already written into the Park's own Management Plan.



TRAINING IN THE FIELD

Capacity built on-site, cave by cave



Cave mapping practice, Actun Nohoch
Chii



Instructing rangers in SRT gear assembly



Practicing rope change-overs at camp



Gary Zuniga, Protected Areas Manager

A NOTE ON METHOD

Responsible, non-invasive practice

- All samples are surface-collected — no excavation has been permitted, no unique cultural material removed
- Human remains sampling proceeds only with the Principal Investigator's written permission, using the smallest possible sample
- Specimens return to the Institute of Archaeology; findings feed public interpretation at Monkey Bay and teaching at Galen University



Collecting jute samples, Actun Nohoch Chii

BEYOND BELIZE

A pattern, not a one-off

An under-resourced protected area, holding an irreplaceable cultural record, exposed to compounding climate and human pressure — met with a partnership that builds local monitoring capacity instead of publishing and leaving.

Thank you

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